education sciences

Special Issue Reprint

Identifying and Supporting Giftedness and Talent in Schools

Edited by
Kirsi Tirri and Valerie Margrain

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This is a reprint of articles from the Special Issue published online in the open access journal *Education Sciences* (ISSN 2227-7102) (available at: www.mdpi.com/journal/education/special_issues/D8IN03ZYW1).

For citation purposes, cite each article independently as indicated on the article page online and as indicated below:

Lastname, A.A.; Lastname, B.B. Article Title. *Journal Name* **Year**, *Volume Number*, Page Range.

ISBN 978-3-7258-0116-9 (Hbk)
ISBN 978-3-7258-0115-2 (PDF)
doi.org/10.3390/books978-3-7258-0115-2

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About the Editors

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Dr. Kirsi Tirri is a Professor of Education at the Faculty of Educational Sciences at the University of Helsinki and a visiting professor at St. John's University, New York, USA. Professor Tirri was the President of the ECHA (European Council for High Ability) in 2008–2012 and the President of the Finnish Academy of Science and Letters in 2016–2017. Her research interests include school pedagogy, moral and religious education, gifted education, teacher education, and cross-cultural studies. She has published 14 monographs and numerous journal articles related to these fields.

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Dr. Valerie Margrain is a Professor of Educational Work in Sweden and an Adjunct Professor at Victoria University, Australia. Dr. Margrain has supervised 13 doctoral students and has around 50 academic publications, focusing on early childhood education, inclusive education, gifted education, early literacy, and internationzlisation in teacher education. Her work at Karstad University supports the Centre for Child and Childhood Studies in Education, Utbildningsvetenskapliga studier av barn och barndom, UBB. Previously, Dr. Margrain held the role of National Director, Early Childhood at Australian Catholic University, a national role across six campuses providing leadership for four Bachelor and Masters degrees and other leadership positions at ACU in early childhood education. Her current research includes a funded study of internationalization in preschool teacher education, partnerships with Swedish and NZ colleagues working on projects involving early literacy, early childhood teacher knowledge on gifted education in New Zealand, Australia, and Sweden, and Australian teacher reflection on curricula.

Preface

The purpose of this reprint is to present current research on identifying and supporting giftedness and talent in schools all over the world. This reprint contains 19 articles from differing international contexts: Australia, Austria, Finland, France, Greece, Norway, Scotland, Sweden, Turkey, and the USA. The content of this reprint comprises theoretical articles and qualitative, mixed-method, and quantitative empirical research. By sharing differing approaches with one another, we can learn and be inspired as to how to deliver quality educational experiences for gifted children and students. Diverse approaches to identification include broad (even 'fuzzy'), multi-categorical, and curriculum-specific opportunities for talent to emerge within enrichment programs. Diverse approaches to gifted education support include differentiated teaching or curriculum content, such as the use of transdisciplinary, holistic education; acceleration; ability-grouping; special programs; and enrichment opportunities. Alongside these considerations are why we engage in gifted education, specifically the needs and educational rights of children and students. We take a holistic approach to education in schools and early childhood education that includes cognitive, emotional, social, and moral domains concerning giftedness and talents. This means that all aspects of a gifted learner are important, not just their academic achievements. We increasingly find that gifted child and student well-being is tied to the identification and support they receive in schools and early childhood services.

Kirsi Tirri and Valerie Margrain
Editors

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Article

Identification and Education of Students with Gifts and Talents Based on the Fuzzy Conception of Giftedness

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Abstract: The purpose of this article is to review the Fuzzy Conception of Giftedness (FCG) and discuss its implications for the identification and education of gifted students. According to the Fuzzy Conception of Giftedness, the manifestation of giftedness results from the interplay between personal dispositions and stimulus conditions; thus, giftedness exists in the interaction between a person and the environment (e.g., stimulus conditions). While a person is disposed to carry out actions, the environment is potent to allow these actions. In line with this proposition, the identification and education of gifted students should be built on interactions. Interactive models are useful to identify and educate students who have overachievement potential. The FCG proposes three components to define giftedness that could be used in identifying and educating gifted students: intellective and non-intellective dispositions, stimulus conditions, and interaction.

Keywords: giftedness; talent development; disposition; interaction; stimulus condition; education; identification

Citation: Sak, U. Identification and Education of Students with Gifts and Talents Based on the Fuzzy Conception of Giftedness. *Educ. Sci.* **2023**, *13*, 562. https://doi.org/10.3390/educsci13060562

Academic Editors: Kirsi Tirri, Valerie Margrain and Jacobus G. Maree

Received: 4 May 2023
Revised: 15 May 2023
Accepted: 26 May 2023
Published: 30 May 2023

1. Identification and Education of Students with Gifts and Talents Based on the Fuzzy Conception of Giftedness

Giftedness is a sort of ability. Abilities are dispositions implying possibilities. Thus, giftedness is a possibility. Abilities are dispositions to succeed under certain conditions [1]. Likewise, giftedness is a possible manifestation of dispositional properties to succeed under certain conditions. This simple definition offers three implications related to the three hypothetical components of the giftedness concept. First, giftedness requires non-intellectual dispositions to start actions. For example, a person must first intend or attempt to solve a problem. Second, giftedness includes some sort of intellectual disposition to carry out actions. For example, a person uses working memory to process information to solve problems. Third, gifted behavior is performed under certain conditions. For example, there should be a problem providing sufficient challenge and stimulus for the person to intend to solve the problem and maintain engagement in solving the problem. According to the Fuzzy Conception of Giftedness (FCG), giftedness is a network of dispositions, a higher-order disposition, evolving upon interacting with stimulus conditions at the micro level and the environment at the macro level [2]. This definition implies three hypothetical components necessary for developing and manifesting giftedness: dispositions, stimulus conditions (environment), and interactions. In this article, I first present a refinement of the components of the FCG (more details are available in [2] and then propose implications for identifying and educating gifted students. I briefly answer two questions in each section: How should we assess giftedness? How should we nurture giftedness?

2. Dispositions

All the dispositions are ascribed properties of the person and modifiable upon interactions. They are composed of intellective (e.g., reasoning) and non-intellective dispositions (e.g., motivation). As postulated by John Locke [3], the dispositional properties of giftedness are secondary properties, such as color, not primary, like size. For example, a man's height is a primary property, while his hair color is not, as the color is invisible in the dark even though the height does not change. The color changes under certain conditions. Likewise, the concept of giftedness changes from context to context and thus should not be considered a person's property. Instead, our reactions to certain human behaviors create giftedness. We ascribe such behaviors as gifted under certain conditions. A person may be considered gifted by some people but not by others. Ascriptions are fuzzy constructs and thus dispositions, as they are social judgments. Four propositions related to the specification of dispositions essential for talent development and their implications for identification and education are discussed next.

Giftedness is a higher-order disposition. Manifesting dispositions of giftedness is a possibility only. A possibility is a potential emergence of a disposition. The disposition itself is the possible emergence of a lower-order disposition [4]. Thus, a higher-order disposition is an ability to attain another (new) ability [5]. As the term is applied in giftedness research, giftedness can be considered an ability to develop further personal dispositions, such as motivation, consciousness, and creativity, leading to excellence and the manifestation of excellence.

Implication for identification: The traditional identification of giftedness often assesses the degree of skills already attained by students. In addition, assessing giftedness should include the ability to develop new skills and the degree of attainment of new skills. Dynamic assessments may be used to assess giftedness as a proximal development of higher-order dispositions.

Implication for education: Educational adaptations should include practices on developing new skills necessary for developing higher-order dispositions. For example, meta-cognitive skills can be a precursor to further dispositional development.

Dispositions are causally related to their manifestations [6]. The giftedness concept may be explicated by its properties manifesting under some conditions. A particular disposition is causally related to the emergence of giftedness if this disposition is a member of every sufficient condition. Various terms are used to designate a set of personal dispositions in gifted education, such as precocious, intelligent, able, talented, academically advanced, gifted, etc. Nevertheless, such dispositions do not explicitly refer to stimulus conditions where they display their manifest properties. Personal dispositions are canonical dispositions that manifest when they are exposed to corresponding stimulus conditions [7]: "A" would show "C" if it were to be situated in "B" at "t". When applied to the giftedness concept, a person is said to possess giftedness only if she exhibits dispositional properties relevant to giftedness (e.g., acquiring new skills or creating novelty) when interacting with corresponding stimulus conditions. From this perspective, no "hidden gift" should exist in a stimulus condition sufficient for mobilizing efficient interactions between stimuli and personal dispositions.

Implication for identification: Assessment of giftedness should be conducted using stimulus conditions relevant to manifest properties of dispositions of giftedness. For example, performance-based assessments in a domain can stimulate dispositions of domain-specific giftedness. On the contrary, general intelligence tests may not be sufficient to identify gifted students for talent development programs.

Implication for education: Educational adaptations should provide a learning environment that stimulates manifest dispositional properties of giftedness. An irrelevant environment to a particular talent type may not stimulate dispositions relevant to this talent.

Dispositions have the potency to be stimulated by diverse stimulus conditions [8]. Multi-track dispositions characterize giftedness. A disposition of giftedness could be activated by multiple stimulus conditions. Multi-track dispositions are characterized by responding to more than one pair of stimulus conditions [8]. For instance, a child's interest in reading can be stimulated by her parents' night readings, a television program, picture books, or by interacting with peers who are good readers. Because giftedness manifests through multiple dispositions, there exist many ways through which giftedness develops and manifests.

Implications for identification: Multi-method assessments of giftedness should be used to observe the growth of a potential disposition relevant to the manifestation of giftedness. Standardized tests may not be the best way to assess giftedness. Furthermore, each disposition relevant to manifesting giftedness may be assessed using a different method. For example, some creativity skills can be assessed using observations, some by performance-based assessments, and others by paper-pencil tests.

Implication for education: Educational practices should provide multiple adaptations to foster a single disposition relevant to a particular talent. For example, some children's dispositions may be stimulated when visiting a library, while others may be stimulated when they go on field trips.

The development and manifestation of giftedness require an interplay of intellective and non-intellective dispositions. Giftedness emerges from multiplicative interactions between personal dispositions, including intellectual and non-intellectual ones, and the environment. Dispositions exhibit veto and compensation potentials [9]. The absence of one disposition necessary for the interaction can veto the emergence of giftedness. Therefore, non-intellective dispositions should not be considered catalysts; instead, they should be accepted as essential as intellective dispositions to develop and manifest giftedness. For instance, motivation [10] is as essential as natural facilities [11] in manifesting giftedness. A lack of interest in a domain can preclude talent development in this domain, even if all the intellectual dispositions are fully developed.

Implication for identification: Besides intellectual dispositions, non-intellective dispositions, such as motivation, interest, and goal orientation, should be used to assess giftedness. Many theories of giftedness (e.g., the three-ring conception of giftedness, [12] propose non-intellectual dispositions to be essential for giftedness. However, identification practices are not aligned with these theories.

Implication for education: Educational practices should be adapted to build a corresponding bridge between intellectual and non-intellective dispositions so that dispositions present mutual stimulations, resulting in multiplicative interactions. For example, a learning environment adapted to stimulate a particular intellectual disposition should first excite a corresponding non-intellectual disposition.

3. Stimulus Conditions

Personal dispositions' manifestations are always relevant to stimulus conditions because a person manifests giftedness when interacting with stimulus conditions. The quality and relevance of stimulus conditions are essential for developing giftedness. An environment provides numerous potential stimuli [13]. Some of these stimuli are active; some are passive. Active stimuli happen in stimulations only. From a talent-development perspective, a passive stimulus becomes active, provided that it activates a person's disposition. Nonetheless, passive stimuli (e.g., bicycle) for an individual may be active stimuli for others.

Stimulus conditions comprise external and internal stimuli [14]. Any environmental condition is an external stimulus, whereas an internal stimulus can be an aftereffect of an environmental stimulus or an aftereffect of a personal disposition. Just like how an external stimulus (environmental) can arouse emotions in a person, a personal disposition (e.g., memory) also can create a similar stimulation without an external stimulus. For example, both an external stimulus and thinking without an external stimulus have the potency to stimulate emotions. Both types are necessary for talent development as their interaction initiates and maintains engagement in talent development. Three propositions related to the specification of stimulus conditions and their implications for identification and education are discussed next.

Stimulation is a personal experience. Stimuli are generic [13], but stimulation is unique. Two children are stimulated differently by the same stimulus conditions. A storybook does not necessarily stimulate two children in the same way. One child asks questions after reading the storybook, whereas another child may not be interested. Stimulation plays a significant role in talent development, as developing talents is fundamentally personal work. Thus, one should ask, "How is a person stimulated to engage in activities that develop talents" rather than "What type of stimuli-environmental adaptation is the best for developing talents." In accordance with this perspective, searching for or creating the richest resources may not lead to exceptional talent development; instead, a stimulus condition that activates stimulation for a person should be constructed.

Implication for identification: Because stimulation is personal and thus more relevant to assessing personal dispositions than stimuli, the assessment of giftedness should not be generic; instead, it should be person-based and individually tailored to stimulate personal dispositions. A norm-based assessment often is employed to identify students with gifts in traditional identification of giftedness. This method of identifying gifted students is mostly generic, presenting the same stimuli to all students. Observations of personal stimulations with person-based stimuli in assessments can inform whether someone has dispositions relevant to a specific talent.

Implication for education: Talent development programs should provide a personally meaningful experience. The relevancy of stimulus conditions to a set of dispositions essential for a specific talent domain increases the possibility of manifesting giftedness. Learning experiences irrelevant to a special talent may stimulate intellectual dispositions but not necessarily non-intellectual ones, resulting in additive interactions, not multiplicative ones.

A stimulus condition's causal relevance to manifesting giftedness cannot be generalizable. Stimulus conditions are needed to manifest giftedness. However, no particular assembly of stimuli is required to express giftedness. A stimulus condition can be considered an INUS condition [15]. A particular stimulus condition may be sufficient but unnecessary for manifesting giftedness [16]. An entirely different assembly of stimulus conditions may create the same stimulation. For instance, a child's artistic expression can be aroused by her mother's love, a cat's, or a dog's love. A scientist's creative thoughts can be stimulated by her research, a lecture another scientist offers, or a scientific article. The result can be the same manifestation of talent.

Implication for identification: A multi-trait-multi-method time series assessment of giftedness can be used to identify multiple conditions appropriate for identifying gifted students. For example, a particular set of conditions may be insufficient for stimulating some manifest properties of giftedness at a point in time due to developmental differences but sufficient for other dispositional properties. For example, ideational fluency may be sufficiently activated by simple science experiments at age seven, but it may require a different set of prompts to manifest at the same five.

Implication for education: There are more ways than one to foster dispositions of special talents. Stimulus conditions are qualitatively and quantitatively heterogenous [8]. A stimulus condition activates multiple dispositions for manifesting giftedness, from emotional arousal to creativity. Educational practices should provide multiple adaptations for talent development as an educational adaptation believed to be superior to other adaptations may be unnecessary but sufficient to foster a particular personal disposition.

Talent development requires hierarchically organized stimulus conditions. Hierarchically organized stimulus conditions increase the likelihood that the interaction between an individual and stimulus conditions adaptively continues. A nonhierarchical stimulus condition can lead to the disappearance of a particular behavior important for talent development. For example, gifted students who are bored in traditional educational settings show a lack of learning motivation [17]. In addition, the relevancy of the hierarchical organization of stimulus conditions to a specific talent domain increases the possibility that giftedness manifests.

Implication for identification: Stimuli used to assess giftedness should be progressively organized to maintain continuous stimulation for expressing giftedness and to assess higher-order dispositions. A hierarchical organization of stimulus conditions in assessments should include intellectual and non-intellectual dispositions. Like intellectual dispositions, non-intellectual dispositions come in degrees.

Implication for education: Educational practices for talent development should be progressively adapted to personal dispositions so that adaptations continuously stimulate interactions between a person and the environment. Educational adaptations should apply two principles. First, educational adaptations should lead to progressive adaptations in personal dispositions. Second, educational adaptations should be advanced enough to further the interaction between a person and the environment. Stimulus conditions should include individually responsive enrichment in education by which students develop interest and start interacting with the environment.

4. Interaction

Interaction should have the lion's share in talent development because the potential for giftedness manifests when interacting with stimulus conditions [2]. Indeed, research shows a sizeable unexplained variance after considering the main effects of many variables, such as intelligence, personality, motivation, practice, and environment, on talent development and exceptional achievement in specific domains, such as mathematics [18], sciences (e.g., [19]), music (e.g., [20,21]), sports (e.g., [22]), and general academic achievement (e.g., [23–25]). Interaction effects primarily account for unexplained variance in exceptional achievements.

Sternberg [26] recently postulated a three-step process to explicate the concept of giftedness. According to this view, a three-way interaction of an individual, task, and situation leads to exceptional achievement. Giftedness resides in the interaction of a person and tasks representing the sociocultural situational contexts. This new conceptualization implies a higher-order interaction in talent development. Thus, giftedness should be sought in higher-order interactions, not in a person. However, traditional practices (trait-based) for identifying gifted people assume that identifying a person's intellectual predisposition will guarantee an efficient interaction between the person and environment since it relies on seeking giftedness in a person. This may be wrong because higher-order interactions require many personal dispositions to interact with each other.

The quality of interaction is a matter to consider in talent development. All interactions do not necessarily lead to the development of exceptional talents because developing exceptional talents requires progressive adaptations of interactions [27]. Nevertheless, progressive adaptations of interactions do not occur without corresponding adaptations in personal dispositions and environment. This implies a higher-order interaction between intellective dispositions, non-intellective dispositions, and the environment. A reciprocal causation between dispositions and environment may lead to progressive interaction, creating multiplier effects in talent development. The person-environment correlation model offered by Stanovich [28] explains how such interaction effects occur in development.

Talent development requires higher-order interactions. As the manifestation of giftedness requires the interplay of many personal and environmental variables, interactions between person and environment should not be constrained to intelligence and environment only but should include higher-order interactions, the combined interaction of several variables. In higher-order interactions, one or more factors shape the interaction between two or more factors [29]. The combined effect of multiple factors can be larger than their main effects on talent development (e.g., skill attainment), or the interaction effect of an independent variable can be larger than its main effect on a dependent variable. Higher-order interaction effects are observed in many domains of talent development. On musical competence, for example, the joint effect of training, intelligence, memory, SES, and personality (openness to experience) is as large as the sum of their main effects [21]. Intelligence (intellectual disposition) and personality (non-intellectual disposition) indirectly affect musical competence through mediating music training (stimulus condition). Similarly, the interaction effect of intelligence with engagement (deliberate practice) is much higher than its main effect on musical achievement [20]. Individuals with higher intelligence and certain personality characteristics may benefit more from musical training.

Talent develops through a recurring feedback process between a person and the environment. This process has the potency to multiply the main and interaction effects of personal dispositions and stimulus conditions. It also creates new interactions. That is, talent development essentially requires a multiplicative process, which leads to higher-order interactions. A multiplicative process reduces the environment's and intelligence's contribution as single variables in talent development. Nevertheless, it maximizes their contribution to interactions. Furthermore, their interaction effect depends on non-intellective dispositions, as they are jump-starters for interactions. For example, an adolescent with the most advanced intellectual skills in the richest family does not necessarily become a high-achieving adult, provided she interacts efficiently with her environment, resulting in multiplicative effects on her achievement. Studies of giftedness have reported a multiplicative effect (e.g., [30]).

Implication for identification: The assessment of giftedness should include both measures of dispositions and the observation of interactions (e.g., engagement quality) with stimulus conditions used to assess giftedness. Alternative assessments, particularly observation-based, of giftedness can be suggested to assess interactions that could be used as expressions of giftedness. The assessment of interactions can provide information about discrepancies, if any, between intellectual and non-intellectual dispositions, whereby a more accurate profile of giftedness can be obtained.

Implication for education: Educational practices should consider curricular connections among personal dispositions and learning-oriented environmental adaptations to initiate and maintain higher-order interactions between the person and the environment. Higher-order interactions can be observed in the classroom over time when students engage in classroom activities. A higher-order interaction may be evident if the quality of personal dispositions and instructional activities mutually increase.

Non-intellective dispositions initiate interaction between a person and the environment (e.g., inquisitiveness), while the interaction is mediated and maintained by personal dispositions and the environment. Ziegler [27] put forward a hypothetical link between actions and goals. Personal goals lead to actions. Enjoyment is the primary goal. Then, other goals, such as skill acquisition, may be achieved. Applied to developing special talents, a child's initial interest in attaining a skill can initiate mutual causation between the child's dispositions. For instance, assume that the first skill for a three-year-old child to develop football talent is to hit a ball. The child takes action to hit the ball if she is curious about hitting the ball. If she enjoys hitting the ball, her parents will respond to her, and she may keep doing the same action, gradually improving her skills, such as coordination and muscle strength. The better she hits the ball, the more satisfaction she enjoys; the more she enjoys hitting the ball, the more she practices with the ball, leading to a feedback loop. The child's curiosity (non-intellective) initiates the action of hitting a ball. Her ability, interest, enjoyment, and her parents' actions mediated and maintained the child's interaction with the ball. Nonetheless, an intellectual disposition can stimulate a non-intellectual disposition that can sometimes start an interaction.

Implication for identification: Most assessments of giftedness include intellectual dispositions only, assuming that intellectual skills are the single cause of exceptional achievements. However, achievement requires jump starters for the interaction between an individual and the environment. In most cases, the jump-start is a non-intellectual disposition (e.g., goal orientation). The assessment of domain-specific non-intellective dispositions should be a component of assessing giftedness. Too general non-intellectual dispositions (e.g., being interested in everything) may not work as a jump-starter.

Implication for education: Educational adaptations should be built on the idea that intellective dispositions can be effectively used when non-intellective dispositions are sufficiently active. The primary question should be, "How do students engage in learning activities?" when developing instructional activities.

An interaction requires evolutionary changes for exceptional talent development. Analogous to the diversification and advance in the evolution of species [31], talent development depends upon interactions that require two types of adaptations, both in person and in the environment. The first one is focused diversification. The second one is advancement. These adaptations can potentially lead to "multiplier effects" [32] in developing special talents. Focused diversification for individuals applies to the number of specialized skills and knowledge needed to achieve excellence in a talent domain. On the other hand, advancement for individuals implies growth in each skill and knowledge level necessary to attain excellence in this domain. Both focused diversification and advancement require the effective use of environmental resources and efficient interactions with the environment. Focused diversification at the environmental level includes increased opportunities and resources (teachers, schools, courses, mentors, teams, etc.) in a talent domain in which the person has a keen interest and goals. Advancement at the environmental level implies the quality of opportunities and resources. A person cannot achieve exceptionality provided she gradually improves the quality of the environment in which she attempts to develop exceptional talents.

Implication for identification: Growth in talent development should be used to assess giftedness. Assessments may include focused diversification and advancement in a talent domain. The attainment of and progress in special skills essential to talent development in a domain can be used as a manifestation of giftedness. In addition, the efficient use of environmental resources may be used as a gauge of talent estimates. Static assessments provide valuable information about a person's past growth in a talent domain and make estimates accordingly, but do not show how this person benefits from resources to develop talents.

Implication for education. Educational practices should provide adaptations to support the diversification and advancement of special skills critical to developing talents. Both quantity and quality of skills are important for talent development because special talents are composed of various skills. For example, an exceptional basketball talent requires various skills, such as dribbling, rebounding, passing, shooting, endurance, acrobatic ability, agility, and speed. Advancement only in one skill is insufficient for an exceptional basketball player. In addition, each increase in skill development should follow a corresponding resource advancement.

5. Conclusions

The FCG is not concerned with identifying the intellectually smartest students for gifted education programs but with selecting students whose personal dispositions fit these programs. The fittest students display an adaptive network of personal dispositions and interact efficiently with opportunities and resources provided for talent development. In contrast, the smartest students who lack adaptive dispositions may not develop adaptive interactions leading to talent development. Research shows that insufficient adaptation in the learning environment is one of the major causes of underachievement among gifted students (e.g., [33]). According to the FCG principles, formal identification is unnecessary for gifted education programs. Rather, a selection process should be carried out to search for students who develop adaptive interactions with the educational environment because identification assumes that giftedness exists in a person, whereas selection assumes that giftedness exists in the interaction. Identification may produce underachievers as it is static, whereas selection generates overachievers as it is dynamic. Thus, a norm may not be the best criterion for identifying gifted students.

Students can be selected for gifted education programs through a self-selection and adaptive retention process [34]. Self-selection refers to the process through which students who believe they have high ability, motivation, and interest in gifted education programs can apply to these programs. However, self-selection produces too many applicants, some of whom may be misfits in the programs. Adaptive retention can correct this misfit throughout the learning process. Some self-selected students may not develop exceptional achievement, learning motivation, and interest throughout the program. They should be guided to find education programs that are more appropriate for their talent development. The fittest students remain in the program.

Talent development is uniquely multiplicative, requiring progressively more complex higher-order interactions between personal dispositions and stimulus conditions as parts of a larger learning environment. Expertise-reversal-effect models [35] and trait-treatment interaction models [36] can be good educational adaptations for talent development. Nonetheless, a unilateral view of giftedness applied in gifted education programs usually tends to offer the same education for all students, with a primary goal of raising academically advanced pupils. This understanding of giftedness and the approach used to educate these pupils are not aligned with the view addressing diversity in gifted education: One size does not fit all [37]. Because talent develops through higher-order interactions with evolutionary changes in personal dispositions, educational practices should focus on environmental adaptations that promote higher-order interactions creating multiplier effects in talent development.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: No new data were created or analyzed in this study. Data sharing is not applicable to this article.

Conflicts of Interest: The author declare no conflict of interest.

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education sciences

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Interdisciplinary Insights That Reveal Contextual Influences on the Development of Giftedness and Talent

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Abstract: There are powerful, hidden contextual influences that strengthen, weaken, or distort the discovery of aspirations and the development of talents in gifted individuals. These influences can be hidden from gifted individuals and their teachers and mentors because they are not sufficiently addressed in the gifted education research literature. This analysis highlights and describes examples of contextual influences that emerge from phenomena studied by scholars in a wide variety of fields. After these examples are presented and clarified, recommendations for educators and scholars of the gifted are provided.

Keywords: gifted; talent; education; interdisciplinary; ethics; transformational giftedness

Citation: Ambrose, D. Interdisciplinary Insights That Reveal Contextual Influences on the Development of Giftedness and Talent. *Educ. Sci.* **2023**, *13*, 690. https://doi.org/10.3390/educsci13070690

Academic Editors: Kirsi Tirri and Valerie Margrain

Received: 21 May 2023
Revised: 28 June 2023
Accepted: 28 June 2023
Published: 7 July 2023

1. Overview of Interdisciplinary Creative Intelligence Explorations

For a very long time, scholars in most academic disciplines have focused intently on phenomena within their own fields. They seldom consider theories and research findings from beyond their own domains [1–3]. In one example, over 20 eminent researchers came together to unify theories of creative intelligence. This was an interdisciplinary group including an economist, a philosopher, a theoretical physicist, psychologists, and gifted education specialists, among others. This posed a problem because the participants did not know the knowledge bases and terminology their colleagues brought into the forum. Consequently, the author of this article was brought in to serve as an interdisciplinary translator who would read the works of all of the participants and turn their major insights into visual metaphors [4]. These were drawings and paintings in which the imagery metaphorically captured the ideas from the research. Each visual metaphor was accompanied by a brief story explaining how the symbolism in the imagery conveyed the theories and research findings. They were set up around the conference rooms as if in an art museum and during breaks, the participants could wander around, look at the images, read the accompanying text, and familiarize themselves with the knowledge bases from the fields represented in the project. This helped them communicate with one another.

When interdisciplinary teams are not involved, individual scholars still can carry out far-ranging interdisciplinary explorations that can add concepts and theories to the knowledge base in gifted education. For example, one project involved the cross-referencing of 87 theories and research findings from 29 academic disciplines and professional fields to create insights about creative intelligence [5]. This exploration enabled the discovery of cross-disciplinary influences. For example, ideas about leadership from indigenous studies [6] were connected with insights from feminist standpoint theory [7]. There were intriguing similarities. Both bodies of work showed how those who align with them tend to embrace multiple perspectives when carrying out complex decision making. Authoritarian leadership tends to be absent from the more inclusive processes magnified by indigenous studies and feminist explorations. These ideas also were connected with phenomena in critical thinking because they aligned well with intellectual humility, which signifies the critical thinking ability of decision makers that helps them avoid falling prey to their own dogmatic rigidity [8].

These interdisciplinary explorations have made my conception of giftedness expand and diversify throughout the years. I still recognize the value of traditional conceptions that include advanced cognitive abilities; exceptional scholastic achievement; prodigious accomplishment in an area of endeavor; and outstanding creative, artistic, or leadership capacities (see [9]). There also are some useful modifications and refinements in the field, such as a strong emphasis on the emergence of giftedness through long-range talent development [10]. But the interdisciplinary discoveries forced me to recognize that these conceptions cannot be held rigidly, and must be augmented with other capacities and dispositions, which are discussed in the sections to come.

Due to the interdisciplinary nature of this article, it is a conceptual piece instead of an empirical analysis. It is conceptual because it involves the importation and syntheses of a wide variety of research findings and theories from many fields. The interdisciplinary exploration in this article is not as broad as the aforementioned large-scale projects, but it does include constructs from fields including economics, ethical philosophy, political philosophy, psychology, evolutionary biology, primatology, sociology, social epidemiology, neuroscience, history, the complexity sciences, various STEM fields, and gifted education.

This article is one more step on an interdisciplinary journey that has been taking place for more than three decades. Throughout the journey, I have been exploring the literature in multiple disciplines to discover theories, empirical research findings, and phenomena that can refine, clarify, and expand our knowledge of giftedness, talent development, and creativity. I have also been collaborating with scores of scholars from these various fields so they can contemplate some ways in which their work can apply to high ability. In essence, this and the other interdisciplinary projects tend to generate conceptual syntheses that produce insights conducive to additional theorizing and empirical work in gifted education.

Interdisciplinary work is needed because gifted education is a fragmented, porous, contested field [11]. Consequently, giftedness is a complex, ill-defined construct because there is no dominant theory as there would be if the field was unified, insular, and firmly policed [11,12]. An example of a unified field is neoclassical economics, which revolves around the dominant rational actor theory. The ideas for gifted education that are inspired by constructs from many disciplines are very diverse, including revisions of conceptions of giftedness, motivational dynamics, underachievement, and productive ways to solve problems in complex environments, among others. The following sections provide some examples of interdisciplinary connection making with high ability.

2. Transformational Giftedness versus Predators

Questions arise about the extent to which giftedness is used for beneficial or harmful purposes. Sternberg [13–15] draws distinctions between transactional and transformational giftedness. Individuals who are transactionally gifted use their impressive intelligence and talents to benefit themselves, often at the expense of others. In contrast, those who are transformationally gifted use these abilities to inject compassion and altruism into their innovative proclivities so they can make the world a better place. Sternberg recommends that the field of gifted education pay more attention to the ethical dimensions of high ability so bright, talented individuals will be more likely to move toward transformational manifestations of giftedness when they become adults. He also points out that only some transactionally gifted individuals do truly harmful things that might be considered similar to the damage caused by talented psychopaths (see [16]). Many of the transactionally gifted do not mean to do harm, but they can do it when they are only thinking about themselves.

Contextual pressures in societies can push the gifted toward either transactional or transformational inclinations as they develop toward adulthood. Many of the most powerful of these pressures come from the ways in which societies run their economies, which range from communist government control to vigorously deregulated, free market capitalism, with prudently regulated capitalism in between. For several decades, many developed nations have strongly favored deregulated capitalism [17] so individuals can have maximal freedom as they develop their aspirations and talents and produce innovative enterprises. Deregulation minimizes government control over the economy so attempts by political agents to set up protections against unethical predation are weakened and discouraged. In contrast, nations that strongly favor the regulation of capitalist enterprises impose protections against economic predation, but they can diminish the freedom that makes high-level economic innovation easier [17–19]. Due to the shift of developed nations toward deregulated capitalism, this section of the article focuses on the effects of this economic system on gifted individuals.

Striking a balance between regulation and deregulation tends to make the economy vibrant and inclusive. It does not marginalize large portions of the population in a society but it still creates considerable wealth. But going too far in one direction or the other harms the economy and the lives of most citizens. The field of economics has been dominated by neoclassical theory, which portrays human agents in the economy as *rational actors* who are perfectly rational, make decisions on the basis of nearly complete information sets, and carry out these actions for entirely selfish purposes [18,20–22]. According to this theory, millions of selfish individuals engaging in economic actions make the economy strong and beneficial for all. But leading economists who dissent from rational actor theory argue that the economies of most nations around the world have become too deregulated and pour most of the wealth up into the pockets of a very small percentage of the population while leaving most others exploited and deprived [17,18,22,23]. Mulgan [24] used an insect metaphor to effectively convey the essence of this huge economic problem:

> If you want to make money, you can choose between two fundamentally different strategies. One is to create genuinely new value by bringing resources together in ways that serve people's wants and needs. The other is to seize value through predation, taking resources, money, or time from others, whether they like it or not. Your choice, in short, is whether to be a bee, or a locust. (p. 52)

Clearly, the most intelligent and talented human locusts in a society are transactional and enrich themselves without caring about the effects on others. In contrast, the gifted human bees in a society are transformational and try to ensure that their enterprises help others by going beyond selfishly stuffing their own pockets. This enormous, powerful contextual pressure on the ethical development of the gifted needs to be addressed by professionals in the field of gifted education, as recommended by Sternberg [13–15], Tirri [25], and Ambrose and Cross [26]. They need to become more aware of the locust–bee economic phenomenon and establish gifted programs that encourage students to aspire to become transformationally gifted bees instead of selfish, exploitative locusts.

3. Are We by Nature Vicious Competitors?

In scholarship related to the locust–bee metaphor, Charles Darwin's [27] insights about natural selection have fueled the popular notion that nature is red in tooth and claw, which means highly competitive and somewhat vicious. Compassion and cooperation seem not to fit well into this portrayal. Consequently, the notion that humans should be very aggressive and competitive has prevailed in a number of fields including economics, which portrays people as selfish rational actors (for details, see the prior section on transformational giftedness).

But some scientists have been arguing that the red in tooth and claw perspective is shortsighted. Ryan [28] argues that cooperation has played a much bigger role in evolutionary processes, and that human societies largely develop through cooperative inclinations. Similarly, primatologist Frans de Waal [29–31] has shown how cooperation and empathy are very evident in animal behavior. Observations in this field have revealed widespread empathetic actions within species, but surprisingly, the empathy can extend even further when creatures from different species interact and help one another.

The implications for gifted education are intriguing. Competition dominates the selection processes for identifying students for gifted programs because these processes are dominated by supposedly precise, mechanistic measurements of intelligence and academic achievement (see [14,32]). Scholars and other professionals in gifted education have been developing and implementing more holistic, "less competitive" identification processes for a long time [32] but at the local level, mechanistic measures are magnified because they are somewhat resistant to arguments against their accuracy and inclusiveness, so they stand out as tools for selection of the gifted.

If professionals in the field were to heed the advice of prominent scholars who challenge long-term suppositions about intelligence, and step away from assumptions about nature being red in tooth and claw, they might align themselves more with the insights provided by the biologists and primatologists who have discovered and magnified the importance of cooperation and compassion. This could incline them to broaden their conceptions of giftedness while being more cautious about the accuracy of precise measurements (more on this precision in a later section). They also might focus less on promoting individualism and create more opportunities for the gifted to experience collaborative work aimed at helping others who are not in their identity group (see more on identity dynamics in the next section).

4. Particularist versus Universalist Morality

Many of the most serious problems in societies arise from the extent to which individuals favor those who are in their identity group while marginalizing or harming those who are not. Political philosopher Kristin Renwick Monroe [33–36] and ethical philosopher Alan Gewirth [37] illustrated some ways in which individuals can fit into two different moral–ethical camps. Those who align with *particularist morality* can be kind, generous, and compassionate toward those who are within their identity group. These "insiders" tend to be favored by particularist individuals because they are of the same ethnicity, race, religion, or other important identifiers. But particularists can denigrate, marginalize, or even do considerable harm to "outsiders" who do not fit their identity. This harm can be minor, but it also can extend all the way up to slavery and genocide. In contrast, those who align with universalist morality tend to extend their kindness, generosity, and compassion to all of humanity, including those who are very different from them.

When particularists come to dominate a society, conditions can become dire. Nazi Germany was a frightening example. Adolf Hitler and his supporters motivated the masses to follow the Nazi cause by selecting groups of outsiders and labeling them as subhuman and evil (see [38,39]), thus giving their followers enemies. This strongly encouraged the followers to adopt and firmly embrace their Nazi identities so the leaders could exploit them for political gain. Consequently, Jewish people and some other marginalized groups suffered miserably. The Nazis exterminated millions while engaging in a world war.

Along similar lines, unethical leaders in some developed nations today are identifying groups to be targeted for the same reasons that Hitler chose. These leaders promote and fuel the rise of authoritarian populism because they want large numbers of dogmatic followers who will obey and support them [40]. They distract their followers from the unethical exploitation they impose on them by denigrating certain racial and ethnic groups. This drives the followers into a frenzy that can turn violent at any time. The result is strong polarization in the population that undermines democracy [2,41].

These conditions provide gifted individuals with major problems to overcome and significant opportunities for leadership. All of this aligns with the aforementioned concept of transformational giftedness [12–14]. If some ethical individuals who are transformationally gifted (intent on making the world a better place) become interested in the power dynamics of sociopolitical systems, they will use their impressive intellectual capacities and talents to promote the growth of universalist morality throughout their societies while preventing the growth of harmful particularist versions of morality. They will find ways to suppress the deceptive messaging that encourages the masses to fall for toxic authoritarian populism. In contrast, some of those who are transactionally gifted (using extraordinary abilities for selfish purposes) will aspire to become powerful leaders in the sociopolitical system, and they will creatively design communication processes to promote and strengthen the unethical messaging that fuels the growth of toxic forms of particularism. Given the harmful trends toward the undermining of democracy in the 21st century [2,41–43] it is extremely important to help gifted individuals become transformational universalists instead of transactional particularists.

5. Chronic Stress Emerging from Severe Inequality

Socioeconomic inequality grows and recedes over the long term. In some locations and eras, it is rather mild, while in others, it becomes extremely severe. The more inequality grows, the more chronic stress it forces onto the population, with the deprived suffering more than those who have significant wealth [44–46]. However, even those who are very well off suffer from the chronic stress caused by social comparison. Affluent individuals can feel this stress when they compare their assets or incomes with the wealth of others and find themselves losing the comparisons.

Sapolsky [47], a prominent neuroscientist, showed how the chronic stress suppresses and distorts cognitive development and processing. He describes how the "biological grind" caused by this long-term stress in highly unequal societies causes inflammation, chromosomal damage, and distorted brain functioning. Here are some of the suppressions and distortions of the brain–mind system:

- prefrontal cortex impaired (lowered executive function diminishes planning, decision making, and impulse control)
- hippocampus reduced (learning and memory weakened)
- amygdala distortions (fear and anxiety heightened)
- mesolimbic dopamine system (crucial for motivation; disruption leads to depression and addiction)
- retracting connections between neurons and suppressing the birth of new neurons (diminishes thought capacities)

Here is how Sapolsky [47] describes the essence of the inequality problem: "We know enough to prompt moral outrage at the situation. It is outrageous that if children are born into the wrong family, they will be predisposed toward poor health by the time they start to learn the alphabet".

Social epidemiologists Wilkinson and Pickett [45,46] show how the chronic stress from inequality also aggravates societal problems, which include elevations in mental illness and drug and alcohol addiction, lower levels of trust, suppressed social mobility (the chances that a child will become more successful than her/his parents), higher levels of violence and incarceration, and suppression of educational achievement, among others. They show how the social problems in more egalitarian nations (e.g., Japan, Finland, Sweden, Norway, etc.) are much less brutal than they are in nations with far more extreme inequality. The United States is by far the most unequal of the developed nations, and has the most acute social problems.

One other phenomenon embedded in the severe inequality we are experiencing in the 21st century is the difference in treatment between street criminals and corporate criminals [48,49]. Those who come from deprivation can commit very small crimes but end up incarcerated for decades in the horrific conditions of maximum security prisons [50]. Politicians, who like to portray themselves as "tough on crime", have promoted the growth of the "carceral state", a term Gottschalk uses to show how widespread, unfair, and toxic the crime–punishment system has become in the United States.

How can educators of the gifted and their students benefit from more knowledge about the effects of inequality on gifted students? First, they can recognize the ways in which their aspirations and talents might point them toward becoming either bees or locusts in adulthood, and strive to become the former instead of the latter. And while "becoming bees", they will be injecting their impressive aspirations and abilities with the ethical awareness that encourages them to become transformationally gifted (making the world a better place) as opposed to selfish and transactionally gifted (see the prior section on transformational giftedness for details).

Second, they can recognize that students' educational achievement and mental health are being suppressed and damaged if they live in a highly unequal nation. Such awareness can help them realize that any underachievement they are experiencing is at least partially due to the chronic stress produced by their nation's inegalitarian economic system. While this awareness can produce frustration, even disgust, it can be somewhat liberating because these individuals can recognize that they have impressive, hidden abilities that have not been allowed to emerge due to economic circumstances. They will be motivated to discover and develop these abilities to the full extent possible. When they become adults, they also might be inclined to make the world a better place by pushing the ideological and economic systems in their nation toward the bee metaphor as opposed to the locust one.

Intriguing, powerful examples of individuals transforming from locusts into bees come from the "Lost Prizes" program at the University of Winnipeg in Canada [51,52]. The professionals who designed and operate this program look for deprived individuals who have gone astray and then help them discover their aspirations and talents so they can establish new, more productive, ethical life trajectories. In one example, they helped an incarcerated young man regain his freedom and develop his abilities to the point where he is currently a practicing physician. Along with other recovered lost prizes, he is now doing positive, ethical work instead of destroying himself and others on the violent inner-city streets.

In addition to the Lost Prizes initiative, some professionals in the field of gifted education have been revealing the effects of severe inequality on the gifted while recommending ways to address this large-scale problem. For example, a group of scholars analyzed the effects of inequality on the gifted in a Special Issue of the *Roeper Review* [53]. Taken together, the contributions showed how severe inequality suppresses and distorts the aspirations and talent development of deprived, gifted individuals while diminishing their chances for admission to gifted programs. Some other scholars illustrate the ways in which gifted programs do not sufficiently address the effects of implicit bias against the educational prospects for Black, Hispanic, and Indigenous students (e.g., [54,55]). Essentially, all stakeholders in gifted education should be aware of the effects of socioeconomic inequality on the gifted and talented. Educators and parents need to address these effects to the full extent possible in terms of guiding, mentoring, and strengthening the motivation and achievements of the deprived students. Gifted, impoverished students must recognize that their impressive abilities could be hidden by the socioeconomic pressures they face.

6. Colossal Disasters and Creative Constraints

Most people logically assume that creative thought and action cannot take place effectively when there are significant barriers. It seems likely that individuals and groups confronting economic difficulties, environmental problems, large-scale conflicts, and other high-pressure issues will be too busy trying to survive and they will not be able to come up with innovations. But counterintuitively, research in the field of creativity studies shows that constraints can actually fuel impressive creativity [56–58]. Rather than completely blocking progress, when problem solvers remain somewhat flexible, the constraints imposed by the barriers can enable them to contemplate unusual solutions and select and implement the best of them. The results can be highly creative, impressive problem solutions or innovations.

One interesting example of creativity becoming vibrant in the face of constraints comes from what was arguably the world's worst pandemic, the Black Death that began in 1346 [59]. This plague exterminated half of the population in many regions and caused enormous suffering. It is hard to imagine a more daunting constraint than this. But because of this massive devastation, the shrinking of populations left more assets in the hands of survivors. Demand for various goods grew, and the European economy expanded. This new economic vibrancy jumpstarted the creation of new technologies such as blast furnaces, water power, wind power, and new weaponry.

Similar creative processes emerged in response to the constraints imposed by the COVID-19 pandemic [60]. Transport and trade disruption caused by this horrific global problem prompted the creative development of new agricultural innovations, including new forms of automation in food production.

When confronted with intimidating barriers while trying to carry out their work, gifted individuals can freeze up and stop trying because persisting seems futile. But if they know about the ways in which creative constraints can spark the emergence of creative insights, they might find themselves being more optimistic about the conditions in which they find themselves. They might be more willing to try various options and fail multiple times because they know that one or more creative solutions is hidden within the contextual turbulence that currently confines their thoughts and actions. Gifted perfectionists (see [61]) might benefit the most from this because knowledge of the creativity embedded in constraints can make problem solvers more accepting of their own failures.

7. Riding Hope to Prevent an Impending Apocalypse

Primatologist Jane Goodall has studied animal behavior, as well as trends and issues in the 21st century (see [62]). In her far-reaching investigations, she has contemplated ways for humanity to grapple with the large-scale macroproblems that are discussed elsewhere in this analysis (see [63,64]). In recognition that the combination of these problems produces the next essential crisis, she and her colleagues have investigated the phenomenon of hope that might help us survive and perhaps thrive in the decades to come.

She identifies four reasons to be hopeful. First, there is the recognition that nature is surprisingly resilient when environmental disasters strike. Climate change and pollution might destroy plants and animals on a large scale, but nature has a tendency to evolve and produce survivors that can deal with new conditions. Second, the human intellect is surprisingly effective because it can adjust to deal with rapidly changing conditions. This is in spite of the fact that these intellectual capacities also have been creating and fueling many of today's most serious problems. Third, the indomitable human spirit enables populations to grapple with problems while pondering the efficacy of possible solutions. Fourth, the power of young people to recognize and deal with the problems caused by prior generations has been impressive throughout human history. Taken together, these four reasons for hope represent a metaphorical lifeboat on a sinking 21st-century Titanic that has slammed into a gigantic iceberg comprised of 21st-century macroproblems. This lifeboat might be able to bring humanity to safety and prosperity on a nearby metaphorical island.

How can this magnification of hope benefit gifted young people? Young people growing up in today's turbulent world cannot see much reason for hope because the news outlets and social media platforms surrounding them tend not to produce any optimism about the large-scale problems [65]. But if they learn about Goodall's four reasons for hope, they might be able to replace their pessimism with some degree of optimism. Moreover, if they engage in authentic learning and inquiry projects that connect with some of the macroproblems, they can do practical work that fuels optimistic attitudes.

8. Finding the Zone of Complexity

Some gifted individuals can be scatterbrained at times. They also can lock themselves inside rigid, dogmatic conceptual boxes [66]. Fortunately, many gifted individuals can also effectively deal with problems and create highly complex, flexible, productive ideas and processes. These very different actions can fit into a simple framework drawn from the interdisciplinary field of complexity science. According to research in this field, complex adaptive systems tend to oscillate along a continuum from excessive order to excessive chaos, with a highly productive, desirable space in between these extremes [67–70] (see Figure 1). Complex, adaptive systems can take a very diverse array of forms. Examples include animal populations in ecosystems, chemical reactions in a laboratory, traffic patterns in cities, individual brain–mind systems, groups of minds operating in teams, and many more.

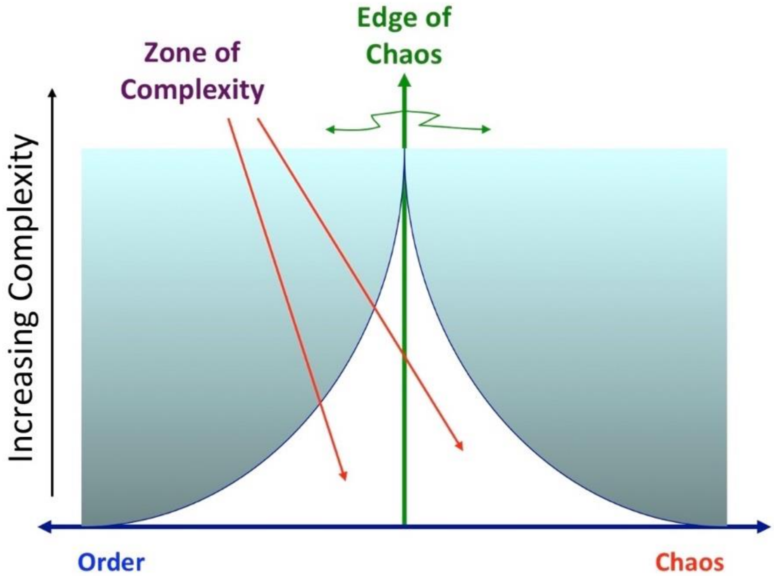

Figure 1. The chaos–order continuum (derived from [71]).

The inclination for complex, adaptive systems to oscillate along that continuum means they will move from rigid order through the zone of complexity at the *edge of chaos* (an opportunity space for the development of productive complexity) and toward excessive disorder at the other extreme. And then they swing back to the other side. Occasionally, they can become trapped at either end of the continuum, with some becoming excessively ordered and others becoming too chaotic.

Examples come from the operations of the human mind. Those who have inflexible cognitive inclinations can be trapped in rigid, dogmatic order. The minds of those who are trapped at this end of the continuum tend to produce any blend of narrowminded, shortsighted, superficial, rigid thinking. In contrast, those who suffer from schizophrenia can find themselves trapped in the excessive chaos end because their thought processes are too fragmented, disordered, and unpredictable [71]. Fortunately, those who can avoid entrapment at either end of the continuum can frequently find themselves in the *zone of complexity* in the center of the continuum, where a dynamic tension between chaos and order helps them create highly complex thoughts and actions. In this zone, they can come up with impressive innovations that can be either beneficial, or harmful, or both.

Some implications of the tendency for gifted minds to oscillate on this continuum include the need for professionals in the gifted education field to ensure that they are aware of chaos–complexity–order dynamics, and that their students become aware of them as well. With such awareness, they can avoid contributing to the world's biggest problem, which is dogmatism, because it fuels the growth of gigantic 21st-century problems [72,73]. These macroproblems are enormous issues in the world that can cause widespread, severe harm to populations around the globe [63,64]. They are so complex because they are international (cannot be solved from within the borders of a single nation), interdisciplinary (cannot be solved from within a single academic discipline or professional field), and long-term (took decades or centuries to emerge, and can take long time periods to solve). In contrast, those who learn about the zone of complexity at the edge of chaos will be more able to participate in the production of 21st-century macro-opportunities, which are enormous international chances for creating and spreading innovations that will improve the prospects for humanity. Some phenomena in the world are hybrids because they blend macro-opportunities with macroproblems. Here are three examples of these massive, 21st-century situations. For obvious reasons, climate change is a macroproblem and the emergence of green energy is a macro-opportunity. The development and growth of artificial intelligence (AI) is a hybrid because it can produce innovations that are very positive, or very harmful, or both.

9. 21st-Century Technological Innovation

The artificial intelligence mentioned in the prior section could produce new, highly beneficial modifications to socioeconomic systems, but it also could enable widespread totalitarian systems to arise throughout the world, devastating the lives of billions. With artificial intelligence developing the capacities to take over a lot of jobs in the economy, market leaders could turn this trend into a huge benefit for most of humanity because it could lead to far more rapid, efficient production of goods and services. This could expand wealth considerably and spread it broadly throughout the population while diminishing the need for employees to work long hours. However, it also could lead to just a few oligarchs controlling these new systems of technology for their own benefit while marginalizing and impoverishing most others. An especially interesting possibility is that advancements in AI could produce a *singleton*, which would be a concentration of power that could generate a global totalitarian regime (see [74,75]). The singleton could take the form of a few massively wealthy individuals who commandeer and retain the levers of power while destroying individual, personal autonomy and democracies. It could turn the masses into billions of "objects" to be controlled or marginalized by the technology. Another form of singleton could be artificial intelligence itself taking power away from humanity and controlling the lives of virtually everyone on Earth. Clearly, artificial intelligence increasingly represents a 21st-century macro-opportunity–macroproblem hybrid because it could produce enormous benefits or devastating harm, or both.

Another important form of 21st-century technological innovation is the production and dissemination of green energy systems that diminish the need for petrochemicals that are pushing climate change into very dangerous territory (see [76,77]). There are many forms of green energy systems. Here are a few examples: wind-powered turbines, solar power, hydropower, geothermal energy, and biofuels. If humanity is to prevent the devastating effects of climate change, green energy will have to advance and spread around the world quickly.

The implications for gifted education are intriguing. Some scholars in the field have been emphasizing the need for more effective learning about STEM (science, technology, engineering, and mathematics) innovation and its implications (e.g., [78]). Due to the powerful negative and positive effects of innovations in artificial intelligence, green energy, and other technologies, the importance of STEM learning in gifted education is even more evident. Moreover, this STEM learning needs to be combined with more emphasis on *panoramic scanning*, which is the ability to contemplate very long-range issues and broad-scope, interdisciplinary insights that can contribute to the expansion of knowledge about those issues [79]. Those who are effective panoramic scanners can discover and understand the long-range implications of technological innovations and the phenomena they produce while avoiding entrapment within shortsighted, narrow perceptions of knowledge that is confined within their own fields. If gifted young people can develop this long-range, broad-scope awareness, they will be less likely to generate unforeseen, harmful effects when they become adult innovators in STEM fields.

10. The Tyranny of Sterile Metrics

Excessive faith in the accuracy of precise measurement seems to plague many academic fields and professions. Here are some examples. Many economists portray gross domestic product (GDP) as a supposedly precise measurement of economic health and growth in a nation, but it ignores and distorts a lot of important economic phenomena [80]. A nation can have a high GDP even though its ideology and political policies severely undermine the life chances of a large percentage of the population. Similarly, IQ and standardized test scores are assumed to be precise indicators of giftedness even though they ignore a lot of very important abilities [32].

In a long-range, far-reaching interdisciplinary exploration, the author of this article has so far discovered 47 prominent scholars from 21 academic disciplines who are pointing at the same problem of excessive faith in quantitative precision and calling it different names. Here are just a few examples:

- pseudo-quantitative precision—Robert J. Sternberg, psychologist;
- sterile certainty—William Byers, mathematician;
- weapons of math destruction—Cathy O'Neil, mathematician;
- the tyranny of metrics—Jerry Muller, historian;
- the flight from reality in the human sciences—Ian Shapiro, political scientist;
- reductive megalomania; shift a muck heap with a teaspoon—Mary Midgley, moral philosopher;
- silly reductionism—Gerald Edelman, neuroscientist.

If a large number of eminent scholars from a wide variety of domains are concerned about the same problem, that problem can cause considerable harm throughout the world.

So what can be done about this widespread situation? It is important that professionals in the gifted education field become more aware of the problems caused by sterile certainty and work to overcome these problems. For example, they can strive to enlighten themselves about the need for an expansion of the methods for identifying the gifted and talented [32]. Too often, the identification processes are dominated by the precision of mechanistic measurements because this form of identification is more difficult to challenge than more complex processes that bring into play cognitive and social–emotional abilities that are very difficult to measure, such as the highly complex visual–metaphorical thought that Einstein used to develop the theory of relativity [81]. Educators of the gifted also should ensure that students understand that some of their abilities might be hidden by the sterility of the mechanistic assessments they undergo in the regular curriculum, and in gifted identification processes. If they understand that their measured achievement, which may not be as strong as they anticipated, did not include some powerful, hidden abilities, they might become more confident, even if they are not selected for gifted programs.

11. Insights from Outside Disciplines That Reveal Some Aspects of Hidden Giftedness

When giftedness is identified through the use of "sterile certain" quantitative measures, some of the most talented individuals are not selected because their abilities are largely or completely ignored by the testing. Some of these individuals are dual-exceptional (2e) because they have weaknesses in aspects of academic skills and knowledge that are focused on in the testing, but they have a strength in an area that is not. In essence, these individuals can have brilliance far beyond the norm, but that brilliance is hidden by a weakness such as a learning disability, ADD, ADHD, autism spectrum disorder, and other conditions [82,83]. Consequently, they might appear average or even below average to the teachers with whom they work.

There is a strong connection between visual–spatial thinking and STEM giftedness [84]. Neuroscientific research also shows this connection [85,86]. For example, O'Boyle showed how those who are gifted in mathematics tend to have brain-based processes that develop strong visual–spatial thought capacities. The visual–spatial thinking–STEM connection also appears in the history and philosophy of science literature. [81,87]. For example, "Scientists strongly prefer the visual mode of thought in their research" ([81], p. 281). Building more awareness of dual exceptionality and the power of visual–spatial thinking in the gifted could help educators and the 2e students they work with appreciate and develop these hidden abilities.

12. Concluding Thoughts

Gifted education is a complex field with a diverse group of stakeholders (students, teachers, counselors, parents, policymakers). What are the implications of the interdisciplinary phenomena explored in this article for the thoughts and actions of these various stakeholders? These phenomena tend to highlight the need to resist falling prey to dogmatism, and to think in big-picture ways that lead to positive ethical results. All of the stakeholders need to know about the impact of these phenomena and the need for strengthening ethical awareness in gifted students. In order to build that knowledge and awareness, the adult stakeholders in the field need injections of panoramic scanning capabilities [1] so they can contemplate the implications of their future actions for the gifted young people they know and help them infuse their growing talents and aspirations with empathy. Gifted students need to know about these concepts from diverse disciplines so they will understand how contextual pressures and constraints influence the development of their abilities and motivational and social–emotional dynamics.

Those who trap themselves within the thick walls of their specialized academic domain can do good work within that silo. However, they usually do not have the interdisciplinary knowledge necessary to contemplate the ways in which powerful contextual pressures can strongly shape, distort, or suppress the phenomena they study [3,79]. The best way to ensure that gifted education can escape its silo is to import relevant insights from diverse fields and explore how these insights connect with the research literature addressing giftedness and talent development. This analysis carried out some of that exploration by considering the nature and nuances of economic activities, evolutionary processes in nature, various forms of moral development, the impact of socioeconomic inequality, the influence of constraints on creative thoughts and actions, the importance of hope in a complex world, the balance between chaos and order in complex adaptive systems, various forms of technological innovation, some problems that occur when excessive faith in precise measurement prevails, and some aspects of dual exceptionality. A lot of ideas about giftedness and talent emerged from these analyses, but this is only a small exploration of very broad, complex, interdisciplinary conceptual territory. More of this exploration is needed to align gifted education with trends and issues in the 21st century.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The author declares no conflict of interest.

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education sciences

Article

A Small Country with Big Ambitions: Does This Include the Gifted?

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Abstract: Scotland is a small country with an education system whose roots lie within an inclusive and egalitarian approach to the education of young people. Subsequent legislation, policies, and curriculum frameworks have been influenced by this, and also by the international move toward equitable, inclusive, and quality lifelong learning for all. Supporting those who are highly able/gifted and talented against such a backdrop offers both opportunities and challenges. In this qualitative study, the Global Principles for Professional Learning in Gifted Education are used to interrogate recent key legislation; the current curriculum framework, Curriculum for Excellence, and the National Framework for Inclusion; to ascertain the extent to which this inclusive approach, on paper, affords in-class and school-based support for gifted and talented/highly able learners. The results indicate that the legislative and policy frameworks coalesce with the Global Principles. While legislation does not change practice, it does influence and shape practice, and so can be used as a springboard for developing dynamic, culturally appropriate opportunities for Scotland's gifted young people.

Keywords: inclusion; professional standards; policies

1. Introduction

The World Council for Gifted and Talented Children [1] recently identified ten principles which aimed to "provide guidance when decisions concerning education are being considered by local, regional, state/provincial, or national entities" [1]. A committee of 24 educators from 19 countries was formed, and met to share practice, legislation, and experiences in gifted education from around the world. They used this as a basis for the production of a document that was "intended to be a tool to create positive change on behalf of gifted education" [1]. One of the authors of this paper was a member of the committee. The ten principles map out guidance for decision makers, educators, and teachers relative to high-quality outcomes in professional learning in gifted education. Using the principles as a benchmark, this paper explores whether the existing Scottish legislation, curriculum, and teacher professional standards coalesce with the key components identified within the global principles, so that teachers in Scottish schools could, in theory, provide excellent education for gifted young people.

Scotland has a cautious relationship with gifted education. Scotland is one of four nations that make up the United Kingdom (UK). With a population of 5.53 million [2], it is comparable in size to other European countries, such as Finland, Sweden, and Denmark [3]. Geographically, Scotland comprises heavily populated urban areas, along with sparsely populated rural and island landscapes. The Poverty and Income Inequality in Scotland 2019–2020 report [4] estimated that 21% of working-age adults were living in relative poverty after housing costs in 2019–2022, and that 24% of children were living in relative poverty after housing costs during the same period. Although Scotland is part of the UK, it has always had a separate education system and concomitant legislation to those of its neighbours. It claims a proud tradition of valuing education, and has a particular commitment to providing a socially just and inclusive education system [5]. Against this

Citation: Sutherland, M.; Reid, C. A Small Country with Big Ambitions: Does This Include the Gifted? *Educ. Sci.* **2023**, *13*, 832. https://doi.org/10.3390/educsci13080832

Academic Editors: Kirsi Tirri and Valerie Margrain

Received: 31 May 2023
Revised: 26 July 2023
Accepted: 8 August 2023
Published: 16 August 2023

backdrop, we will examine how the policy and curriculum landscapes in Scotland allow teachers to address challenges and opportunities in identifying and supporting gifted students in school settings. Questions arise as to whether gifted education, often seen to perpetuate privilege, can be compatible with social justice and inclusion [6].

Before delving into the current situation in Scotland, it is important to give a brief outline of the historical development of education in the country. As Alexander [7] (p. 5) says, "No educational policy or practice can be properly understood except by reference to the web of inherited ideas and values, habits and customs, institutions and world views, that make one country distinct from another". This is perhaps even more important given the contentious nature of gifted education (see, for example, Smith and Campbell [8], Borland [9], Worrell and Dixson [10]). There is a recognition within the field of gifted education that ". . . education for the gifted is interwoven with a country's philosophical and political views, its cultural history, and its economic base" [11] (p. 288). For example, in the wider cultural and educational context in Scotland, giftedness is a term that has never sat comfortably within the inclusive approach to education. Indeed, it is generally not common terminology in education in Scotland, where the term "highly able" is more commonly used [12]. However, as will be demonstrated later in this paper, highly able learners are considered as part of the additional support need provision within Scottish education [13]. It is recognized that, like other learners with additional support needs, highly able learners may require temporary or lasting additional provision, in order to develop their potential. Ainscow [14] argues that "every learner matters and matters equally" (p. 124), and that this is a hallmark of inclusive education. Scotland's past is intertwined with the particularities of modern practice. It is important, therefore, to understand the past, in order to understand the present, and discuss the future.

A Brief Historical Perspective

Egalitarianism has long been at the heart of Scottish culture and education. The historical, philosophical, and political narratives which underpin this grounding principle are firmly rooted in the belief that education is a right for all [15]. As far back as 1496, the Estates of Scotland approved the first education act and, by 1560, following the publication of the First Book of Discipline, there was aspiration to have a teacher (schoolmaster) in every parish, and a college in larger towns [16]. The tradition of providing education for all was not without its issues, and Humes [17] (pp. 233–234) notes that "by the mid-nineteenth century the old parish system of provision was no longer able to cope with the problems thrown up by industrialization, urbanization and rapid population expansion". As a result, state intervention was deemed necessary and, in 1872, compulsory universal primary education was established for children aged 5–13, with secondary education following suit in 1945 [18] (pp. 1, 23). As early as 1826, Scottish universities were engaged with widening the participation of economically disadvantaged students, aiming to produce professional men whose work in Scotland and beyond would drive national prosperity [19].

Comprehensive education became the norm in the 1970s. The support for comprehensive education continued and, in the national debate about education that took place in the year 2000, there was overwhelming support for comprehensive education [20]. In 2022, a National Discussion on Education [21] took place, and the results of this will be published soon. Public events related to the most recent National Discussion were attended by the authors of this paper, and the conversations that took place suggest that the provision of high-quality education for all has remained an important goal for Scotland.

It can be seen that Scotland has a long tradition of valuing universal state education, and it could be argued that it has served the country well, including the gifted and talented. A number of Nobel prize recipients hail from Scotland—for example, Sir William Ramsay (chemist); Sir Alexander Fleming (biologist and pharmacologist), Sir John Boyd Orr (scientist and authority on nutrition)—with one of the most recent, Professor McMillan, being awarded the Nobel prize for chemistry in 2021. It was widely reported at the time that he praised the "brilliant" education he had received, saying "I am one of those people who's incredibly lucky to have come through that system" [22]. Hayward [5] (p. 39) argues that a "commitment to community and the right of every child to be part of that respect for education and for teachers; and a desire for social justice" lie at the heart of contemporary Scottish education. Legislation (see, for example, refs. [23–25]) and the curriculum framework [26] would seem to support this claim. However, as indicated earlier in this paper, a focus on equity and social justice could well serve to disadvantage the gifted and talented, when gifted education is considered to serve upper-middle-class learners [27,28]. Gallagher [27] (p. 32) suggests that the tensions between excellence and equity in education systems "have often been in a serious struggle for scarce resources... Because the problems of equity have greater immediacy than does the long-term enhancement of excellence, this struggle has often been won by equity". However, the perceived value of the gifted label to high-status parents is still a significant issue for some education systems. Dixson [29] describes how the social value and prestige of the gifted label still lead to the distortion of attempts toward gifted education in the US, citing a 2019 study by Grissom, Redding, and Bleiberg, which illustrated both a considerable over-representation of the most affluent in GATE programs, and the resource expenditure which affluent families deployed in order to bring this about. Scottish education must grapple with the complex challenge of excellence without elitism. One aspect particular to Scotland that could serve the gifted well, while considering the excellence and equity conundrum, was the reconceptualization of special educational needs that took place in the early 2000s. Scotland moved from a deficit-driven special education model to one that considered a range of factors that could lead to a young person requiring additional support for learning, with being gifted included as a factor [15]. The result in this shift in thinking was a new Act that placed a duty on Education Authorities to identify, and provide for, those deemed as requiring additional support [24]. This change in legislation took Scotland further down the inclusive pathway that it was pursuing, and offered an opportunity for Scotland to address the excellence and equity issue for gifted young people. Nevertheless, the implementation of this Act has been the subject of debate, with a recent review [30] making key recommendations for the future. Among other things, it recommends that teachers understand "their role in the identification of additional support needs and the need to adapt their teaching to meet the needs of children and young people" [31]. Within the discourse in Scotland, there is space and opportunity to ensure that the gifted are considered part of the move toward a more just and equitable education system.

2. Materials and Methods

A qualitative methodological approach was employed in this study, namely deductive coding [32]. To answer our research question—can existing Scottish legislation, curriculum and teacher professional standards support teachers in Scottish schools to provide excellent education for gifted young people?—it was necessary to select and analyze the key legislation and documentation that guide teachers in Scottish schools. The documentation included:

- Legislation
- Curriculum for Excellence (CFE) [33]
- The National Framework for Inclusion (NFI) [34]
- General Teaching Council of Scotland (GTCS) Professional Standards [35]

All documents included in the study are open access; they are publicly and freely available to educators and parents on the Scottish Government and GTCS websites. The legislation was selected due to its salience for gifted education. The researchers reviewed key legislation from the year 2000 to the present. The following Acts were selected, as they have driven forward the inclusive education agenda in Scotland:

- Standards in Scotland's Schools, etc. Act (2000) [23]
- Additional Support for Learning Act (2004, 2009) [24,36]
- The Children and Young People Scotland Act (2014) [25]
- Education Act—Education (Scotland) Act (2016) [37]

Key curricular documents were also identified. Although Scotland does not have a national curriculum enshrined in law, curriculum guidance is available in the form of Curriculum for Excellence, in particular the 'refreshed narrative' [33]. This guidance is built on values and principles [26], and was designed to offer a "seamless curricular experience for pupils aged 3–18" [15]. Curriculum for Excellence is well embedded in Scottish schools, and so was selected for inclusion in the study. The National Framework for Inclusion was incorporated because it picks up on the change in the legislation for the (Additional Support for Learning (Scotland)) Act, which was broadened to include highly able learners [15,38]. Finally, the GTCS Professional Standards were selected, as they are an integral part of teacher professionalism, and act as a "benchmark for professional competency" [35].

Using the 10 principles as our pre-determined codes, we interrogated the documentation, legislation, and frameworks in Scotland. In this way, the authors sought to examine the key components that guide practice in schools in Scotland, to see whether, in principle, the legislative and curricular frameworks, when used appropriately, can support gifted young people. The 10 principles are:

(1) tiered content, (2) evidence-based, (3) holistic, (4) broad, (5) equitable, (6) comprehensive, (7) integral, (8) ongoing, (9) sustainable, and (10) empowering.

Taking inspiration from the work of Jolly and Robins [39], the researchers independently coded the materials, using the principles. A deductive coding approach was deployed, using the 10 principles as codes. Where the description and language used in the documentation and frameworks addressed the principle/s, they were included for review. The researchers then met to discuss the coding noting agreements/disagreements, thus helping to establish trustworthiness in the process [40]. A summary table of results was then used to form the basis of the Results section of the paper (see summary in Table 1, below).

Table 1. Global Principles and Scottish legislative, curricular, and teacher education context.

Global Principles	Legislation	CfE	NFI/GTCS
1 tiered content		X	X
2 evidence-based	X	X	X
3 holistic	X	X	X
4 broad	X	X	X
5 equitable	X	X	X
6 comprehensive	X	X	X
7 integral	X	X	X
8 ongoing	X	X	X
9 sustainable	X	X	X
10 empowering	X	X	X

Notes: X indicates the Global principle is discernable in the document

3. Results

The overall Scottish legislation, curriculum guidance, National Framework for Inclusion, and teacher standards allow for the development of appropriate practices and support, as identified by the Global Principles (see summary in Table 1, below).

The above table includes: Legislation—Schools Act (2000)—Standards in Scotland's Schools, etc. Act (2000) [23]; ASN Act (2004, 2009)—Additional Support for Learning Act (2004, 2009) [24,36]; Childrens Act (2014)—The Children and Young People Scotland Act (2014) [25]; Education Act—Education (Scotland) Act (2016) [37]; CfE—Curriculum for Excellence (CFE) [32]; NIF/GTC—The National Framework for Inclusion (NFI) [33]; General Teaching Council of Scotland (GTCS) Professional Standards [34].

The results are presented in three sections. Section 3.1 focuses on aspects of Scottish legislation that pertain to HAL. It examines to what extent this legislation supports the education of HAL, in accordance with the Ten Principles [1]. Section 3.2 explores the Scottish Curriculum for Excellence [26,38], and the opportunities it offers for curriculum development and pedagogy, to meet the needs of HAL, in accordance with the Global Principles. Section 3.3 examines the professional standards for teachers in Scotland, highlighting the importance of career-long professional development in developing pedagogies and educational organization to meet the needs of gifted learners, in accordance with the Global Principles.

3.1. Scottish Legislation

Gifted education in Scotland is supported by an increasingly rights-based legislative approach to education. Scottish ASN legislation is deeply rooted in a rights-based model of education, which affirms the rights of gifted pupils to appropriate education [15]. MacAllister [41] (p. 520) describes the Additional Support Act [24] as a "landmark moment" in extending human rights to children, so that those who required additional support to develop their talents and abilities to their full potential must be provided with that support. Subsequent amendments to the Act continue to explicitly mention those 'who are particularly able or talented' [25,36,37]. The Acts also granted stronger powers to children's voices, so that a child older than 12 who was judged competent could independently assert their right to additional support provision [42]. Archard [43] suggests that age-based tests can be arbitrary, and should be supplanted by competence tests. This idea has obvious salience for gifted young people, who may achieve a sophisticated and nuanced understanding of their own educational needs significantly earlier than might be expected. However, this does also invite the question of who should set these competence tests, what competencies should be valued, and whether a test which measures intellectual understanding might give a false appearance of competence in a very young gifted learner, whose ability to intellectualize outstrips their emotional development or social understanding. Valuing children's voices requires educators to not only listen when competent highly able children claim their right to additional support for learning, but also to engage reflectively with what competence means for this unique group of young learners, and to adapt their teaching and curriculum in light of this reflection.

The examination of key Scottish legislation on Additional Support Needs (Additional Support for Learning (Scotland) Act (2004, 2009) [24,36], Education (Scotland) Act (2016) [37], Standards in Scotland's Schools etc. Act (2000) [23], and The Children and Young People Scotland Act (2014) [25] indicated that Principles 2–10 could be supported by the Scottish legislation. Principle 3—Holistic is well supported by the Child's Plan approach outlined in The Children and Young People Scotland Act (2014) [25], which requires teachers to consider a range of wellbeing concerns when engaging in educational planning. For gifted children, these could include difficulty relating to same-age peers, frustration and boredom during class, the need for academic challenge, and emotional sensitivity. There is a notable depth of support for Principle 5—Equitable, particularly with regard to equitable education for pupils who have experienced socio-economic deprivation. In the Scottish context, socio-economic deprivation and child poverty [44] are a long-term governmental focus, and are perceived as a significant equity issue. While, in some contexts, references to low income or socio-economic deprivation can be understood as 'deracialised terminology' [45] (p. 82), this is not the case in Scotland. Scotland's historically low racial diversity [46] means that high rates of persistent child poverty [44] are not generally understood in terms of race. Principle 7—Integral is also notably well supported through the requirement in the Standards in Scotland's Schools, etc. Act (2000) that "education is directed to the development of the personality, talents and mental and physical abilities of the child or young person to their fullest potential" [24] (Section 2). This commitment requires equitable opportunities for talent development for all students, including the highly able, and initial teacher education and CPD opportunities, which support that development. Principle 10—Empowering is, importantly, supported by the legislative emphasis on young people's developing capacity and rights to "make, communicate and understand decisions and their implications" [36] (Section F13). Children's educational agency is not determined by age and stage, but instead by capacity.

3.2. Curriculum for Excellence

In their recent review, the OECD described Curriculum for Excellence (CfE) as a common philosophy, from which schools had the freedom to develop their own curriculum, to help students to develop the "knowledge, skills and attitudes necessary to thrive in the 21st century" [47] (p. 3). The common philosophy is that of the four capacities: confident individuals, effective contributors, successful learners, and responsible citizens. Although critiqued as a 'mantra' of Scottish education, rather than a curriculum rationale [48] (p. 351), the four capacities remain central to the 'refreshed' CfE [33]. The curriculum is currently divided into a Broad General Education (BGE) phase and a Senior Phase, with the BGE divided into four Levels, with associated Experiences and Outcomes, and the Senior Phase characterized by opportunities to study for qualifications such as Nationals, Highers, and Advanced Highers.

Even from its earliest incarnations, CfE was identified as having the potential to support the education of gifted pupils. Sutherland [49] (p. 204) noted that "in the hands of an experienced and knowledgeable pedagogue", CfE's flexibility and scope for local interpretation had the potential to allow for effective gifted education. The "continuous process" of translating curricular aims into an effective pedagogy leaves considerable scope, too, for teacher development, to lead to a reflective, responsive classroom practice. For example, Principle 3—Holistic meshes successfully with the CfE Four Capacities: confident individuals, effective contributors, successful learners, and responsible citizens. Promoting confident individuals could lead teachers to recognize the maturity, sophistication, and knowledge that often characterize gifted learners. The promotion of effective contributors could encourage teachers to actively teach the skills necessary for working with others, thus supporting highly able learners in overcoming barriers to successful working with same-age or cognitive peers. The Capacity of successful learners stresses the importance of teacher responsiveness to the pace and challenge required for all pupils to learn in class, including the most able. Teachers could incorporate resources and practices from gifted education to support such responsiveness. The responsible citizens Capacity allows for engagement with challenging and controversial social issues, while taking into consideration the potential emotional impacts, which are significant for understanding and responding to the potential sensitivities of gifted learners. Principle 4—Broad is also potentially well supported by the CfE emphasis on cross-curricular and interdisciplinary learning, which could lead to a focus on the development and deployment of deep disciplinary learning that are necessary to support meaningful interdisciplinary working [50]. Helpfully, although the levels within CFE are grouped around age and stage, it notes from the first to fourth level that some learners might achieve these "earlier or later for some", thus acknowledging different rates of learning [51]. It is concerning, however, that Early Level notes that some might achieve the goals later than their chronological age, but there is no consideration given to young learners having the potential to meet these earlier. The importance of ensuring an appropriate level of challenge for young learners is well documented in the gifted literature [52–56]. This omission has the potential to see young gifted children overlooked in the early stages of their educational career.

3.3. Teacher Education, Teaching Standards, and The National Framework for Inclusion

The teaching profession in Scotland is an all-graduate profession and, since 2011 [57], has been moving toward Master-level. There is a desire within Scotland that teachers should continue to develop and hone their skills across their career. In 2001, teachers were expected to undertake 35 h continuing professional development (CPD) per year, following the publication of *A Teaching Profession for the 21st Century* [58]. As part of this drive for professional development and a raising of standards, the General Teaching Council for Scotland (GTCS) developed a suite of standards that spanned each stage of the career trajectory. The GTCS is an independent body, whose remit is to set and monitor the professional standards of teachers. The initial version of the standards included Provisional Standards for those in Initial Teacher Education (ITE); the Standard for Full Registration, a benchmark for those undertaking their induction year; the Standard for Headship; and the Standard for Chartered Teachers. These standards were revisited and “refreshed and restructured” in 2021 [35]. The purposes of the professional standards are:

- to create a shared language for teaching professionals
- as a benchmark for professional competency (Standard for Provisional Registration and Standard for Full Registration)
- to develop and enhance professionalism
- to support career-long professional growth
- to provide a framework for Initial Teacher Education, probation, and leadership pathways and professional learning programs
- support for self-evaluation and reflection for teachers in, and aspiring to, formal leadership roles, and contribution to dialogue about leadership and management
- to inform the process of recruitment and selection
- to ensure and enhance public trust and confidence in the teaching profession [35]

However, translating standards into practice can present challenges to schools, teachers, and school leaders. In acknowledgement of this, and of the challenges facing teachers as they work with diverse groups of learners, a Working Group was established by the Scottish Teacher Education Committee. The Working Group was originally set up to address issues related to the learning of young people with dyslexia, but this was felt to be too restrictive, and did not reflect the shift that had taken place with the Additional Support for Learning (Scotland) Act (2004) [24], as mentioned previously. Instead, the Working Group suggested that the shift in provision through the Act would be better addressed through the development of a National Framework for Inclusion (NFI) [34]. The Working Group comprised teacher educators from across all the Initial Teacher Education (ITE) institutions in Scotland [38]. Working in this institutionally collaborative way was unique, and allowed a range of expertise to contribute to the work. Crucially, there were contributions from an expert in high ability [15]. The approach adopted by the NFI was one that used a series of questions related to inclusion and inclusive pedagogy. The questions were differentiated across the career path trajectory, and reflected the stages of development and responsibility across the span of a career. This approach was selected as it was deemed to offer schools, teachers, and managers/leaders the opportunity to contextualize the questions, and make them culturally and pedagogically relevant to their situation [38]. Building on the work of the GTCS, and acknowledging the updating of the standards, the National Framework for Inclusion (NFI) was revised to reflect the changes in the standards, with the third version being published in August 2021 [34].

As we have argued, Scottish legislation and policy rarely mention gifted and talented/highly able learners explicitly. But neither do they mention, explicitly, any other specific group of learners. Scotland is not alone in this, as studies conducted in Australia [39] and Italy, for example [59], demonstrate. The exclusion of labels was seen as important within the NFI, as it allowed teachers to focus on learning, teaching, and pedagogy rather than on categories and labels [60]. In relation to high-ability/gifted and talented in Scotland, the term gifted is acknowledged within the literature as being problematic [61,62], particularly in countries, such as Scotland, that believe themselves to be egalitarian [63]. Given the absence of identified groups of learners within the Scottish documentation, and given the problematic nature of the terminology, it could be argued that, in fact, a more flexible approach that has its roots in inclusive pedagogy [64] offers teachers opportunities to consider and support gifted/highly able learners, or those learners who are twice exceptional in a more contextualized way. Indeed, the inclusion of labels could have led to the exclusion of the gifted and talented/highly able, as research suggests that the gifted and talented/highly able are unlikely to be considered when a deficit view of support is applied [65]. Although policy has moved away from an ‘individual deficit’ focus [66], approaches to Additional Support for Learning which focus on individual deficits do persist in Scottish education [65]. The Morgan Report on Additional Support for Learning in Scotland [30] noted that even the language of additional support perpetuates a focus on deficits, which stigmatizes young people, and could exclude the gifted.

The NFI is linked to the three broad areas covered by the Standards:

1. Being a Teacher in Scotland
2. Professional Knowledge and Understanding
3. Professional Learning

These three areas are underpinned by interdependent themes:

1. Being a Teacher in Scotland: Professional Values, Professional Commitment and Standard for Full Registration
2. Professional Knowledge and Understanding: Curriculum and Pedagogy, Professional Responsibilities
3. Professional Learning: Curriculum and Pedagogy, The Learning Context, Professional Learning

The questions in the NFI document were framed around these themes.

For the purposes of this paper, a sample of the questions within the document was selected from across the broad areas. Questions were also selected from each stage of professional development: student teachers (ST), all teachers (AT), and experienced teachers (ET). Where questions apply to all three categories, there are different criteria for each stage:

1. Standard for Probationer Registration: Student teachers have knowledge and understanding of. . .
2. Standard for Full Registration: Teachers have an in-depth knowledge and understanding of. . .
3. Continuous Lifelong Professional Learning: Experienced Teachers have an enhanced and critically informed knowledge and understanding of. . .

In this way, there is understanding that there should be continual professional development across the trajectory of a career. The questions were then linked to the 10 Global Principles [1], and consideration was given to what this might look like in practice. Just as with curricular documents and legislation, the NFI consistently aligns with the 10 Global Principles. For example, Principle 2—Evidence-Based is well supported through the emphasis on understanding theoretical approaches to pedagogy and learning, which supports the development of theory-informed classroom practice which can support the learning of all students, including the most able. Principle 7—Integral is also particularly applicable to ensuring that highly able learners are discussed in authority, school, and departmental meetings, and that they are included in policies and plans. The NFI offers scope for Scottish teachers to engage deeply and productively with education for the most able.

4. Discussion

Looking across the legislation and documentation presented above, it can be seen that a key stakeholder in the support of gifted learners consists of the teacher, and their mediation of the curriculum and legislation in order to appropriately challenge the gifted learner. Indeed, it was in recognition of the importance of the teacher that the WCGTC Global Principles for Gifted Education [1] were developed. The Scottish Additional Support for Learning legislation, national curriculum guidelines, and standards for Scotland's teacher registration offer tremendous scope for effective gifted education, as Sutherland and Stack [15] have argued. However, to meaningfully support gifted children and gifted education in practice, rights-based legislation must overcome what Riddell and Carmichael describe as "professional resistance" [42] (p. 489). Resistance to rights-based additional support needs is often the focus for parents of gifted children in discussion with the authors of this paper. Teachers must therefore be supported to embrace gifted pupils' voices, as part of effective educational provision. The construction of the teacher standards allows for continuous learning across the trajectory of a career, and so teacher education can offer a route toward teacher acceptance—and celebration—of rights-based gifted education.

CfE's curricular flexibility and emphasis on the local interpretation of national philosophy has the potential to both benefit and inhibit gifted learners in the classroom. They could benefit from the non-linear approach to learning, but be disadvantaged by those who fail to utilize the flexibility on offer. Since its inception, the implementation of CfE has been criticized for offering insufficient time and support to teachers, who were left to make sense of the new curriculum [67]. Hedge and MacKenzie [68] argue that teachers require education and support in order to become interpreters of the curriculum. When they receive such support, CfE offers scope for significant pace and challenge to be embedded for all, and particularly the gifted. A thorny issue remains: how and when are teachers introduced to such support, and how can this be done to include all?

The WCGTC Global Principles [1] offer a framework for developing support for teachers. As argued elsewhere in this paper, the context and culture have to be considered within in any educational development, and so linking the principles to already established frameworks becomes important. In a Scottish context, The NFI "proposes... minimum expectations of student teachers and fully registered teachers, and proposes an aspirational framework for more advanced teachers, including teacher educators" [34] (p. 6). The framework is also grounded in Scotland's inclusive approach to education and, as such, it does not highlight specific groups of learners but, instead, asks questions that allow managers, teachers, teacher educators, and students to interrogate the standards, and think about what this means in practice. However, the questions in the framework offer opportunities to consider the pedagogical, social, and emotional needs of gifted and talented/highly able learners, as well as the needs of other identified groups. The issues that arise for experienced professionals differ to those of the other two groups, and the questions reflect the depth of understanding that is required at each level, and so can be used to tailor the content of any professional learning activity. The NFI offers schools the opportunity to analyze and audit their practices and policies and, crucially, allows schools to do this while considering how it supports all learners. Professional learning materials that support the development of children's rights were produced by the Scottish Government in 2023 [33]. Within the training sessions, article 29—Education must develop every child's personality, talents and abilities to the full [69]—was cited. As we have seen in previous sections, this description was picked up in subsequent legislation in Scotland. Thinking about the development of talents and abilities for all, including the gifted and talented/highly able, is consistent with the legislation and international protocols.

The drawback to an open-ended approach is that those using the framework must look at the questions through the lens of the gifted and talented/highly able in order to utilize the framework in a way that supports this group, but teachers report feeling unsure of how to best support gifted and talented/highly able learners [70,71].

5. Conclusions

Overall, there is potential for alignment between the 10 Global Principles and the legislation, curriculum, and inclusion frameworks in use in Scottish education. This suggests that, on paper, Scotland has a strong basis from which to build inclusive and appropriate educational opportunities for gifted and talented/highly able learners. However, the implementation of policies and legislation is acknowledged as problematic, with different interpretations being applied by different stakeholders [72,73]. Plucker et al. [74] (p. 210) argue that policies "serves as the framework and social context in which all other educational activities take place". Policy is therefore driven by wider societal issues and contexts and, as they go on to point out in the article, "because there are always perceived needs, policy makers (and communities at large) make value judgments all the time about whether a perceived need does or does not need to be addressed" [74]. A current and overriding concern for Scottish education is the growing attainment gap between those in the poorest areas and those from more affluent areas. Scotland is not alone in being concerned about this gap. However, perhaps less spoken about in Scotland and further afield are the excellence gaps that exist within the gifted and talented/highly able community [75]. If Scotland is to pursue the excellence and equity agenda, it cannot ignore highly able learners in its pursuit. Scotland's career-long professional learning trajectory, as discussed above, serves as a platform for embedding in classroom practice the ideas contained within the global principles for gifted education.

A review of the implementation of the Additional Support for Learning (Scotland) Act took place in 2020 [76]. The independent review elicited the views of stakeholders across the educational community. The recommendations found that the "implementation of Additional Support for Learning legislation is over-dependent on committed individuals, is fragmented, inconsistent and is not ensuring that all children and young people who need additional support are being supported to flourish and fulfil their potential" [76]. While this could be seen as a damning indictment of the approach Scotland has taken, the report makes clear that the intentions of the principles, policies, and guidance are sound. "The challenge is in translating that intention into thousands of individual responses for individual children and young people facing different learning barriers in different family, home, community, nursery, school and college situations" [76]. In contributing to the report, the frontline staff were clear about the things that would support them:

- Values-driven leadership
- An open and robust culture of communication, support, and challenge underpinned by trust, respect, and positive relationships
- Resource alignment, including time for communication and planning processes
- Methodology for the delivery of knowledge learning and practice development, which incorporates time for coaching, mentoring, reflection, and embedding into practice [66].

This report is shaping the development of practice and support for those who require additional support for learning, and it is through its development that we see the potential for gifted children to be recognized and supported. It is encouraging that the report is congruent with some of the 10 Global Principles for professional learning in gifted education, in particular 5—equitable, 8—ongoing, 9—sustainable, and 10—empowerment. As the Scottish Government and the Convention of Scottish Local Authorities develop an action plan in response to this report, it is worth noting that highly able learners do appear as part of the Professional Learning Framework [77], through which teachers are guided to resources to build in-depth progression into the curriculum. In addition, authors of this paper have been invited to contribute to a number of Government-led initiatives and reviews. These include the Additional Support for Learning Network, chaired by the Scottish Government, The National Discussion, and the Independent Review of National Qualifications and Assessment, with specific reference being made to highly able learners in the final reports of both the National Discussion and the Review of Assessment. In addition, we were asked to invite parents of gifted young people to attend specially formed parents' meetings on the Review of Assessment, as it was recognized that these voices were missing from the discourse. These contributions may seem like small steps. Advocating for gifted education outside of these recognized channels within a country such as Scotland is unlikely to prove effective in getting this group of learners recognized and supported. Thus, we have argued that the national legislation and frameworks could be used as a springboard for developing dynamic, culturally appropriate opportunities for Scotland's gifted young people. Educating teachers about the gifted is not just a nice idea, but a moral imperative. Effective teacher education about the gifted, as outlined in the global principles, is required by the inclusive principles that are driving the wider educational context in Scotland. The seeds of development for highly able learners are there, but it remains to be seen whether they flourish and blossom, or whether school environments prove to be stony ground.

Author Contributions: M.S. and C.R. contributed equally to the writing and analysis. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: All the documentation is open access.

Conflicts of Interest: The authors declare no conflict of interest.

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education sciences

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Article

"It May Be a Luxury, but Not a Problem": A Mixed Methods Study of Teachers' Attitudes towards the Educational Needs of Gifted Students in Norway

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Abstract: This study aims to investigate Norwegian primary teachers' attitudes towards gifted students and gifted education and discuss their potential impact on their pedagogical practices. In Norway, gifted education is a relatively non-existent phenomenon, and this research field has been scarcely explored in the Norwegian context and teacher education. The Official Norwegian Report NOU 2016:14 highlights a reluctance among Norwegian teachers to cater to gifted students, indicates a lack of training for teachers in identifying and differentiating gifted education, and points out a need for more research within the Norwegian context. In an earlier study, we showed that Norwegian teachers reported having little formal or non-formal education on the theme of gifted education and that few were aware of the abovementioned report. This study aims to investigate Norwegian primary teachers' attitudes towards gifted students and gifted education and discuss their potential impact on their pedagogical practices. Data in the study are collected through an online mixed methods survey in a small municipality in Norway. An interesting finding is that culture significantly influences teachers' attitudes towards gifted education. We argue that teachers' attitudes should be more informed by evidence-based practice and less by culture, as it can impact gifted students' access to equal and adapted education.

Keywords: gifted education; teachers' attitudes; inclusive education; gifted education legislation; pedagogical practices; gifted education practices; gifted education in Norway; evidence-based gifted education; differentiated gifted education

Citation: Furnes, G.H.; Jokstad, G.S. "It May Be a Luxury, but Not a Problem": A Mixed Methods Study of Teachers' Attitudes towards the Educational Needs of Gifted Students in Norway. *Educ. Sci.* **2023**, *13*, 667. https://doi.org/10.3390/educsci13070667

Academic Editors: Kirsi Tirri and Valerie Margrain

Received: 26 May 2023
Revised: 23 June 2023
Accepted: 27 June 2023
Published: 30 June 2023

1. Introduction

Teachers play a crucial role in identifying and supporting gifted students, and teachers' attitudes towards gifted education can significantly affect the identification process and the type of education that gifted students receive [1,2]. However, the attitudes and beliefs of teachers towards giftedness can vary significantly, and teachers may hold positive or negative views towards gifted education for various reasons; this may affect their pedagogical practices. To enhance the support and education provided to gifted students, exploring the attitudes and beliefs that shape teachers' pedagogical practices is crucial. By gaining insights into these factors, we can better understand the challenges and opportunities teachers face in meeting the educational needs of gifted students. This understanding can inform future professional development initiatives and guide the implementation of successful strategies in gifted education.

Norway has an egalitarian school system that does not officially recognise giftedness among children and currently lacks specific provisions for gifted education [3–6]. Giftedness traditionally refers to individuals who demonstrate exceptional abilities in one or more areas than their peers [7–9]. In egalitarian school systems, giftedness is often perceived as a privilege, leading to suggestions that resources and support should not be allocated to gifted students due to the perceived priority of other, visibly disadvantaged groups [10,11]. However, contemporary views on giftedness emphasise that many gifted children may not exhibit openly exceptional achievements and can possess strengths and difficulties, particularly in social situations and when faced with challenges [12]. These difficulties highlight the importance of competent teachers in identifying gifted students and supporting them academically and socially.

It is important to note that the egalitarian perspective on giftedness has been challenged in Norway in the last decade by some researchers and organisations that argue that neglecting gifted students' needs can hinder their educational development and deprive them of opportunities to reach their full potential [3,4,6,13–15]. These voices urge the Norwegian school system to foster a more comprehensive and inclusive education system for all students, including the gifted, and work towards a more equitable and inclusive educational environment that benefits all students.

These efforts have resulted in the release of The Official Norwegian Report NOU 2016:14 *More to Gain: Better Learning for Students with High Learning Potential* [6]. This report has introduced the term "High Learning Potential," adding another term to the already extensive list of over a hundred terms Hany [16] has found. NOU 2016:14 indicates that the current primary education system does not provide gifted students with adapted and inclusive education that enables them to utilise their potential fully. It also highlights that schools are not utilising the opportunity to adjust teaching pedagogically and organizationally to meet gifted students' individual needs. Furthermore, it is pointed out that the Norwegian education system lacks a joint knowledge base to implement measures to improve education in the short and long term, both nationally and locally. As a result, gifted students in Norway report not experiencing academic and social inclusion, and many report feeling invisible, socially isolated, and rejected. The NOU 2016:14 report concludes that teachers have the autonomy and opportunities to provide for gifted children within the existing system. The Norwegian Education Act § 1–3 on adapted education states the following: "Education must be adapted to the abilities and aptitudes of the individual pupil, apprentice, candidate for a certificate of practice, and training candidate" [17].

Teachers play a crucial role in identifying and supporting gifted students, and teachers' attitudes towards gifted education can significantly affect the identification process and the type of education gifted students receive [1,2]. However, the attitudes and beliefs of teachers towards giftedness can vary significantly, and teachers may hold positive or negative views towards gifted education for various reasons; this may affect their pedagogical practices. To enhance the support and education provided to gifted students, exploring the attitudes and beliefs that shape teachers' pedagogical practices is crucial. By gaining insights into these factors, we can better understand the challenges and opportunities teachers face in meeting the educational needs of gifted students. This understanding can inform future professional development initiatives and guide the implementation of successful strategies in gifted education.

In this study, we have investigated Norwegian teachers' attitudes to gifted education seven years after the report NOU 2016:14 [6]. The study aims to gain an understanding of how teachers perceive giftedness and what attitudes they present concerning gifted education. To explore Norwegian teachers' attitudes towards gifted education, we have developed the following research question: How do Norwegian primary teachers describe their attitudes towards gifted students and gifted education, and how do they support their views and practices? We have earlier found that Norwegian teachers report having little or no formal education on the theme of gifted education [18]. Few respondents in the study knew the governmental report NOU 2016:14. The current study explores possible connections between attitudes and perceived knowledge of giftedness among Norwegian teachers and their support of adapted gifted education. The article presents theoretical insights into the factors that may influence teachers' attitudes towards gifted children, including research, legislation, and cultural influences. It then discusses empirical findings on how teachers in Norway perceive and approach gifted children in their pedagogical practices.

2. Background, Theory and Definitions of Giftedness

In Norway, limited research has been conducted on gifted education since Hofset's [19] attempt to publish his research book on gifted students was rejected in 1969 [4]. Gifted education is also not prominently featured in national policy documents and teacher education programs, further contributing to the lack of focus on this area [6]. Historically, both the Norwegian school system and researchers have exhibited a negative attitude towards gifted students and gifted education [4,6]. From the 1970s onwards, there has been a growing emphasis on equity in the Norwegian school system, particularly concerning students facing various challenges [20]. However, this focus on equity seems to have created tension between the concept of giftedness and the pursuit of equality. The notion that giftedness is a privilege and gifted students constitute an elite class has further exacerbated this tension. Consequently, gifted students in the Norwegian school system often do not receive the specialised education necessary to meet their unique academic and social needs.

There are various perspectives or "truths" in theory, legislation, guidelines, and culture regarding gifted children. Some are even blended, so legislation sometimes seems to be impacted more by culture and politics and less by pedagogy.

There are several models of identifying giftedness in the research literature. Renzulli and Reis [21] have developed a three-ring model for identifying gifted children with the following areas: superior ability, creativity, and commitment. Gifted children are identified by assessing their skills and achievements in these areas. Gagné [9] has developed a differentiation model that focuses on talent development and identifies gifted children by assessing their skill level in different areas and their potential for future development. The model takes into account intellectual, creative, social, and physical development. Mönks and Pflüger [20] have presented perspectives that emphasise both ability potential and achievements in relation to age and background. They also emphasise motivation and personality traits. Moreover, finally there is the ACCEL model (active concerned citizenship and ethical leadership) for identifying the gifted by Sternberg [7] that is highlighting perceptions of ethics and critical thinking as giftedness in an era when there is much uncertainty on future obstacles and possibilities.

Hany [16] has indicated that over a hundred terms and concepts describe giftedness in the research literature. In addition to the diversity of concepts, there are various models of giftedness [7,8,11,20]. Mönks and Ypenburg [11] have shown that different perspectives on giftedness can be linked to different views on learning, politics, attitudes, values, and cultural practices. They summarise perspectives on gifted people in four explanatory models: capability models, cognitive component models, performance-oriented models, and sociocultural-oriented models.

Early definitions of giftedness were related to IQ (intelligence quotient) by Terman [22]. He pioneered this research field and conducted a longitudinal survey of around 1500 highly gifted students in the 1920s. Some researchers, such as Salovey and Mayer [23], Gardner [24], and Sternberg [7], have suggested that emotional intelligence (often called EI or EQ) is far more important than IQ. Salovey and Mayer describe emotional intelligence as the ability to monitor one's and others' feelings and emotions, discriminate among them, and use this information to guide one's thinking and actions [23].

Several studies have distinguished between "giftedness" and "talent" [25–28]. Gagné has developed the differentiated model of giftedness and talent (DMGT) [28], proposing a clear distinction between these fundamental concepts in gifted education. According to this model, giftedness designates the possession and use of untrained and spontaneously expressed superior natural abilities (aptitudes or gifts) [9]. Talent designates the superior mastery of systematically developed abilities (or skills) and knowledge in at least one field of human activity [9]. Gagné [9] states that the main distinction between giftedness and talent is that giftedness is a natural ability that some children are born with, while talent is a skill we can develop with time. Gagné [28] argues that giftedness can be transformed into talent and highlights three types of catalysts that may help or hinder the process: (a) interpersonal (I) catalysts, such as personal traits and self-management processes; (b) environmental (E) catalysts, such as socio-demographic factors, psychological influences (e.g., from parents, teachers, or peers), or special talent development facilities and programs; and (c) chance (C).

In addition, Tannenbaum [29] differentiates between "giftedness" and "talent" with the following notion: "Keeping in mind that developed talent exists only in adults, a proposed definition of giftedness in children is that it denotes their potential for becoming critically acclaimed performers or exemplary producers of ideas" [29] cited in [28]. However, perspectives on giftedness are still evolving. Sternberg [7] suggests this is due to new insights and society's challenges. He argues that one way to address the question of identifying gifted individuals is to ask what challenges the world faces at a given time and what kind of giftedness is needed to meet those challenges [7]. As Sternberg points out, the world currently struggles with multiple challenges and is best served by gifted individuals who possess knowledge, talent, and ethical thinking. He argues that high IQ alone is insufficient to discover ethical challenges before they arise.

The various terms used to describe gifted children are likely to be affected by language and culture. Moreover, the diversity of terms concerning gifted children can affect school cultures and pedagogical practice [30]. School culture refers to the norms, values, attitudes, and practices prevalent and maintained in a school [31,32]. It is defined as an ethos affecting teaching and learning, although out-of-school influences such as the socioeconomic status of the community also impact school culture [31]. School culture is a broad term that encompasses all aspects of the school environment and influences the experience and interaction between students, teachers, administration, parents, and society. When it comes to gifted education, school culture can affect the local conversation about gifted education and have implications on teachers' perceptions of and attitudes towards gifted education.

In this study, we do not take a position on what giftedness entails. Giftedness seems to be various concepts that are still evolving; understandably, teachers might find various definitions confusing. Although, if giftedness is, as Sternberg [7] argues, a complex concept tied to contemporary challenges and needs in society, this may require teachers to understand how contemporary theories of giftedness should impact pedagogical practices. It also requires that the subject of identifying giftedness is addressed in teacher education, legislation, and guidelines.

3. Teachers' Perceptions of Gifted Students

Gifted children are often mistakenly perceived as high achievers, and their educational needs for intellectual stimulation are often overlooked (e.g., [1,2,33,34]). Consequently, gifted students go unidentified in schools and do not receive an education tailored to their social and academic needs. This is unfortunate, as the lack of appropriate support for gifted children in school can lead to underachievement and difficulties in areas such as social interactions and mental well-being.

Lacking an appropriate teacher education concerning gifted education, gifted students are not always easy for teachers to identify in the classroom. They are not a homogenous group but children who might or might not exhibit openly exceptional achievements in one or more fields (e.g., [7,8,22,24,35,36]). Gifted children can possess an exceptional memory or the ability to make rapid associations that may be difficult for others to follow. However, they do not always exhibit their abilities willingly.

Identifying giftedness among children might also be challenging due to the many terms, definitions, and models used internationally (e.g., [7,9,34–36]). Giftedness is a debated theme in education, and the diversity of models and definitions reflects different values and implies diverse pedagogical approaches (e.g., [11,30]). Moreover, gifted children can possess strengths and difficulties, particularly in social situations and when faced with challenges [12]. They may struggle with issues such as immaturity, lack of social skills, and feelings of not fitting in, which can lead to isolation. Furthermore, Renzulli and Park [37] have identified a correlation between giftedness and high school dropouts, emphasising the crucial role of teachers in supporting gifted children's academic and social development.

This highlights the critical importance of teachers in identifying and promoting gifted students' growth in both academic and social domains.

Robinson and Shore [38] argue that teachers' perceptions of gifted students should be informed by evidence-based practice (EBP) which involves integrating the following three knowledge fields: (1) the highest quality research evidence, (2) the expertise of professionals, and (3) the individual values and preferences of students. This means considering the students' personal concerns, expectations, cultural influences, and unique characteristics. By combining these elements, EBP aims to provide the most effective and personalized education to meet the needs of each individual student. However, it is worth mentioning that evidence-based practice have also been criticised by, among others, Biesta [39]. He argues that the notion of "what works" in education is overly instrumental and reductionist, failing to capture the complex and nuanced nature of educational processes and the goals of education itself. Teachers should have the trust and autonomy to decide which pedagogical practice is needed. Nonetheless, considering that the field of gifted education is also a complex one, we argue that teachers can benefit from the knowledge of the highest quality research-based evidence and the individual values and preferences of students in addition to their own expertise as professionals.

Teachers are bound by legislation and guidelines that shape their knowledge, attitudes, and pedagogical practices regarding gifted education. Mullen and Jung [1] have found that teachers who report having perceived knowledge of giftedness are more likely to support gifted programs, while a negative predictor results in perceptions that gifted programs are elitist. This section will outline the relevant legislation and guidelines on gifted education in Norway.

4. Legislation and Provisions Concerning Gifted Education in Norway

Legislations do not always reflect the concerns for education. Tourón and Freeman [33] conducted the gifted education in Europe survey (GEES) which was designed to shed light on current European educational provisions for the gifted. The study has demonstrated an awareness among education administrators in most European countries regarding the need for special provisions to be made for gifted and talented children to reach their full potential [33]. However, these concerns are not always reflected in official legislation and are often communicated to schools through directives rather than clearly articulated.

In Norway, there has not been a cultural acceptance of providing specialised education for gifted students outside the regular education system (e.g., [4,6,13,14]). As a result of a school policy that promotes inclusion, the number of special schools in Norway has significantly decreased since the 1970s. This means that most students with special educational needs have the right to receive specialised education programs at a school in their local area, where they can realise their potential for learning and socialisation [40]. The argument that integrated education can increase inclusion implies that segregated training programs can promote exclusion. This notion requires schools to avoid segregated instruction whenever possible, so all students can feel included. However, integrated learning may not meet students' educational needs in all contexts. Therefore, schools offer various segregated education programs for students with learning difficulties, in line with the Norwegian Education Act § 5–1 for special education (e.g., [41–43]). Some secondary schools also offer segregated education programs for gifted children through cooperation with high schools.

In recent years, there have been some improvements in Norway, mostly out-of-school enrichment opportunities related to students' skills in science, technology, engineering, and mathematics (STEM), such as Newton rooms, Olympiads on various subjects, research camp on Andøya, research clubs, and all kinds of local initiatives [44]. In addition, a possible provision is accessing four talent centres situated in or by larger cities in Norway [45–48].

Legislation is often linked to how a phenomenon is culturally perceived. Some educators believe that since gifted children may have special educational needs beyond the ordinary education program, they may be entitled to special education [11,43]. This notion is supported by the Council for Exceptional Children (CEC) [49], the largest international professional organisation dedicated to improving educational provision for people with disabilities and giftedness or talent. The CEC conveys that both groups are seen as exceptional and may therefore need tailored training. Nonetheless, in Norway, gifted children historically have not been defined as children with special needs or entitled to individually adapted education [50], and this has not changed in the new proposition for The Education Act [51].

The principles of inclusive education in Norway, as outlined in the Education Act, promote social acceptance and joint learning for all students, regardless of their abilities or disabilities [17]. However, despite its goals, the Act may inadvertently exclude gifted students due to its explicit wording that states these students are not entitled to special provisions. However, gifted students may have the option to skip one or more grade levels or apply for exemption from school subjects in which they excel. While there has been a growing emphasis on equity in the Norwegian school system to support students who face various challenges, there has been a lack of focus on providing adequate support for gifted students who may also struggle emotionally and socially. This neglect can lead to gifted students feeling excluded if they do not receive the necessary support to fully engage in learning and social activities. Skipping grade levels and exemption cannot be perceived as inclusive education.

Privileging one student group to the detriment of the others is not in line with policy by the Council of Europe [34] (a body for intergovernmental cooperation between 25 European states). The Council of Europe reaffirms education as a fundamental human right and believes that it should, as far as is possible, be appropriate to each individual. The Council of Europe states the following:

> Gifted children should be able to benefit from appropriate educational conditions that would allow them to fully develop their abilities for their benefit and the benefit of society as a whole. No country can indeed afford to waste talents and it would be a waste of human resources not to identify in good time any intellectual or other potentialities. [34]

Based on this statement, it can be assumed that gifted children are entitled to an education that gives them opportunities to develop in line with their prerequisites. Tourón and Freeman [33], in line with the Council of Europe [34] have emphasised the importance of legislation, research, teacher training, establishing special provisions for gifted children in ordinary schools, avoiding negative consequences of labelling children as gifted and talented, and promoting debate and research concerning giftedness as a construct.

However, it appears that some Scandinavian countries, including Norway, do not fully follow these recommendations, as official programs and identification tools in gifted education do not exist [4,6,14,20]. Tourón and Freeman [33] found that initiatives related to giftedness in Scandinavia are generally explored through private opportunity associations, and efforts to support the needs of gifted children are not affiliated with formal legislative decrees but are typically sought voluntarily by parents. This interesting finding should be examined concerning why states that promote inclusion and equity leave a gap where some gifted children receive private support while others are deprived of such provisions. This way, practising equity is working against less-privileged children in the Scandinavian school systems, even though they are supposed to provide equal opportunities for all.

The legislation does not always have the desired effect. While the Official Norwegian Report NOU 2016:14 [6] highlights that teachers have the autonomy and opportunities to provide for gifted children, studies show that they refrain from doing so [4,13,14,52,53]. It is crucial to investigate factors affecting teachers' attitudes to gifted education and inform their pedagogical practices.

5. Teachers' Attitudes to Gifted Education

To explore the relations between teachers' attitudes and pedagogical practices related to gifted education, it is helpful to examine possible connections between attitudes and behaviour. Theorists have found a strong relationship between attitudes and behaviour, which can be influenced by factors such as culture, beliefs, values, and context [54,55]. Teachers' attitudes and behaviour are likely to be complex, as they are subject to theories, legislation, official guidelines, and cultural practices that also impact their pedagogical practices.

Fishbein and Ajzen [55] propose a strong correlation between "the evolution of beliefs to attitudes, attitudes to intentions, and finally, intentions to actions". While Liska [54] acknowledges the vital interrelationships between attitudes and behaviours, he critically examines the causal structure of Fishbein and Ajzen's attitude–behaviour model. Liska argues that the model does not fully consider the influence of situational factors and does not adequately address the issue of behavioural consistency. He claims that attitudes cannot always explain or predict behaviour. Social norms and context can play a significant role in determining behaviour. Consequently, Liska suggests that different situations can impact the relationship between attitudes and behaviour over time.

Regarding giftedness, various factors may impact teachers' attitudes and pedagogical practices [1,56]. Given that teachers' pedagogical practices are shaped by their underlying beliefs, attitudes, and context, in addition to theories, legislation, and official guidelines, the attitude–behaviour model by Fishbein and Ajzen [55] may not fully capture the complexity of teachers' behaviours concerning gifted education. The arguments by Liska [54] contribute to understanding the complexity of the relationship between attitude and behaviour by showing that social norms and context can play a significant role in determining behaviour and adding that time can also be a significant factor. This argument aligns with Krüger [57], who refers to teachers' practices as "an ensemble of discursive practices." He views discursive practices as cultural and ideological ways of thinking, speaking, and acting, which can be verbal or nonverbal. These practices contain specific "styles of reasoning" and unquestioned assumptions, also known as "truths". DeCuir-Gunby and Bindra [56] support that teachers' biases can impact their perceived knowledge and interactions with students, as well as differentiation, and ultimately affect students' learning outcomes and possibilities in the future. Teachers' biases based on various values and attitudes can potentially expand or limit students' access to professional, emotional, and social support.

Culture also appears to be a significant factor in legislation and research which informs teachers' pedagogical practices towards gifted children. We have found similarities and differences between the school systems in Australia and Norway. Both countries have school systems that value egalitarianism which generates antipathy against elitism and gifted education [1,58]. Egalitarian school systems, out of fear of creating good conditions for elitism, tend not to recognise giftedness among children officially. Gross [10] points out that the notion that giftedness is a privilege might lead to suggestions that provision should not be made for gifted students due to the more pressing needs of other, visibly disadvantaged groups.

Mullen and Jung [1] studied Australian primary and secondary school teachers' attitudes towards gifted students. They found that teachers' perceived knowledge of giftedness is connected to whether they support gifted programs/provisions. Australian teachers who report having perceived knowledge of giftedness are more likely to support gifted programs, while a negative predictor results in perceptions that gifted programs are elitist. Additionally, Australian teachers in primary school may be more supportive of gifted programs than secondary school teachers.

The findings from Australian studies by Mullen and Jung [1] are perhaps relevant not only to the Norwegian context but also to the Scandinavian context due to similarities in values concerning egalitarianism. Several studies in Scandinavian countries have shown that schools prioritise inclusive education for students with disabilities over gifted students [3,58–61]. In Finland, Tirri and Kuusisto [61] show that there is a greater need to recognize the social and affective needs of gifted pupils. Nissen, Kyed, and Baltzer [62] have found in 2005 that in Denmark, official programs in gifted education do not exist, and that few schools pay special attention to gifted education or provide systematic provisions for gifted students. Denmark has, however, according to the Ministry of Education in

Denmark [63], since 2011, launched talent development in the education system as an explicit policy objective. In Sweden, Persson [60] shows that teachers' attitudes towards gifted students in primary and secondary schools in Sweden differ from those in Australia. According to Persson [60], primary school, in particular, has been a hostile environment for gifted students. However, conditions did improve somewhat as participants moved from primary to secondary school, and again from secondary to tertiary education. This finding contradicts what Mullen and Jung [1] have found in Australia, where primary schools seemed more supportive of gifted programs than secondary school teachers. One of the more disturbing findings by Persson [60] was that teachers at all levels of the education system in Sweden were found to have punished what he calls "gifted behaviour". He reports that some teachers appeared to have felt threatened by the opposition and, in response, forced students into submission—gifted students in Sweden report low satisfaction at all levels of the education system.

In Norway, research on gifted education is limited, although some have conducted a few studies. A recent qualitative study by Lenvik et al. [14] indicates that the Norwegian education system does not meet the needs of gifted students at individual or systemic levels. Lenvik et al. notes that the study title reflects the informants' experiences with education, which they believe is not adequately adapted to gifted students' needs and abilities. The researchers conclude that teachers in Norway might have limited knowledge about giftedness and how to support gifted students.

Considering that teachers play a crucial role in identifying and supporting gifted students and that teachers' attitudes towards gifted education can significantly affect the identification process and the type of education gifted students receive e.g., [1,9,28], it is essential to understand how teachers' attitudes towards gifted children can impact their pedagogical practices. After presenting the methods used in the study, we will delve into the empirical findings that shed light on Norwegian teachers' attitudes towards gifted children and gifted education.

6. Materials and Methods

The study is based on a digital survey online on Questback [64] that employs a mixed methods approach, combining quantitative and qualitative data collection methods [65,66]. The survey was distributed to primary and secondary school teachers in a small Norwegian municipality, in the outskirts of a larger city, with approximately 400 teachers from 17 schools being invited to participate. To ensure teachers' anonymity, we had an agreement with the local municipality (school owners) to distribute the survey to the headmasters at all schools who then will distribute the survey to the teachers. The survey aimed to gather information about the teachers' educational background, knowledge, perceptions, and pedagogical practices related to gifted education.

The survey is designed to include multiple-choice and Likert scale-based questions for quantitative data, as well as text-based questions for follow-up qualitative data [67,68]. The survey utilizes automated detection of quantitative responses and offers tailored follow-up questions to minimize non-response and encourage respondents to provide their own perspectives. This feature has proven to be effective in improving data quality by eliciting more-detailed and insightful answers to open-ended questions. Additionally, to enhance the depth of knowledge gathered, the survey invites respondents to participate in interviews for future research purposes. The survey included questions pertaining to teachers' demographics, knowledge of policies and research, guidelines, and school practices.

Ethical considerations were taken concerning General Data Protection Regulation (GDPR) [69] and the study has a data management plan (DMP) [70] that is in line with guidelines with The Norwegian Centre for Research Data. The study was approved by NSD—Sikt [71].

The study achieved a response rate of approximately 14 percent (n = 56), which is relatively low and limits the generalizability of the findings. Of the respondents, around 40 percent work at secondary schools, 35.7 percent at lower secondary schools, and 25 percent at primary schools. Due to the limitations of the response rate, the quantitative data were used primarily to complement and support the qualitative data in the study. Despite the low response rate, the diversity of schools within the municipality reduces the influence of local cultural conditions on the data. Other limitations can be the replication of the study to other municipalities that are farther from larger cities and with less possibilities to access external gifted programs and talent centres [44]. To increase the response rate in future studies, we will discuss whether direct contact with several schools is more fruitful than distributing the survey through the municipality.

Given the limitations with the study's low response rate, we have placed a greater emphasis on the analysis of qualitative data compared to quantitative data. In examining teachers' attitudes towards gifted education, the qualitative data were analysed from a dialogical perspective, drawing on the work of Bakhtin and Holquist [72]. Bakhtin introduced the concept of polyphony to describe the interaction between different discourses. According to Bakhtin, utterances are not isolated expressions, but are part of a more extensive dialogue. Previous utterances impact subsequent utterances and can carry both explicit and implicit meanings. The context and individual interpretations contribute to hidden meanings, and the performance of utterances can influence our actions in practice. We as researchers believed teachers in general had limited knowledge on gifted education and that this topic is marginalized in teachers' conversations. By employing a Bakhtinian perspective on dialogism, our aim was to actively listen to and gain a better understanding of the voices of teachers, encompassing their knowledge, attitudes, and practices concerning gifted education. Applying the dialogical perspective to data analysis, we conducted an examination of the interactions, conversations, and discourses within the research context. We placed particular emphasis on identifying and analysing the diverse voices and perspectives present, observing how they engage in communication and whether they seem to contribute to the formation of collective understanding [72]. Our analysis involved identifying patterns, contradictions, power dynamics, and the negotiation of meanings within the data. By closely examining these aspects, we aimed to gain a deeper understanding of the complexities and nuances of the research context and shed light on the social and interactive dimensions of communication and knowledge construction. During the analysis, we remained mindful of our voices within the polyphony of utterances and how they may have influenced the findings.

7. Results, Analysis, and Discussion

In our study, we identified the following three factors that can influence teachers' perceptions of giftedness, their attitudes, and pedagogical practices regarding gifted education: research, legislation, and culture. In the subsequent sections, we will delve into various aspects that teachers in the study have commented on concerning giftedness and gifted education that we have categorized within these factors. We will then analyse teachers' statements from a Bakhtinian [72] perspective and discuss their perceptions and the implications for their attitudes and pedagogical practices in the context of gifted education.

7.1. Teachers' Perceptions of Theoretical Terms Concerning Gifted Students

The following section presents the respondents' preferred labels for gifted students and discusses how their use of these terms may impact their attitudes towards gifted education and the identification and pedagogical practices employed. We presume that the definition of giftedness may be a significant indicator that strongly influences teachers' attitudes and practices [11,30].

Teachers in our study have different academic backgrounds in the area of gifted education and various perceptions. When we asked the teachers whether they had received lectures about gifted students during their teacher training, approximately 80 percent responded negatively or were unsure. This finding suggests that the topic of gifted students has not been given sufficient priority in the study programs in which the participating teachers were enrolled. This observation aligns with the lack of emphasis on gifted students in the National Guidelines for Primary and Lower Secondary Teacher Education 1–7 and 5–10 grades, where this specific student group is not mentioned [73,74].

When asked to select the most relevant terms that describe gifted children (multiple answers were allowed), teachers in the study provided the following responses: "Gifted children" (65.5 percent), "Children with higher learning potential" (63.6 percent), "Highly achieving students" (29 percent), "Good students" (12.7 percent), "Smart students" (9 percent), and "Children with academic talent" (5.5 percent). In the text-based responses to this question, some teachers mentioned children who excel at high levels or demonstrate high competency in specific subjects. "Gifted" has been the common term until the NOU 2016:14 report which introduced the term "higher learning potential". Both terms seem to be preferred by teachers in the study.

The text-based results show also that teachers in the study have various perceptions of what giftedness entails, although they seem to prefer the term "gifted". We argue that various perceptions might lead to different attitudes and pedagogical practices. The diversity of concepts found in the data aligns with findings from previous studies, which have shown a lack of consensus regarding the terminology used in reference to gifted students [4–6,16]. From a Bakhtinian [72] perspective, the conceptual diversity observed among the teachers in our study reflects a polyphony concerning their beliefs about gifted students, indicating a variety of perceptions. The presence of multiple voices and discourses surrounding the terms used may indicate variations in values and attitudes regarding giftedness and gifted education [30]. It is essential to acknowledge and further explore this polyphony to gain a deeper understanding of how this diversity can influence teachers' attitudes and pedagogical practices concerning gifted education.

7.2. Teachers' Perceptions of Legislation Concerning Gifted Education

The following section presents teachers utterances on legislation concerning gifted education. Most teachers in our study report that the Education Act obliges them to provide adapted and tailored instruction for gifted students as well as the rest of the students. Some teachers emphasize the importance of creating enthusiasm for learning and motivation for development. A few aim to ensure that gifted students receive appropriate challenges to enhance their competence level. These latter teachers advocate for individualized instruction, assigning tasks that match the gifted students' abilities, and allowing them to reach higher goals.

When asked about what The Education Act obliges teachers to do for gifted students, a common response in the study is that every student in the Norwegian school system has the right to tailored education. This implies that teachers in our study recognize the importance of providing educational practices that are adapted to meet the individual needs of each student. This viewpoint aligns with the principles of inclusive education, as it emphasizes the equitable treatment of all students, regardless of their abilities or challenges [17]. The differences found in the responses in the current study revolve around *how* to cater to the needs of gifted students, and whether they have equal rights to students who struggle in different ways.

When asked about their familiarity with the NOU 2016:14 official report, *More to gain. Better learning for students with higher learning potential* [6], over 80 percent of the teachers responded negatively or were unsure. Only about 16 percent had heard of the report, and a mere 1.8 percent reported having read it. Regarding the impact of the report on teachers' ability to adapt instruction for gifted students, 90 percent indicated they did not know, while 10 percent stated that there had been no change. In terms of the Education Act's obligations for gifted students, teachers' perspectives in the study varied widely. Some were uncertain about the specific requirements, while a few believed that there should be demands for specially tailored programs on an equal footing with students who struggle academically. From a Bakhtinian [72] perspective, the presence of conflicting views and voices regarding giftedness and gifted education in Norway reflects the existence of multiple discourses and perspectives within the education system. These conflicting views are a manifestation of polyphony, where different social groups, such as teachers, policymakers, and researchers, hold diverse understandings and opinions on the topics "giftedness" and "gifted education". However, when only 1.8 percent of the teachers in our study have read the official NOU 2016:14 report [6] concerning gifted education, several years after its publication, it indicates that sources other than official policy have taken priority in informing teachers' attitudes and pedagogical practices. This suggests that the report has not been widely disseminated or emphasized within the education system. Such a notion implies that in our study, teachers' knowledge and understanding of gifted education may rely more heavily on alternative sources, such as personal experiences, informal discussions with colleagues, or professional development activities that may not align with the official policy recommendations and can be more subjected to cultural practices.

Only a few teachers in our study recognize that legislation obliges them to provide tailored education to gifted students on the same level as for other students, and they report striving to facilitate further learning and support within their time and resource constraints. Several of these teachers emphasize the need to adapt the instruction to meet the needs of all students, including the gifted ones, and promote inclusive education. Though, some teachers stress the need for more knowledge and resources for doing so as the respondent below:

> Differentiated instruction is essential for every student, including those who are well above average among their peers. However, there is currently insufficient knowledge, tools, and resources available to effectively implement differentiated instruction specifically tailored to meet the needs of these exceptionally gifted students. (Respondent No. 39) [our translation]

The utterance above on the concept of differentiated instruction for gifted students is in line with research that has shown that teachers in Norway do not possess the knowledge and resources necessary to cater for gifted student's academic and social needs [4,6,13]. This teacher and others who gave similar statements demonstrate an understanding of the importance of providing equitable opportunities for all students, regardless of their abilities. From a Bakhtinian [72] perspective, the utterance above reveals tensions and contradictions within the education system. This teachers' recognition of the need for differentiated instruction reflects an acknowledgement of the diverse needs and abilities of students. The statement suggests a desire to create a learning environment that caters to individual differences and promotes the development of each student's unique potential—also the gifted students. This aligns with Bakhtin's [72] emphasis on dialogue and responsiveness to the individual. However, the statement also highlights the limitations and challenges faced in implementing differentiated instruction for gifted students in the Norwegian school system. The lack of knowledge, tools, and resources implies that there is a disconnect between the recognition of the gifted students' needs and the practical means to successfully meet those needs. This gap creates a tension between the educational ideals and the realities of the system. From a Bakhtinian perspective, this can be a signal that the tension might be perceived as a conflict between competing voices and interests. On one hand, the utterance advocates for tailored and responsive education for gifted children, recognizing their unique abilities and the need for nurturing. On the other hand, there are constraints imposed by limited knowledge, resources, and systemic factors that hinder the realization of these ideals. When multiple interests collide, negotiations within the education system regarding priorities and resources often do not seem to prioritize the needs of gifted students.

Very few teachers in our study recognize that legislation obliges them to provide special education for gifted students. They believe that gifted students have unique educational requirements that should be addressed to ensure their full potential is realized. One respondent has specifically highlighted the importance of addressing the needs of gifted students alongside students with special needs by uttering the following:

> Greater provision should be made for gifted children in school. Today, the main focus is probably on children with special needs (which, of course, should not be reduced). Gifted children can easily get bored and some have unwanted behaviour. [There should be] Mapping of gifted children, it does not occur today. (Respondent No. 51) [our translation]

This statement is in line with The Council for Exceptional Children [49] that promotes establishing special provisions for gifted children in ordinary schools. From a Bakhtinian [72] perspective, the statement highlights the presence of conflicting discourses and priorities within the education system regarding the provision of resources and support for gifted children. By asserting that greater provisions should be made for gifted children, this respondent challenges other voices in the Norwegian education system that do not promote doing so. This perspective also points out that catering to gifted children's needs can prevent boredom and potentially disruptive behaviours. It suggests that the current focus on children with special needs should not overshadow the importance of catering to the needs of gifted children as well. The statement also draws attention to the absence of a mapping or systematic identification process for gifted children in schools. This observation reveals a gap in current practices and implies that the education system may not adequately recognize and address the needs of gifted children. This absence of mapping can be seen as a silencing the voice and unique experiences of gifted children within the educational discourse. In addition, in this utterance we find the presence of conflicting views and voices regarding giftedness and gifted education in Norway.

Only one respondent in our study addresses the issue of *identifying* gifted students in order to tailor adapted education that is supportive for their needs. "After all, it depends on identifying children who are gifted" (respondent No. 46) [our translation]. Identifying gifted students is a crucial practice that can help facilitate their education socially and academically [7,61]. From a Bakhtinian perspective, this response indicates a plurality of voices and discourses surrounding the identification of gifted children. In this case, the teachers' response reflects diverse perspectives and pedagogical practices on whether gifted students are identified or not. This teacher believes that identification can be a means to ensure that gifted students receive appropriate challenges and opportunities for growth. Gifted children who are not identified might also not receive an adequate education that is tailored for their needs.

This section has demonstrated that teachers may hold differing views on the extent to which the Education Act mandates them to provide adapted and tailored instruction for gifted students, as well as for other students. In the study, only a few teachers were familiar with the official NOU 2016:14 report. This suggests that teachers in the study may rely more on alternative sources, such as personal experiences, informal discussions with colleagues, or professional development activities that may not align with the official policy recommendations and may be influenced by cultural practices.

7.3. Teachers' Cultural Perceptions of Gifted Education

The following section presents teachers' utterances concerning gifted education that we have perceived as references to cultural practices. Researchers have found a strong relationship between attitudes and behaviour, which can be influenced by factors such as culture, beliefs, values, and context [54,55], and some of these factors are visible in our data.

When asked whether their schools have guidelines on how to adapt instruction for gifted children, over 60 percent of teachers in our study answered "I do not know," 28 percent answered "No," and 9 percent answered "Yes, it has." In the text-based answers, teachers are requesting more guidelines, time, and knowledge from their school management on how to meet the academic needs of gifted students.

> We have little focus on this! Management also has little focus on this area. Time is needed to map, plan, and collaborate across grades/schools. Time must be set aside for training staff. Currently, there is limited effort being made in this regard. (Respondent No. 51) [our translation]

The statement above shows that teachers would like to have more focus in this area, but they need more time and knowledge concerning how to do so. This statement is in line with studies that show that teachers do not feel competent to cater for gifted children's needs [4,6,13]. From a Bakhtinian [72] perspective, this utterance can be interpreted as a collective response produced by a representative of the teacher fellowship at this school. However, according to Bakhtin, no utterance occurs in a vacuum but rather in the context of a larger conversation or discourses. By using the word "we," the teacher highlights that the teacher fellowship at their school does not emphasize gifted education. This "we" also provides legitimacy for this respondent's pedagogical practice. Being part of a culture of pedagogical practices is easier to legitimatize current practice than standing alone. Furthermore, respondent No. 51 also expresses that management at this school does not prioritize gifted education. This utterance highlights that in the polyphony of voices in education, areas that school management prioritizes are more likely to be prioritized by the teachers. When management does not do so, teachers perceive this as a signal of policy and guidelines. This response can be interpreted as part of a larger conversation consisting of multiple voices or perspectives within discourses on gifted education. Although the speaker here is speaking on behalf of the rest of the teachers at this school, it is one voice of many contributing to the discourse on this topic.

To provoke responses that can signify which attitudes teachers in our study have towards gifted children, we asked our respondents to comment to the following statement: "Being gifted is a luxury problem" [Norwegian: luksusproblem] (The Norwegian term "luksusproblem" is a compound of the words "luxury" and "problem. According to the Norwegian Academic Dictionary, the term "luksusproblem" signalises an insignificance presented as a problem. The term can be used to describe a situation in which a problem may seem like a challenge or concern to someone. However, it may be perceived as less significant or privileged than larger or more serious problems. The phrase can be used ironically or critically to point out that a problem or concern may seem less important or less justified when viewed in the face of more pressing or serious societal problems. The term can also be used to reflect on privileges and perspectives in different situations. It is important to note that the term can be perceived as controversial or inappropriate, especially when used to downplay or dismiss other people's problems or concerns.). The cultural term "Luksusproblem" in Norwegian signifies that someone is more lucky than unlucky—even privileged. By using this term, we have hoped to provoke responses that highlight teachers' ethics concerning gifted children's educational needs. We were pleased to note that most teachers in our study that responded to this statement did not agree with it, although several teachers did have this notion. Respondents answer this question by emphasising that giftedness can have both positive and negative consequences if the abilities of gifted students are not acknowledged and utilized. Some respondents highlight that being gifted is not necessarily a "luxury problem" but can lead to frustration if not addressed. Gifted students may be overlooked and prioritized last in the classroom, resulting in stagnation or loss of motivation for learning. However, there are differing opinions expressed regarding the challenges faced by gifted students, including social difficulties, lack of appropriate challenges, loss of interest, and stigmatization. The overall consensus is that being gifted is not a luxury and can present significant challenges in various aspects of a student's school life. The following statement from a teacher in our study is critical to the notion that giftedness is perceived as a privilege might result in a practice that does not cater for gifted students' needs:

> This is a statement that can serve as a comfortable cushion for school staff [that they can use for not doing anything]. In any society, there is a need for individuals at all levels, and those who have the ability and opportunity to achieve great heights have an equal right to have their school day adapted to meet their needs, just like those who face other challenges. (Respondent No. 50) [our translation]

The statement above aligns with research and policy that claim that children at all levels have the right to have an education that is tailored to their educational and social needs [4,6,20,34,49]. From a Bakhtinian [72] perspective, the statement above reflects a polyphony of voices and discourses. On one hand, it recognizes the significance of meeting the needs of gifted students and adapting their school day accordingly. At the same time, this perspective stresses that children with exceptional abilities have an equal right to have their educational experience tailored to their needs, just as those who face other challenges. Nonetheless, this statement also implies a critical voice against the schools and school system that can use such a notion that giftedness is a luxury as a "comfortable cushion" or an excuse for inaction by school staff. The statement stresses that the principle of equity should apply to all children. From a Bakhtinian perspective, we can see a tension between different voices who represent conflicting discourses and interests within the education system concerning gifted education.

A few teachers in our study concurred with the statement that giftedness is a privilege for gifted students, although several also commented that having such students in the classroom poses more challenges for teachers than for the students themselves. One teacher expressed the following viewpoint: "It might be considered a luxury, but not a problem" (Respondent No. 7) [our translation]. This latter notion aligns with egalitarian school systems that often perceive giftedness as a privilege, leading to suggestions that resources and support should not be allocated to gifted students due to the perceived priority of other, visibly disadvantaged groups [10]. From a Bakhtinian perspective, the statement reflects a conflicting voice to The Norwegian Education Act § 1–3 on adapted education that states the following: "Education must be adapted to the abilities and aptitudes of the individual pupil, apprentice, candidate for a certificate of practice, and training candidate" [17]. Some teachers appear to perceive giftedness as a privilege for gifted students, attributing it to their exceptional learning abilities. They view giftedness as something desirable and valuable, akin to a luxury. This perspective reflects a high regard for knowledge. However, the contrasting viewpoint of teachers that consider giftedness as a luxury highlights the consequences of limited research, legislation, and focus within teacher education in Norway in the field of gifted education. In the absence of proper guidance, teachers and schools may heavily rely on cultural factors, which can influence and shape teachers' attitudes and pedagogical practices to a greater extent than they should.

8. Conclusions

This study shows that teachers play a crucial role in identifying and promoting gifted students' academic and social development, and it is essential to understand their attitudes and beliefs that inform their practices. This underscores teachers' critical role in identifying and promoting gifted students' academic and social development. Competent teachers are more positive about facilitating adapted gifted education and integrating gifted students into social contexts to help them feel acknowledged and understood.

Furthermore, this study shows that research, legislation, and teacher education are undoubtedly crucial means of enforcing evidence-based practice in gifted education. Without these means to inform teachers, cultural factors may be given more weight in defining teacher practices. Additionally, when schools do not support gifted children, it creates a gap that others attempt to fill. As Tourón and Freeman [33] have found in their studies of gifted education in Europe, private associations and parents make efforts to fill this gap. In Norway, we have found the same. As a result, some gifted children will receive private support, while others will lack the means and network to access such resources. In this way, paradoxically, ideas of equity in the egalitarian Norwegian school system are working against less-privileged children, even though it is supposed to provide equal opportunities for all. In the future, it is essential to implement more provisions in Norwegian schools to ensure equal opportunities for all gifted children. This will help promote equity and ensure that every child has access to the appropriate resources and support. By recognizing and addressing the unique needs of gifted learners in Norway, schools can create an inclusive learning environment that promotes the development and success of all learners, regardless of their abilities.

Author Contributions: Conceptualization, G.H.F. and G.S.J.; Methodology, G.H.F. and G.S.J.; Formal analysis, G.H.F. and G.S.J.; Investigation, G.H.F. and G.S.J.; Writing—original draft, G.H.F. and G.S.J.; Writing—review & editing, G.H.F. and G.S.J. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Board (or Ethics Committee) of Norwegian Centre for Research Data (protocol code: 599640 and date of approval: 26 March 2021).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Data availability is in line with the Norwegian Centre for Research Data (NSD) [71] stored at NLA University College. Please contact the corresponding author with questions.

Acknowledgments: We would like to thank all the participants in this study for their confidence and interest in this project.

Conflicts of Interest: The authors declare no conflict of interest.

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education sciences

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Article

Assessment and Gifted Discourse in Swedish Early Years Education Steering Documents: The Problem of (In)Visibility

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Abstract: This study explores how assessment is presented in Swedish early years' steering documents and considers risks for young gifted students in relation to assessment (or lack thereof). Document analysis was undertaken on, firstly, Swedish curriculum documents for the preschool and for the compulsory school, and secondly, mapping materials used in the preschool class with six-year-old children. Results show that assessment is not a term used in Swedish early years curricula. Instead, preschool teachers are asked to evaluate their own practice; preschool class teachers are asked to engage with mapping and only to consider working toward later assessment goals in year 3 of school. A plethora of alternative assessment terms are used in the curriculum without definition. Giftedness is also invisible in the curriculum. However, the mapping materials used with six-year-old students in the subject areas of mathematics and Swedish do encourage teachers to consider children who achieve mastery early. Further, these materials provide supportive questions and activities for teachers to use in exploring further. The specific examples of assessment discourses and the need to consider gifted children are combined in this article to highlight aspects of teacher work that are important for the educational rights of an often-forgotten group of learners.

Keywords: gifted; early childhood; preschool; assessment; curriculum; policy; Sweden

Citation: Margrain, V.; van Bommel, J. Assessment and Gifted Discourse in Swedish Early Years Education Steering Documents: The Problem of (In)Visibility. *Educ. Sci.* **2023**, *13*, 904. https://doi.org/10.3390/educsci13090904

Academic Editor: Jacobus G. Maree

Received: 10 July 2023
Revised: 22 August 2023
Accepted: 26 August 2023
Published: 7 September 2023

1. Introduction

This article discusses the attention given to assessment and giftedness within early years' steering documents in Sweden. The topic is important, as unless assessment is engaged with, recognition of children's capabilities is likely to be at risk. The topics of assessment and giftedness have both been contested in the early years due to differing ideas about children's rights, learning and teaching philosophies, and equality. The purpose of addressing these two contested areas in combination is to draw attention to the double risk of invisibility or misunderstandings regarding young gifted children in Sweden. We believe Sweden provides an interesting case study, being a context in which children's rights are strongly articulated, yet there has not been a tradition of giftedness being recognised. Further, in Sweden, the interpretation of 'assessment' in the early years is oriented toward teacher self- and system-evaluation. The aims of the study are, firstly, to identify different ways that assessment is presented in early years' steering documents and, secondly, to consider attention to giftedness in these documents. At the intersection of these issues is the consideration of children's rights. We interpret assessment broadly as meaning to be noticed, recognised, and understood, and thus logically, children have the right to 'have assessment or be assessed' in the early years. From this assessment can come consideration of curriculum-connected learning opportunities, including appropriate stimulation and support. We begin with, firstly, a discussion of the early years context in Sweden—prior-to-school (preschool or early childhood), preschool class, and the early years of school. This frames the subsequent discussion of assessment in the early years in Sweden and, thirdly, the justification of how giftedness has relevance in the early years.

1.1. Context of Early Childhood Education in Sweden

Early childhood education in Sweden has a long history of paying attention to quality education and learning in the early years. This attention to quality ensures that children can attend stimulating and supportive early learning environments, that they have social and democratic experiences, and that parents can work with confidence in the quality of their children's care and education. Early childhood services in Sweden are referred to by the Swedish National Agency for Education (SNAE) as 'preschools', which is a direct translation of the Swedish word *förskola*. For this reason, in the rest of this article, the term 'preschool' will be used when referring to the specific context of Sweden, but early childhood education when referring to broader international contexts. The broader concept of 'early years' covers both early childhood (preschool) and the early years of school. Swedish preschools cater for children aged 1–5 years, are built on principles of quality learning environments, encourage children's play and participation, and are led by a professional and qualified workforce. Sweden is a signatory party to the United Nations Convention on the Rights of the Child [1]. Article 29.1a of the convention states, 'Parties agree that the education of the child shall be directed to the development of the child's personality, talents, and mental and physical abilities to their fullest potential' (p. 9).

The concepts of 'education' and 'care' have been formally integrated since 1968 [2], and preschools have been managed by the same central agency as schools since 1996. Accessibility is important, with children having a guaranteed right to a place and fees being minimal. In the second half of 2022, 96% of five-year-olds attended Swedish preschools. Lower attendance rates of children younger than five are a reflection of the generous and universal paid parental leave of 480 working days, which can be 'stretched' over a longer period. The average attendance statistic is 86% of all children aged 1–5 years [3], varying in attendance between 15 and 40+ h per week. The Swedish preschool curriculum was first published in 1998, then revised in 2010 and 2018 [4]. The curriculum stresses democracy from the very first sentence, as well as responsibility, citizenship, and attention to children's rights.

In 1996, a new initiative was introduced in Sweden, entitled the 'preschool class' (*forskoleklass*), for children aged 6 years. This initiative aimed to provide a bridge between preschool and school. It became a universal right in 1998 and then compulsory in autumn 2018. In 2016, a curriculum for preschool class was included in the curriculum for the compulsory school [5], clarifying objectives for preschool class. Year levels 1 to 3, lower primary (*lågstadiet*), represent children across ages 7–9, often with the same teacher following the group all three years for continuity. A further feature of Swedish education is the provision of school-age educare (*fritids*), attended by the majority of children in preschool class and primary school, ensuring an integrated system of care and education across the day. Table 1 illustrates the parts of the Swedish school system that are in focus for this article and the corresponding curricula.

Table 1. Swedish school system structure and curricula across ages 1–9 years.

1–5 Year-Olds	6 Year-Olds	7–9 Year-Olds
Preschool (early childhood education and care) *Förskolan*	Preschool class and School-age educare *Förskoleklass and fritids*	Lower primary school year levels 1–3 and School-age educare *Lågstadiet and fritids*
Curriculum for the Preschool	*Curriculum for the Compulsory School, Preschool Class, and School-Age Educare*	

The term 'teacher' is used for consistency throughout this article to acknowledge the pedagogical role of educational practitioners, regardless of which level of the education system they work in. Thus, the use of the term 'teacher' in this article embraces degree-qualified teachers as well as educators or pedagogues with lower-level qualifications.

1.2. Assessment' in Early Years Education

Assessment is a contested term across all forms of early years education: early childhood (preschool), preschool class, and lower primary. The word 'assess' (*bedömn*) is not mentioned once in the Swedish preschool curriculum [6]. Yet, the Swedish preschool curriculum (2010) states that teaching should be mindful of children's development and learning.

Commonly, early childhood resists normative, summative, or 'schoolified' approaches. Instead, formative, sociocultural, participatory, and agentic approaches are employed [7]. In Swedish, the translated word for assessment (*bedömning*)' is most commonly understood as meaning the kind of assessment akin to testing and is firmly rejected by early childhood educators.

Sociocultural assessment starts from the assumption that the child has strengths and competencies that can be observed, documented, encouraged, and made more complex. Test-taking, ranking, scoring, and comparative judgments have questionable relevance, benefit, or ethical practice in everyday early childhood education. [7]. (p. 5).

Åsén and Vallberg Roth [8] set out to document the diversity of approaches to documentation and assessment in Swedish preschools. Preschool teachers shared their use of pedagogical documentation and portfolios, individual development plans, evidence-based tools, and even standardised tools relating to such areas as language or social-emotional development. Åsén and Vallberg Roth concluded that the preschool teachers' use of documentation in assessment supported them in following children's development over time and that the development of each child's skills and abilities remained in focus. Thus, their study shows that the absence of explicit curriculum text about assessment does not mean that assessment in the broad sense is absent in practice.

We authors draw on a broad interpretation of early childhood assessment in which it contributes an integral and valuable part of 'robust' early childhood teacher work—provided it is employed in context-specific and ethical ways with valid purpose [9]. We position assessment as part of supporting and understanding children and their learning. For example, a preschool teacher might observe that a child needs extra support with using utensils at lunch time, be aware of their favourite book and play preferences, or notice a prodigious memory and passionate interest in a particular topic. From these observations, a teacher can then plan how to give additional support or stimulation, working within the child's zone of proximal development. The '*right* to be assessed' so that an appropriate education can be provided is no different for gifted children than for other children. It can therefore be positioned as a social justice issue where gifted children are not recognised or receive an education appropriate for them.

A recent initiative on the Swedish assessment landscape is the 2019 introduction of mandatory assessment tools for use with six-year-olds within the preschool class. These tools—described as mapping (*kartläggning*) rather than assessing *(bedömning*)—support documentation of children's mathematical thinking [10] and linguistic awareness [11]. The purpose of the mapping is to gather information that can support the teacher in identifying children who are in need of extra adaptations, special support, or extra challenges. This information and support can then be used to help children reach their individual potential. Nevertheless, there is debate as to the best use of teacher time, with Ackesjö [12] sharing the contention that 'more assessment implies less teaching' (p. 1). Walla's research with Swedish and Norwegian assessment in mathematics for 6-year-olds [13] highlights the challenge of diverse perspectives in early years' assessment. Walla notes 'a diversity of discourses—both between and within the assessment materials—indicating different views on children's learning [of mathematics], on when to assess, on what knowledge to assess, and on how and why to assess' (abstract) [13].

This debate as to what form of assessment is appropriate and at what age continues across the school sector. In the compulsory school curriculum [14], goals are set for year levels 3, 6, and 9. Official grades are not given until the 6th year of school in Sweden, when children are 12 years of age. Prior to 2012, grades were first introduced in the 8th year of school (14-year-olds), and there is currently discussion of introducing grades in school year four (10-year-olds). One of the reasons provided for delaying the introduction of grades is stated to be that

> Using official grades too early is considered detrimental since some children can be categorised and stigmatised. Young children are not yet fully aware of the difference between 'I am' and 'I do', and this can have a negative effect on the modelling of their selves. [2] (p. 7)

However, the exchange of observations and insights about children's progress is particularly important for gifted children, as research indicates skills that parents have in identification [15] and that gifted children may 'mask' behaviour in schools and preschools [16]. We explore gifted issues in the next section.

1.3. Giftedness' in Early Years' Education

In practice, 'gifted education' terminology can differ internationally; schools and early childhood settings can loosely use a wide range of terms: gifted, talented, highly able, exceptional, exceptionally able, high potential, high learning potential, precocious, bright, advanced, and highly advanced. There can also be an absence of any reference to giftedness, especially in early childhood. The Swedish National Agency for Education notes that approximately 5% of students in Swedish schools are potentially gifted. However, no standard measure or process for identification is given, nor is there a definition of what giftedness means [17]. As Ivarsson writes:

> On the one hand, giftedness is described in different ways and has different starting points, which can make the interpretation and understanding of the concept difficult. On the other hand, it can be seen as a strength that giftedness can be understood and viewed in several different ways. [18] (p. 1)

As with the term assessment, the term 'giftedness' and associated synonyms are contested within Sweden and within the Swedish curriculum. A consequence, according to Ivarsson, is that "[e]ven though we in Sweden have "a school for all", gifted students have ended up in the shadows, with no or little attention." [18] (p. 2).

'Giftedness' can be understood in differing ways, according to a multitude of differing theorists. Historically, research focused on conservative single-criterion approaches such as IQ measurement. More contemporary approaches have included multi-categorical perspectives, including such domains as intellectual, creative, social, perceptual, and physical [19], and moral and ethical [20]. Multi-categorical perspectives align more easily with early childhood, within which learning is commonly integrated and holistic and 'the whole child' is recognised. For Renzulli [21], giftedness is defined as the nexus of above-average abilities, task commitment, and creativity. At very young ages, one can see evidence of these three aspects being more developed in some children.

Gagné's [19] differentiated model of giftedness and talent (DMGT) is especially useful for the early years, as he differentiates between hereditary giftedness and talent that has been developed over time. Think of a young child who shows strong and early musical responsiveness by bopping to music in the pram, drumming their fingers to tunes or conducting rhythmically, singing rather than speaking, and recognising portions of classical music. For such a child, support and extension can be offered regardless of any specific testing of their 'musical giftedness' or even any kind of decision about whether they are gifted or not. Perhaps this musically engaged child might enjoy being exposed to music and dance from differing cultures, learning an instrument, using song in pretend play, learning to read music, or performing a small concert. Teachers are likely to be mindful of not pressuring children to 'perform', and to consider their developmental trajectory. For example, Angela passionately enjoyed learning piano and reading musical scores at four years old but became frustrated that her fingers could not physically do what her brain had mastered. Returning to the DMGT model [19], we can suggest that a musically gifted child might develop into a talented individual in time and with the support of context/environment, catalysts, and their own motivation and volition. In Angela's case, as an older child and young adult, she participated in many orchestras, completed a music degree, and composed her own music.

Teachers play an important role in the early identification of potential giftedness and in providing opportunities for the development of talent. Author 1 [22] suggested that it is important for teachers to support potentially gifted children by utilising both 'general' teaching strategies, which benefit all children, and 'specific gifted education' teaching strategies. As with all children, potentially gifted children are unlikely to thrive without a supportive environment, recognition of their potential, or opportunities for stimulation. Teachers can enrich the learning environment with open-ended questions, resources, and activities in the early years. They can also use resources from above-level expectations, differentiation, programs, enrichment activities, or content acceleration. Teachers can also be mindful of common (but not universal) characteristics of potential giftedness: insatiable questioning, exceptional memory, intense observation, problem-solving, early reading and calculation skills, and creative thinking [23]. Author 1 shared an example of creative planning and play from 4-year-old Xavier in a New Zealand early childhood centre. This example is included to show that a play-based, child-centred orientation to learning is supported in the early childhood sector:

> Xavier (4:08) applied his knowledge about space in creative ways through drama. In one early child-hood education service other children did not want to join in with a game he created about planets, but he was able to involve others in a specific children's drama group. The following commentary describes his play: 'There are 10 people in the play, one for each planet, and I'm including Pluto, even though it's a dwarf planet. One person has to be the sun, but they don't get to move, because the other people will be orbiting around them. Everybody in the play will be wearing hula hoops of different colours, the same as the planets, so the people not in the play will know which planet is which and we will sing my planet's song.' This narrative also shows Xavier's awareness of others: both the participants in the play and the audience. [23,24] (p. 35)

The opportunity for parents and early childhood teachers to share insights about a child is important in early childhood education. For gifted children, this can be especially important, as even very young children can mask their ability in certain situations, such as when they feel different from others or have concurrent learning disabilities [25]. It is also important in a context where teachers have a limited understanding of giftedness. A case study by the authors illustrates preschool teacher and parent collective support in the context of a young Swedish child ready for more advanced mathematics [26].

An absence of explicit reference to giftedness and gifted children in five international early childhood curricula and two wider policy texts, including the 2010 Swedish preschool curriculum, was documented by Margrain and Lundqvist [6]. However, their analysis also identified a great deal of implicit attention and support for gifted children in the curriculum text, which gives a mandate to teachers to respond. For example, Swedish curricula indicate that education should build on the children's previous knowledge and experience, provide continuous challenge and new discoveries and knowledge, and give additional support and stimulation to the children who need it [4,14]. Examples of word-level Swedish preschool curriculum text that could be seen as aligning with implicit gifted education policy include the following terms and number of times mentioned: develop (103), learn (56), ability (35), stimulate (17), challenge (9), and equity (9) [6]. These terms all provide scope for teachers to identify a policy mandate to attend to the needs of gifted children within the framework of democratic, equitable education for all children.

1.4. Aim of This Research

In Swedish early years' education policy, assessment and giftedness are contested terms, yet at the same time, children are supposed to be challenged and supported from the start. Therefore, we are interested to see in what ways the steering documents support/enable teachers to recognise and respond to children and their learning potential. The following research questions will guide us in our document study:

- How is assessment (broadly understood in all forms and through alternative terminology) presented in Swedish early years' steering documents?
- In what way is attention to giftedness explicitly and implicitly given in the steering documents for early years' education (in relation to a mandate for assessment practice)?

From these two questions, we aim to highlight considerations at the intersection of the two issues, in particular where steering documents lack visibility and where there are explicit examples to indicate action. Teachers, researchers, and policymakers continue to consider quality care and education for young children, as well as children's rights. By drawing attention to young gifted children and related assessment perspectives, the needs of this often-forgotten and therefore at-risk group can be profiled within these considerations of quality and children's rights.

2. Materials and Methods

In this section, we share our methodology and research positioning, a description of our document analysis method, and an overview of the data. We also give attention to ethical research issues.

2.1. Methodology and Research Positioning

This research draws upon a hermeneutical paradigm through its use of textual interpretation, or, in other words, finding meaning in the written word [27]. Assumptions underlying hermeneutics include the recognition that humans experience the world through language and that this engagement with language/text supports the development of understanding and knowledge. A hermeneutical perspective is relevant to our study because our method involves text analysis of steering documents. We engage with hermeneutical meaning-making and reflection on values espoused relating to assessment work and to giftedness (explicitly and implicitly). Becoming aware of the differing potential meanings of concepts such as assessment or attitudes toward giftedness can support important discussion and reflection on both education policy and teacher practice.

2.2. Method

The research method employed is document analysis [28]. Following the stepwise procedure outlined below, two types of steering documents were analysed by reading and marking downloaded PDF files. Firstly, a curriculum analysis was employed for the Swedish preschool curriculum [4] and lower primary school [14], and secondly, an analysis of mapping materials used in preschool class for the subjects mathematics [10,29–32] and Swedish language arts [11,33–36]. The stepwise procedure meant that key statements were identified (step 1) and key terms could be identified (step 2). Giftedness was not analysed in the curriculum documents, as this had already been analysed in a previous publication [6].

For the curriculum analysis, the whole procedure started with identifying key statements about teachers' 'assessment work' in the two curricula of relevance for this study: the curricula for preschool [4] and the curriculum for preschool class and compulsory school [14]. Key terms were then identified, and through a sorting and coding procedure, a preliminary classification was made, after which additional terms were added if appropriate and the data was revisited (Figure 1).

For the mapping materials—which are specific to preschool class—[10,11,29–36], the material was analysed regarding both assessment and giftedness, and a similar process as for the curriculum analysis was adopted (see Figure 2). Giftedness was included in this analysis as the preschool class mapping materials had not been studied in the Margrain and Lundqvist study [6].

During this process, several cross-checks were conducted where the authors shared their findings with each other and discussed differences, interesting or challenging cases, and other points of interest.

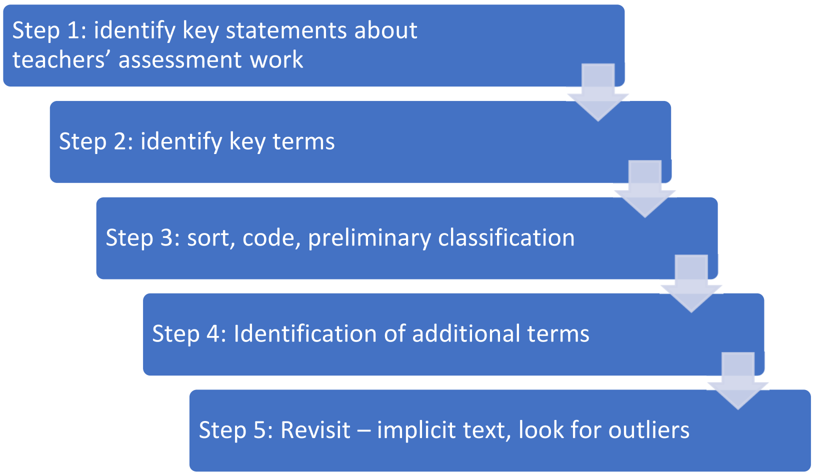

Figure 1. Curriculum document analysis process (preschool curriculum + compulsory school, preschool class, and school-age educare curriculum).

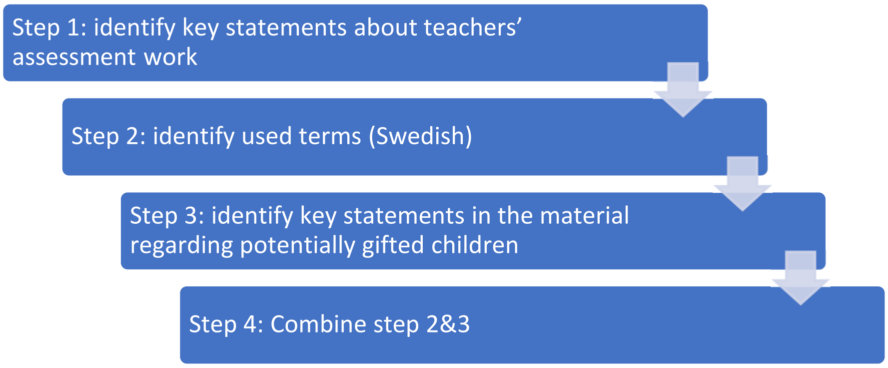

Figure 2. Mapping materials and document analysis process (preschool class).

2.3. Data

The data used in this study are, firstly, the curriculum for preschool [4], and the curriculum for the compulsory school, preschool class, and school-age educare [14] (with attention to lower primary school and preschool class). The newest, revised curricula were used. Secondly, we analysed the mapping materials provided by the SNAE [10,11,26–33] for use in preschool class. These documents were chosen as they are the only compulsory documents provided for teachers within this age group.

The preschool curriculum [4] consists of two parts: one part focusing on the fundamental values and tasks of the preschool (*Förskolans värdegrund och uppdrag*, 7 pages) and one part in which general goals and guidelines are set out (*Mål och riktlinjer*, 9 pages). The curriculum for preschool class is included in the curricula for the compulsory school [14] and consists of three parts: one part focusing on the fundamental values and tasks of the preschool class (*Förskolans värdegrund och uppdrag*, 6 pages), one part in which general goals and guidelines are set out (*Mål och riktlinjer*, 10 pages), and one part specifically for preschool class (4 pages). The curriculum for compulsory school consists of 230 pages, of which 57 are relevant for lower primary school and thus included in our data.

The mapping materials focus on mathematics (*Hitta matematiken* [10,29–32] and Swedish language arts (*Hitta språket*) [11,33–36]. These mapping materials are provided online. For both language and mathematics, the material consists of a general text about the material and four activities described in detail with introductory texts to each activity (53 pages in total). The topics covered in the mapping materials for mathematics are patterns [29], number sense [30], measurement [31], and spatial awareness [32]. For the Swedish language arts, the topics are: telling and explaining [33], listening and conversation [34], communicating with symbols and letters [35], and distinguishing words and sounds [36]. The materials are to be used in preschool class according to the school regulation; Chapter 8, Section 2 of the 2010 school regulation [37] states that from July 2011, national mapping materials must be used to map children's linguistic awareness and mathematical thinking in preschool class. The aim is to support teachers in identifying children who are in need of extra adaptations, special support, or extra challenges to reach as far as possible. Due to a new curriculum, the mapping materials were revised in 2022, and the term 'knowledge requirements' (*kunskapskrav*) was replaced with the term 'criteria for assessment' (*kriterier för bedömning av kunskaper*).

2.4. Ethical Research

No human participants were engaged in this research; the research involved the analysis of publicly available curriculum and related documents, which were openly downloadable from the internet. Therefore, no formal ethical application was required. However, the ethical guidelines of the Swedish Research Council were followed [38]. Particular ethical issues include attention to trustworthiness, accurate reporting, beneficence, and avoiding harm. As two researchers, we were able to share our analyses with each other as a form of accountability. While we may highlight areas that lack visibility or clarity, we also recognise that the curriculum is complex and often specifically designed to allow for diverse interpretations. In this way, our choice of hermeneutical meaning-making perspective is relevant. Nevertheless, the findings of our study are to be treated with care, and complexity should be included in the communication of our findings. We acknowledge that highlighting the absence of explicit attention to assessment and giftedness can be used for negative purposes, but our intention is rather to highlight positive possibilities and the inclusion of alternative discourses.

3. Results

In line with the process of the analysis, we first report on the findings from the analysis of assessment texts in the Swedish preschool curriculum, then follow with assessment texts in the Swedish curriculum for preschool class and compulsory school. These two curriculum sections are then followed by the findings from the analysis of the mapping materials (*Kartläggningsmaterialet*) used in Swedish preschool class.

3.1. Assessment Text in the Curriculum for Swedish Preschool

A curriculum citation from the Swedish preschool curriculum [4] that includes many terms aligned to assessment work is cited below (despite the absence of 'assessment' as an explicit term), with emphasis added by ourselves to highlight these terms. The citation led to us exploring the further use of the highlighted terms and a close reading of the full curriculum to identify other potential terms.

> Preschool teachers are responsible for: . . .
>
> • each child's development and learning being continuously and systematically **followed**, **documented** and **analysed** so that it is possible to evaluate how the preschool provides opportunities for children to develop and learn in accordance with the goals of the curriculum,
>
> • **documentation, follow-up, evaluation** and **analysis** covering how the goals of the curriculum are integrated with each other and form a whole in the education,
>
> • carrying out a **critical examination** to ensure that the **evaluation** methods used are based on the fun-damental values and intentions as set out in the curriculum,
>
> • results from **follow-ups** and **evaluations** systematically and continuously being **analysed** in order to develop the quality of the preschool and thus the opportunities of children for care, as well as con-ditions for development and learning, and

• using the analysis to take action to improve education. (pp. 19–20. emphasis added)

The citation above has potential terms connected to assessment, which we have highlighted in bold. This text is one key example that supported us in constructing a list of potential search words that could be broadly connected to assessment activity. These search words were: analyse, archive, document, examine, evaluate, follow (including follow-up and follow-up), investigate, and monitor. The Swedish preschool curriculum document [4] was then interrogated for mentions of these and other terms. In total, we identified 51 word-level mentions that could be connected to assessment activity, despite there being no explicit use of the word 'assessment', as shown in Table 2. An analysis of the full-text meaning of the relevant sentences from which these words came highlighted that the predominant 'assessment' work of Swedish preschool teachers in the curriculum is to evaluate. The evaluation activity was described in the curriculum as being an evaluation of the teachers' own practice and the system within which they worked. By comparison, there was considerably less emphasis given to assessment of or for children's learning or for helping children to self-assess or evaluate, even though supporting children's agency is promoted. Even less attention is given to caregivers' roles in 'assessment' processes, even though parent-teacher partnership is highlighted often throughout the curriculum. The activity of documentation was not explicitly connected to caregivers—only to teachers and children. There were no mentions of assessments connected to the work of preschool principals, which is a difference from our later analysis of the compulsory school curriculum.

Table 2. Word-level 'assessment' mentions in Swedish preschool curriculum.

Curriculum Word Text	Child		System Teacher's Work	Parents/ Caregivers	Total Word Mentions
	By	Of/For			
Analyse	0	2	6	0	**8**
Archive	0	0	3	0	**3**
Document	1	2	4	0	**7**
Evaluate	3	1	10	3	**17**
Examine	0	0	1	0	**1**
Follow/follow up	1	3	4	1	**9**
Investigate	3	0	2	0	**5**
Monitor	0	0	1	0	**1**
Total by category	**8**	**8**	**31**	**4**	**51**

A review of the text also highlighted that references to assessment-related terms often occurred simultaneously within the same sentence within the preschool curriculum [4]. However, there were no definitions, explanations of differences between the similar terms, or clarifications as to why the order is important. Across pages 19–20, the following phrase citations illustrate the grouping of 'assessment' terms within sentences:

• Continuously and systematically follow, document and analyse

• Systematically and continuously document, monitor, evaluate and analyse

• Documentation, follow-up, evaluation and analysis [4], (pp. 19–20)

Different aspects of assessment are described in these terms. In the first example (systematically follow, document and analyse), the element of evaluation is not included, yet it is included in the second and third examples, pointing to formative aspects of assessment. We further noticed differences between the use of follow, follow-up, and follow-up, again without explanation as to whether there was any important distinction between these variations.

Although we did not undertake data analysis on text around giftedness since this had already been done [6], we could identify Swedish preschool curriculum text content that connected our new research analysis of assessment discourse with an implicit connection to gifted education. For example, the text highlights the importance of challenge, stimulation, and special support and that some children have a right to an education that is adapted to their individual needs. The Swedish preschool curriculum [4] states that the purpose of education is to:

> . . . continuously challenge children by inspiring them to make new discoveries and acquire new knowledge. The preschool should pay particular attention to children who need more guidance and stimulation or special support for various reasons. All children should receive an education that is designed and adapted so that they develop as far as possible. Children who need more support and stimulation, either temporarily or permanently, should be provided with this, structured according to their own needs and conditions. (p. 7)

So, if preschool should 'pay particular attention' to children who have individual learning needs, surely that mandates some form of assessment activity? In the next section, we explore how discourses continue or shift in the early years of the compulsory school sector.

3.2. *Assessment Text in the Curriculum for Swedish Preschool Class and Compulsory Schools*

In 2022, the Swedish Curriculum for the compulsory school, preschool class, and school-age educare [14]—hereafter referred to as the compulsory school curriculum but inclusive of preschool class—was revised. A major shift is noticeable when comparing the previous and current compulsory curriculum documents with regard to the word assessment. A comparison shows that the word assessment (*bedöma, bedömas, bedömning, bedömningar, bedöms*) was mentioned 10 times in the compulsory school curriculum of 2011 (revised 2018) and substantively increased the number of mentions to 176 times in the revised compulsory school curriculum of 2022. Not all 176 words are actually describing a practice of assessment (some might be headings, used as a synonym to 'is considered', or are related to content-specific goals such as reasonableness assessment for estimates and calculations (*Rimlighetsbedömning vid uppskattningar och beräkningar*, p. 55). In 137 of these instances, assessment is related to assessment criteria for children ages 12–16 years and thus not within the scope of this study. Of the remaining, only a few describe a practice of assessment relevant for children ages 6–9 years.

In the section describing goals and guidelines for ages 6–16 years (*Övergripande mål och riktlinjer*, 10 pages), assessment is mentioned twice in relation to what a child is supposed to do, as shown in bold in the text below:

> The school's goal is that every child develops the ability to **self-assess** their results and relate their own and others' **assessment** to one's own work performance and conditions. [14] (translated, p. 18, emphasis added)

Self-assessment and assessment of others are two specific assessment situations that are put forward in the school curriculum for children ages 6–16. Further, assessment is mentioned twice in relation to teacher reporting and grading, as shown in bold in the text below:

> • "based on the syllabus requirements, comprehensively **evaluate** each child's knowledge development, report this orally and in writing to the child and the homes, and inform the principal;
>
> • make an all-round **assessment** of the child's knowledge in relation to the national grading criteria". [14] (translated, p. 18, emphasis added)

There is thus a shift in how evaluation is understood in the school curriculum, with the school sector including evaluation as being of and with children. This is a shift from the preschool sector, where evaluation was understood as of the teacher's own work and system-level evaluation. The citations below indicate that teachers are expected to evaluate and make an all-round assessment of the children's knowledge. Further, teachers are expected to plan and evaluate teaching together with the children:

Teachers should: "[. . .] together with the children, **plan and evaluate** the teaching# [14] (translated, p. 18, emphasis added).

With a focus on the principal, the compulsory school curriculum [14] states that the principal at the school has a responsibility to follow up on grades in relation to assessment criteria. At the school level, results need to be followed up and evaluated in "active collaboration with the school's staff and children and in close cooperation with both homes and with the surrounding community" (p. 10, translated). This follow-up with caregivers has specific references to assessment, grading, and evaluation, which differ from the preschool curriculum.

With specific reference to the preschool class, teachers are to take the criteria for assessment for later years into account, but there are no criteria defined until year level 3. Only one instance of an alternative 'assessment' word (evaluate, utvärdera—p. 18) was found in the curriculum for preschool class. All together, this means that the practice of assessment—with specific relevance to children aged 6–9 years—is only mentioned nine times in the compulsory school curriculum.

3.3. Mapping Materials (Kartläggningsmaterialet) for the Swedish Preschool Class

Connected to a practice of assessment, our examination of the mapping materials [10,11,29–36] led to the identification of the key words. To start with, the material is called 'mapping material' (*kartläggningsmaterialet*), and the word mapping (*kartläggning*) is frequently used in different variances. Other terms used are: identify, notice (*få syn på*), pay attention to, and observation points. Further, assessment is used in relation to the criteria described for year-level 3.

As for the analysis regarding giftedness, the mapping materials have a specific section in the activities that addresses not only how children who have progressed further can be detected (see Table 2) but also the needs they have in their knowledge development. We acknowledge that 'children who have progressed further' are not necessarily gifted, but it is nevertheless of consequence that attention is given to this group of children. The materials provide alternative questions for teachers to ask or alternative tasks to offer for the students who have progressed further. Such attention to those who have progressed further or who learn more rapidly is novel in Swedish teacher resource material. The activities follow a specific structure, and the same words and wordings are used in all activities, as indicated in Table 3.

Table 3. Guidance for attention to children who have progressed further in preschool class mapping materials.

Mathematics	Language
"The teacher **needs to pay attention to** the child who. . ." [10] (p. 5); [11] (p. 9) (emphasis added)	
"A child who has progressed further in his knowledge development in mathematics probably shows competence through, for example: . . ." [29–32] (translated, p. 2)	"A child who has progressed further in their development needs extra challenges. (S)he shows her/his knowledge, for example, by . . ." [33,35] (translated, p. 5); [34] (translated, p. 4); [36] (translated, p. 6)
"**To notice** children who have progressed further in their knowledge development in mathematics, you can ask the following questions: . . ." [29–32] (translated, p. 4, emphasis added)	"In the activity, the teacher is given the opportunity **to notice** if the child . . ." [33–36] (translated, p. 2, emphasis added)

'To notice children who have progressed further' is explained in relation to the specific topics within the mapping materials. An example: The mathematical activity 'playground' deals with the mathematical concept of spatial awareness. The child's curiosity and interest in the mathematical content of the activity, the child's ability to try and use different ideas, and the child's communication and reasoning regarding space, perspective, and time are assessed.

The following examples are given in relation to how children who have progressed further will show their competence:

> • "in their strategy take into account colour, shape, size, and direction of the images;
>
> • explain why one place fits better than another;
>
> • communicate in a way that leads problem solving further, and/or;
>
> • reason and communicate about what season it is and why it is that season". [32] (translated, p. 4)

When a teacher has identified a child who has progressed further, the mapping material gives suggestions for alternative questions that can be asked of such a child. In the same activity, Playground [32], the following suggestions for alternative questions are given:

> • "How do you know that particular picture card shows what the girl sees?
>
> • How do you know that location is incorrect?
>
> • How do you know she's not standing there?
>
> • How can one know what season it is?" [32] (translated, p. 3)

Potential giftedness is mentioned in relation to children's mathematical behaviour and language skills. In the example above, we can see a difference between mathematical behaviour (for example, 'communicate in a way that leads problem solving further') and mathematical skills (for example, 'in their strategy, take into account colour, shape, size, and direction of the images'). Giftedness can thus be connected both to specific mathematical content and to a child's mathematical behaviour. Similar examples can be found in the mapping materials for language, like in the first activity, "we tell and describe":

> The child is able to describe a phenomenon or thing in several stages and is able to actively participate in conversations, invite others to conversations, and listen to others. [33] (translated, p. 5)

In summary and as a short answer to our research questions, assessment (*bedömning*) is not used explicitly, but alternative terminology is used, and through that, different aspects of an assessment practice are apparent in Swedish early years' steering documents. However, there is a different emphasis on particular words at different levels of the system, differing interpretations of the same terms, and a lack of definition of terms. Giftedness is not mentioned in the curricula, but in the mapping materials, explicit statements regarding children who have progressed further are found, including instructions for the identification of such children and suitable follow-up. In the next section, we will relate these findings to the aim of our study and describe in what way the steering documents support/enable teachers to recognise and respond to children and their learning potential.

4. Discussion

In this discussion, we return to our research questions and consider, first, assessment texts in the early years and, second, the specific context of assessment for young gifted children. Thirdly, we take up rights-based implications, including the risk of neglecting assessment for this group, and conclude with possibilities for the future.

4.1. Assessment Text in the Early Years

The word- and phrase-level analysis of the early childhood curriculum (Section 3.1) leads us to reflect on the finding that the majority (31 of 52 mentions) focus on teachers' evaluation of their own practice (as opposed to assessment of and for children). Of course, professional self- and peer-evaluation is important, and care should be taken to avoid prematurely or negatively labelling children. Nevertheless, the minimal attention to assessment of and for children might obstruct teachers' attention to the identification of children's strengths and needs and the establishment of children's zones of proximal development. What does it mean for early intervention when the focus of evaluative-assessment work is on the system, not children or the individual child? Further, if we reflect on the earlier research by Åsén and Vallberg Roth [8]—and our wider knowledge of early childhood teacher work—we are aware that there is substantive 'assessment work' of and for learning in early childhood that is invisible within the curriculum. What does it mean when important work is invisible and potentially seen as taboo to talk about? This nature of the taboo and discomfort with the terminology of assessment can be explored further in ongoing research.

We further wonder: do teachers have clarity as to the difference between the terms evaluation and analysis, and why in the curriculum text are teachers sometimes asked to evaluate before analysing and otherwise just analyse? There is a substantive difference between following up and then documenting vs. documenting and then following up—was this change in text deliberate or accidental, and do teachers notice this shift? Without definition, we also wonder about the subtleties of the difference between following and systematically following; documenting and systematically documenting; and examination and critical examination. These questions are beyond the scope of this article and need follow-up in further research, potentially interview-based.

For the Swedish curriculum for preschool class and compulsory school [14], assessment first seems to be more explicitly present, with almost 180 mentions. However, a closer look reveals that only a few of these instances are related to the practice of assessment of or for children, and none are specifically stated in the section for the preschool class. As with the curriculum for preschool, assessment is often presented in terms of the evaluative-assessment work of the system and teacher practice. Therefore, many of the same reflections we pose regarding the clarity of assessment work in preschool continue on into the context of preschool class and the early years of school.

We also found it curious that, despite strong encouragement for preschool teachers to work in partnership with caregivers, there was limited acknowledgement of the contribution that caregivers make to the assessment process. In particular, there were no mentions of the activity 'document' connected to caregivers, despite the fact that many families have extensive photographic or portfolio documentation of children's milestones, early writing, art, and so forth. We suspect that this issue, like others, might indicate a difference between policy text and actual practice. There is an opportunity to make parent-teacher assessment sharing more visible in policy documentation and guidelines. Nevertheless, documentation sharing can, of course—and we hope it does—occur whether it is explicitly stated in policy.

Our summary of discourse is that there is a shift in focus and terms used across the three system levels we examined. Firstly, evaluation was in focus for preschool, then mapping became in focus in preschool class, and finally, some limited mentions of assessment were made in year level 3 of compulsory school (see Table 4). Discussion of these shifts needs to be well understood by all involved if they are to understand the differing nature of assessment. It is definitely much more complex than to simply say, 'we don't do assessment in Swedish preschool'.

4.2. Assessment of Young Gifted Children

With regard to giftedness, the preschool curriculum has no specific mentions, and the curriculum for preschool class and compulsory school only mentions these children implicitly (see Table 3). With invisibility in policy comes the risk of being overlooked in practice. However, the mapping material stands out positively because of explicit mentions and guidelines on how to notice and detect children who have progressed further (see also Table 3). Teachers are encouraged to assess, map, notice, and evaluate specific competencies and skills. We find the mapping materials provide useful guidance for teachers and serve a positive purpose. Such careful observation and practical follow-up support children's learning and potential identification.

Table 4. Discourse shifts of assessment and giftedness across Swedish preschool, preschool class, and lower primary.

	Preschool Ages 1–5	**Preschool Class Ages 5–6**	**Lower Primary Year Levels 1–3. Ages 6–9**
Assessment Discourse	Evaluating the system—limited assessment of and for children's learning	Mapping material: noticing, mapping	Assessment criteria introduced for year level 3.
Giftedness	Invisible but implicit in the curriculum	Explicit in mapping materials. Invisible but implicit in the curriculum	Invisible but implicit in the curriculum

For young gifted children, the opportunity for caregivers to share family documentation can also be especially useful in providing evidence of competencies that a child might mask or hide in preschool and school. This may be especially important in the early years, when schools do not have other potential identification tools in place.

In the absence of any definition, there will likely continue to be confusion as to whether students are high achievers, have high learning potential, are potentially gifted, or are gifted. However, alongside lamenting invisibility in the curriculum, we can celebrate what does exist. There are online resources on giftedness provided by the Swedish National Agency for Education, and there is an increasing interest in Nordic gifted education research. This is evidenced by increasing publications, doctoral student research, a Nordic research network, teacher professional development opportunities, municipality networks, and parent networks. Such initiatives can be harnessed to support gifted education in the field, for example, by sharing resources and strategies.

Among the analyses conducted in this article, the mapping materials stand out positively as explicitly attending to children 'who have progressed further'. Of course, we can debate what that description means, who is included and excluded, and the dangers of a normative approach (progressed further than whom?). However, using a broad concept such as 'children who have progressed further' is better than having no consideration or mention at all of those who would benefit from program differentiation. The point is, surely, that (regardless of term), we are alert to children's competence and potential and that teachers use whatever tools possible to understand children's learning needs. Then we can follow the equally important next step, which is program differentiation and opportunities for new learning.

4.3. Rights, Risks, and Possibilities

This article began with consideration of the assessment of young gifted children and the risk to them of invisibility in policy document text. In Sweden, where gifted children are in 'regular' class, every teacher is potentially a teacher of gifted children and engages with gifted education. Therefore, attention to gifted children in Swedish preschools and schools is inextricably linked with attention to teachers' everyday classroom work. If Sweden is, as claimed, 'a school for all', then it cannot continue to be that gifted children—or any other group of children—are invisible in policy or practice. There are therefore important opportunities to apply this analysis to wider international contexts where inclusive practice is articulated as an ambition. Does 'inclusion' include all children, in particular gifted children? And what exactly are they included in: in the physical classroom or in opportunities to learn? And do assessment practices—whether formal or not—ensure that teachers can recognise all gifted students? How are we doing with those from diverse linguistic and cultural backgrounds or whose domain of giftedness is something other than academic? These are questions of international interest for all education systems to reflect on.

The implication of our text analysis is that there is a double risk impacting young gifted children. Firstly, they miss being recognised due to the invisibility of both giftedness discourse and assessment discourses of or for children's learning. Secondly, this lack of recognition can present a risk to these children's democratic right to an appropriate education adapted to their learning level. Children's rights are more than simply attending or being present in school or preschool. The UN Convention [1] states that they have the right to an education—that is, they have the right to opportunities to learn.

Opportunities for further research are many. It is important to move beyond the policy text and see how this curriculum is implemented in reality with regard to assessment and giftedness. As noted earlier, the absence of policy text does not mean the absence of practice. Interviews might explore in what way teachers make sense of the terms used in steering documents and the instructions provided in mapping materials. Interviews would also explore how teachers notice and respond to gifted children and their interactions with parents. Observations and analysis of planning might explore how teachers follow and follow-up gifted children and what questions are asked of children who have progressed further. Through an observational or interview study, the enacted curriculum can be in focus, and the children themselves can express their lived experience of assessment and giftedness. This is important so that research is not only 'on' children but also engages their perspective. Ensuring children's voices are heard leads to respect for their educational rights and an important opportunity to analyse policy enactment by those who are affected. We also have an interest in engaging in international comparative analysis of steering documents to be able to share how assessment and giftedness in the early years are framed in diverse countries.

So, what are our recommendations for policy and practice? Further discussion is needed on the collective understanding of assessment activity—taking up assessment in the broadest possible definition, including the activities that we know do occur in preschools, preschool class, and schools: observation, discussions, formative assessment, anecdotal note-taking, and pedagogical documentation. Without these discussions, challenges exist for potential common understandings of assessment practices and processes (including differing definitions and discourses), appreciation for teachers' work, collaboration across school sectors and with caregivers, and the work of early identification. We suggest acknowledgment that assessment is an already existing practice in the early years, used in the context of supporting children's learning. Simultaneously, we recommend sharing examples of gifted children at all levels of the education system and positive examples of teachers' work with these children. Such examples should include diverse and age-appropriate assessment approaches and follow-up on the assessment results. Further, we recommend sharing examples of giftedness and learning support beyond formal education, especially from caregivers. For both assessment and giftedness considerations, we hope that the examples we share in this article can add to professional learning discussions and reflections that lead to questions about explicit and implicit policy. While responsive practice can supersede policy, the text of steering documents sends a message about what is important, what policy text is not, and what is. Policy clarifications, such as definitions and attention to at-risk or marginalised groups, would be useful future actions.

Author Contributions: Conceptualization, V.M. and J.v.B.; methodology, V.M. and J.v.B.; software, not applicable; validation, V.M. and J.v.B.; formal analysis, V.M. and J.v.B.; investigation, V.M. and J.v.B.; resources, V.M. and J.v.B.; data curation, V.M. and J.v.B.; writing—original draft preparation, V.M. and J.v.B.; writing—review and editing, V.M. and J.v.B.; visualization, V.M. and J.v.B.; supervision, not applicable; project administration, V.M. and J.v.B.; funding acquisition, not applicable. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable (the study did not involve humans).

Informed Consent Statement: Not applicable (the study did not involve humans).

Data Availability Statement: Data sources utilised were public documents. No new data were created.

Conflicts of Interest: The authors declare no conflict of interest.

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Article

The Fallacy of Using the National Assessment Program–Literacy and Numeracy (NAPLAN) Data to Identify Australian High-Potential Gifted Students

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Abstract: In Australia, gifted or talented students are defined according to the widely accepted model proposed by Gagné, where giftedness is understood as potential, and talent is shown through competencies (or achievements); in this definition there is a clear differentiation between the two constructs. Most Australian education jurisdictions espouse Gagné's definitions and use a variety of mechanisms for identifying gifted and talented students—a commonly used identification practice is the results from the Australian National Assessment Program–Literacy and Numeracy (NAPLAN) test. This article sets out to explore the fallacy of using the NAPLAN results to identify giftedness in high-potential (gifted) students in Australia, outlining key reasons why the NAPLAN is unsuitable as an identification instrument for giftedness. Moreover, it explores the erroneous use of the NAPLAN as an identification tool for giftedness when it was never designed, validated, or intended as such an instrument.

Keywords: National Assessment Program–Literacy and Numeracy; NAPLAN; gifted students; identification; standardised assessment; Australia

Citation: Ronksley-Pavia, M. The Fallacy of Using the National Assessment Program–Literacy and Numeracy (NAPLAN) Data to Identify Australian High-Potential Gifted Students. *Educ. Sci.* **2023**, *13*, 421. https://doi.org/10.3390/educsci13040421

Academic Editors: Kirsi Tirri and Valerie Margrain

Received: 5 April 2023
Revised: 13 April 2023
Accepted: 14 April 2023
Published: 20 April 2023

1. Introduction

In Australia, gifted or talented students are defined according to the widely accepted model proposed by Gagné [1], whereby giftedness is conceptualized as potential, and talent is evidenced through competencies (or achievement); thus, providing a distinct separation between the constructs of giftedness and talent. Gifted or talented students, like all diverse students, require differentiated instruction to meet their learning needs. One challenging part of being able to provide differentiated programming for these learners is the identification of giftedness and talent. Australian schools use an array of mechanisms for identifying gifted and talented students—a common one is the results of the annual National Assessment Program–Literacy and Numeracy (NAPLAN) testing. In the Australian context, talent, particularly academic talent, can be seen as being relatively straightforward to identify through a student's achievements, on such tests as the NAPLAN, for example. However, what is far more difficult to identify through school assessments and standardised tests is giftedness, or potential. The use of NAPLAN results by schools for identifying giftedness in high-potential (gifted) students is particularly problematic.

2. Defining Giftedness and Talent in the Australian Context

There are multiple definitions of giftedness and talent in use across the globe, yet there is no consensus on shared definitions [2]. However, for nigh on two decades Australian education systems have been captivated by evolving forms of Gagné's [1] Differentiating Model of Giftedness and Talent (DMGT, formerly the Differentiated model). This model has provided a clear distinction between the conceptualization of giftedness and talent. The precise wording from Gagné's DMGT [3] to define giftedness and talent is thus:

> **Giftedness** [emphasis in original] designates the possession and use of biologically anchored and informally developed outstanding natural abilities or aptitudes (called gifts), in at least one ability domain, to a degree that places an individual at least among the top 10% of age peers.
>
> **Talent** [emphasis in original] designates the outstanding mastery of systematically developed competencies (knowledge and skills) in at least one field of human activity to a degree that places an individual at least among the top 10% of 'learning peers', namely, those having accumulated a similar amount of learning time from either current or past training.
>
> (p. 10)

According to Gagné's model, the label of giftedness is associated with *potential*, where giftedness is said to be an outstanding level of aptitude in a particular domain [3]. For giftedness, this constitutes the top 10 percent of age peers in any one of six *Aptitude* domains: *Intellectual* (e.g., g factor–general intelligence, fluid reasoning, and crystallized reasoning); *Creative* (e.g., problem-solving, imagination); *Social* (e.g., perceptiveness, leadership); *Perceptual* (e.g., vision, proprioception); *Muscular* (e.g., power, strength); or *Motor Control* (e.g., agility, coordination) [1].

Conversely, the term talent is associated with *achievements* (or competencies) and conceptualized as outstanding mastery of competencies in a particular field [1]. Talent is reserved for individuals who are among the top 10 percent of peers in any of nine *Fields of Competencies*: *Academic* (e.g., languages, mathematics); *Technical* (e.g., construction, manufacturing); *Science and Technology* (e.g., engineering, medical); *Arts* (e.g., performing, applied); *People Services* (e.g., Health, community); *Management/Sales* (e.g., management, marketing); *Business Systems* (e.g., financial, distribution); *Sports and Athletics* (e.g., Sporting talents); or, *Games* (e.g., video, puzzles).

Of course, for gifts to be transformed into talents (according to Gagné's model), there needs to be a process of talent development. This talent development process involves "a progressive transformation through a **long-term** [emphasis added] learning process" [3] (p. 11), whereby environmental catalysts (e.g., social, interpersonal, and educational) and intrapersonal catalysts (e.g., curriculum provisions, motivation, volition, milieu), impact whether gifts are developed into talents or not. Gagné refers to this development of gifted potential into talent actualization, evident through the competencies, as the *developmental process*. This developmental process, in conjunction with the required catalysts (of course subject to *Chance* factors), is vital for talent (competency) development.

Gagné's definition of giftedness thus emphasizes *potential* among *age-peers*, whereas talent emphasizes 'time' spent on learning/training/talent development (but also the quality of time spent on these), in comparison to "learning peers", ref. [3] (p. 3)—not necessarily age peers (for reader interest, see the work of Ericsson [4] on "world class performers"). This is an important distinction, meaning that talent may never be developed or actualized during schooling years; rather, talent actualization is likely to be a life-long process (or at least longer than school-years) (F. Gagné, personal communication, 11 February 2021).

Conceptualizations of giftedness in North America incorporate the concept of talent development as a life-long process [5]. This conceptualization has similarities with Gagné's definition of talent, which involves a "long development process that has its foundations in remarkable aptitudes [gifts/high potential]", ref. [6] (para. 1). The giftedness definition from the National Association for Gifted Children (NAGC) in the USA states that in young children, giftedness can be evidenced in domain-specific high achievement, high general ability, or in a rapid rate of learning compared to age-peers [7]. As children grow into adolescence, high motivation and achievement in a domain (e.g., mathematics, music, language) is seen as being part of the conceptualization of giftedness [7]. Unlike Gagné's definition, the NAGC [7] definition denotes giftedness as outstanding levels of aptitude—exceptional ability to reason and learn, or competence in one or more domains. Contrasting Gagné's [1] definitions in the DMGT, the NAGC definition does not explicitly differentiate between giftedness and talent. This is a major difference in conceptualizations of giftedness and talent between Australia and North America.

3. The Australian Context and Identification of Giftedness

In Australia, there are six states and two territories, with different state and territory education departments, and regional departments in boundary-specific regions within these states and territories. Each state and territory has some form of policy (or advice) around inclusive education practices (some of which may mention gifted and talented students), and/or a gifted education policy of some sort (although some are make-shift at best). For the most part, some of the more extensive state and territory policy documents outline suitable identification practices for schools. Where policies exist, they more often than not cite Gagné's DMGT in some form (e.g., the superseded 2009 version) as being the educational jurisdiction's conceptualization of giftedness and talent. Accordingly, the identification practices espoused by education jurisdictions should follow Gagné's [1] differentiation between giftedness and talent in his model—the conceptualization of giftedness as potential across the six Aptitude Domains, and the conceptualization of talent as achievement in the nine Competency Fields.

Australia is purportedly an egalitarian society where the expectation is that everyone receives a 'fair go'. Yet, there exists what is known as the 'tall poppy syndrome', a cultural practice where those who flourish before their peers are 'cut down' and everyone is held back so they can flourish at the same time [8,9]. Therefore, it is important to ensure that identification practices are equitable.

An overview of identification assessments used in the Australian context for identifying giftedness as an "outstanding level of aptitude in any domain", ref. [3] (p. 10), can be seen in Table 1. For the purposes of this article, we will concentrate on exploring the Domain of Intellectual giftedness from Gagné's [3] model. Recall that according to Gagné, intellectual giftedness is the *precursor* for academic talent development [3]. The DMGT shows that giftedness has many dimensions; nevertheless, Gagné suggests that intellectual giftedness can be understood as "unidimensional", ref. [3] (p. 14), and its most relevant measure is the Intelligence Quotient (IQ) score, which is seen as the "best measure for that unitary core, commonly called 'the *g* factor' [or general intelligence factor]", ref. [3] (p. 14). The g factor encompasses general intelligence, fluid reasoning, and crystallized reasoning. Therefore, a relevant assessment for intellectual giftedness would be an IQ score derived from an appropriate psychometric assessment (e.g., Screening Assessment for Gifted Elementary and Middle School Students-3 (SAGES-3); Weschler Intelligence Scales–WISC-V, WPPSI-IV; Stanford Binet Intelligence Scales–SB-5; Raven's Progressive Matrices–RPM, Woodcock Johnson-IV–WJ IV) [3,10]. However, the practicality of using IQ instruments may be beyond the resources of schools, in terms of costliness and time required. Improving systemic validity for identifying gifted learners is also challenging due to the limits of psychoeducational assessments [11].

Relying solely, or over-relying, on any kind of psychometric assessment for identifying giftedness (as potential) has a significant number of well-recognized limitations, which may in some instances render it less useful (e.g., does not assess creativity or divergent thinking skills). It is worthwhile briefly noting here that psychometric assessment results, such as the full-scale IQ scores (FSIQ), can be impacted by a number of factors; for example, twice-exceptionality (giftedness and co-occurring disability), culture, educational opportunities, socio-economic factors, and a number of other problems (see for example, Flynn [12], Gould [13], Murdoch [14]).

In some instances (e.g., twice-exceptionality), and for some IQ assessments (e.g., the WISC), the General Abilities Index (GAI) can be a more useful description of an individual's intellectual ability than the FSIQ (see Weiss et al. [15] for specific details). The GAI may be preferred as an alternative way of summarizing overall ability. Thus, the GAI can provide different impressions of a student's overall ability when there is variability across index scores on these tests [15]. Because the GAI does not incorporate Working Memory (WM) or Processing Speed (PS) subtest scores, it may provide clarity for some individuals who score lower on these areas but who show superior intelligence in problem-solving and conceptual thinking [15]. Variability in WM and PS subtest scores for twice-exceptional individuals occurs due to weaknesses in working memory and processing speed, which are characteristic of some disabilities, such as attentional disorders [15]. In these individuals, the GAI may be higher than the FSIQ and thus capture the "maximum potential of the child being assessed", ref. [15] (p. 402).

However, IQ testing is imperfect [12,14], and extensive cautions need to be observed over the appropriateness, use, and application of IQ assessment instruments. Current expanded understandings of human intelligence have moved away from fixed notions of intelligence (predetermined by genetics), as measured by IQ tests (e.g., knowledge base, abstract thinking, mental processing speed) (see also Dai and Sternberg [16], Renzulli [17]). Additionally, there is much more to giftedness than just intelligence; it is well-recognized that intelligence tests measure a very narrow set of psychometric skills and should not be used as the only, or even the main, way of assessing giftedness [18]. The Flynn effect [12] (or secular rise in IQ scores) refers to the increase over time of IQs—approximately 3 points every 10 years. The Flynn effect has shown that intelligence, as measured by IQ tests, is changeable. This change has unknown causes; however, speculation relates to elements such as schooling, test familiarity, complex and stimulating modern environments, and improved nutrition (at least in developed nations) [12].

IQ testing can be culturally biased with respect to individuals from different cultures, backgrounds, students with disabilities, students with English as an additional language and/or dialect, and students from low-socio-economic backgrounds [3,19,20]. Furthermore, as Sternberg [18] observed, "the heritability of intelligence varies by social class" (p. 7). With these limitations in mind, psychometric assessment is well-recognized and highly validated in identifying and assessing giftedness as potential [21,22].

It is considerably easier for Australian schools to identify academic talent rather than intellectual giftedness [23], due to the tangibleness of achievement evidenced from school assessment results (e.g., exams, assignments) and standardised assessments (e.g., NAPLAN). This is in contrast to the much more intangible nature of giftedness as potential. However, if educational jurisdictions—and subsequently schools—are stating they have processes for identifying giftedness that only identify talent (i.e., achievement), then there is a considerable disparity between understandings of Gagné's model, the conceptualizations of giftedness and talent, and the practices associated with, and purportedly based on this model. Identification methods and conceptual definitions of giftedness need to have adequate specificity and internal consistency that connect with operational definitions [24]. However, as McBee and Makel [24] argue, it is not that straightforward; "quantitative or psychometric *analysis* [emphasis in original] must accompany quantitative or psychometric *arguments* [emphasis in original] when conceptual or theoretical ideas about giftedness are being considered" (pp. 1–2). Though this discussion is beyond the scope of the current article, it is worthy of deliberation.

4. The Australian National Assessment Program–Literacy and Numeracy (NAPLAN)

In order to make the case against using NAPLAN as an identification measure for giftedness, it is necessary to first provide an outline of what NAPLAN is. This section briefly explains the four tests that comprise the annual NAPLAN assessments: (1) writing test; (2) reading test; (3) conventions of language test; and (4) numeracy test.

The Australian National Assessment Program–Literacy and Numeracy (NAPLAN) tests are administered annually in March for students in Grades 3, 5, 7, and 9 (prior to 2023 NAPLAN was in May). Australia is in the Southern Hemisphere, and so the school year begins towards the end of January (after the annual summer break) and ends in early December (prior to the annual summer break); so, the NAPLAN tests take place approximately two months into the new school year. The assessments test students' writing, reading, conventions of language, and numeracy skills in timed tests conducted over three days [25]. The tests were first implemented in 2008 under the responsibility of the Australian Curriculum, Assessment and Reporting Authority (ACARA), which was also established in the same year to develop the Australian National Curriculum. Each of these tests is further outlined below.

The NAPLAN writing test examines students' knowledge and skills in either imaginative writing, informative writing, or persuasive writing, with all students receiving the same genre (text type) for the test irrespective of schooling year level. Students are given a writing stimulus or prompt, and write a response in the required genre. There is no choice of text type, and students and teachers are not aware of what the genre will be until the test [26].

The NAPLAN reading test measures each student's literacy proficiency in reading and comprehending written English texts, and their knowledge and interpretation of language conventions [26]. The test consists of a range of texts with different writing styles where students must read the texts and answer related questions through responding to multiple-choice questions.

The NAPLAN conventions of language test assesses students' spelling, grammar, and punctuation. The focus of this test is on students' use and knowledge of written standard Australian English, with multiple-choice, text-entry, and drag-and-drop-type responses in the online version of the test [26].

The NAPLAN numeracy test measures students' achievement in numeracy, including their mathematical knowledge, skills and understanding, fluency, problem-solving, and reasoning across algebra, measurement and geometry, and statistics and probability [26]. In Grade 7 and Grade 9, there are two sections in the NAPLAN numeracy test; a short non-calculator section for students to demonstrate arithmetical calculation skills, and a second section where calculators are allowed [26].

Standardization of the annual NAPLAN test is said to enable comparisons of students in a given year level with other years [27]. As a standardised achievement test, NAPLAN provides an annual one-point in time measure of Australian school students' achievement in those aforementioned areas of literacy and numeracy. This snap-shot view can only "provide vignettes of student achievement rather than a detailed portfolio of learning progress over time", ref. [28] (p. 10), which means results provide limited information about student learning and achievement in those specific areas at that one point in time.

The NAPLAN assesses acquired knowledge and skills—literacy proficiency in specific areas of reading and writing, knowledge and interpretation of language conventions (spelling, grammar and punctuation), and numeracy achievement in specific areas. Achievement in NAPLAN testing is based on what learning students have been able to access to date, and what they have understood and can convey during the testing.

Annual reporting of NAPLAN results is aimed at ensuring that there is a national understanding of student achievement in literacy and numeracy, and how each state's and territory's schools are performing [29]. Results from NAPLAN testing show what level students are at in comparison with other students and schools, and nationally across state and territory schools. Without nationally comparable data on how students are performing, there would be limited information about student achievement in the areas of literacy and numeracy that are assessed by NAPLAN [29].

The NAPLAN results were originally intended to provide data to support teaching and learning in Australian schools, where students and parents were to "discuss progress and compare performance against national peers", ref. [30] (p. 1). The intention was also that individual schools could map their students' progress, identify strengths and weaknesses in teaching programs, and set goals in these areas for their school. A core aim of NAPLAN was to "help teachers to challenge high performers and identify students needing support", for the benefit of "school systems and governments" where valuable data would be used "to support good teaching and learning, and school improvement", ref. [30] (p. 1). The original premise for implementing NAPLAN was based on the idea of supporting "all children to gain 'a world class' education", ref. [31] (p. 392). The subsequent use of NAPLAN results fell very short of these commendable intentions, and the tests came under immense public scrutiny and criticism.

Indubitably, like any standardised test, NAPLAN has its limitations, which have been extensively explored and, indeed, criticized by educators and researchers since its inception (see for example, Johnston [29], Rose et al. [32]). Early criticisms of NAPLAN suggested it was disconnected from the curriculum. This was addressed in 2016 when NAPLAN assessments were mapped against the Australian Curriculum in English and Mathematics to "align the test questions and constructs to the Australian Curriculum . . . and to reflect the dual delivery mode of NAPLAN, online and paper", ref. [33] (para. 2).

As Lingard et al. [34] noted, the widespread criticisms of the tests included the many unintended consequences of NAPLAN testing, which in some respects may actually reduce students' achievement in both literacy and numeracy due to the narrow knowledge and skill foci of the tests. One of the main criticisms is that many important aspects of learning are not measured by NAPLAN, meaning that "what counts the most cannot be counted", ref. [29] (p. 26). These criticisms are often played out annually in the media at NAPLAN testing and reporting times, and include critiques of the ways the data are used (e.g., school comparison league tables), that the tests narrow the curriculum focus to specific knowledge and skills that will be assessed, teaching to the test (e.g., teaching only the requisite skills and knowledge assessed by the tests), declines in students' intrinsic motivation, inability to adequately use the data to address student needs, and increased stress for both students and teachers [34]. There is also some evidence that more attention is provided in class to students who are thought to be able to achieve better results (when compared with their previous NAPLAN results), and consequently high and low achieving students may miss out on additional support from teachers [35]. Evidence also suggests that the results from the testing are not readily available in a timely fashion, so the data are not as useable as they could be in terms of aiming to improve teaching and learning (as results are released towards the end of the school year) [36]. However, this is changing from 2023, with results expected to be available by July each year.

Criticisms have also arisen over the inappropriate use of NAPLAN results (see for example, Wu and Hornsby [37]), which are regularly trialed in the media—in particular, the use of controversial so-called league tables on the federal government's website *MySchool*. The league tables compare NAPLAN results of diverse state and territory government schools, private schools, Catholic schools, and independent schools against each other. This practice has made NAPLAN a particularly high-stakes test for many teachers, schools, and some students and parents [32,38]. League tables still exist; however, schools are now compared with supposedly more 'like schools' in terms of similar socio-economic profile; whether this is any better or not, only time and data use will tell.

5. Australian School Processes for Identifying Giftedness

A review of Australian education jurisdiction websites suggests an array of assessment practices used by schools to identify giftedness and talent (Table 1), such as parent nominations, psychometric assessments, teacher checklists, schoolwork, school reports, and standardised achievement tests, such as NAPLAN. For this review, data were collected from the eight state and territory jurisdiction websites based on their gifted education policy and practices for identifying gifted and talented students. The data collection process consisted of a web search for each education jurisdiction, based on search terms like "Australian Capital Territory education gifted and talented", and then locating each respective state's or territory's education department policy, and/or advice to schools about suitable instruments and methods for the identification of these students. The sources of these data and results are presented in Table 1 under the Source/s column.

Table 1. An overview of gifted and talented identification practices across Australian states and territories from website searches.

State/Territory	Specific Gifted Education Policy	Identification Notations	Identification Practices Assessment Types Listed	Examples of Assessment Instruments Listed	Source/s
Australian Capital Territory (ACT)	Yes	Using data from multiple subjective and objective assessment measures of ability and achievement to identify potentially gifted and talented students.	Parent nomination checklists Teacher nomination checklists External psychometric testing School-based abilities testing Standardised achievement tests Parent observations Teacher observations School work/reports.	Qualitative: Cognitive and Affective Rating Scales Student work and assessments Interviews Quantitative: WISC-V, SB-5, Raven's, Naglieri, PAT, TORCH, NAPLAN, Acceleration Assessments: IAS-Iowa Acceleration Scale, Renzulli Scales, Creativity Tests: Remote Association Task, Khatena-Torrance Tests for Artistic Ability and Talent: Clark's Drawing Abilities, Barron-Welsh Art Scale [39]	ACT Gifted and Talented Students Policy [40] Appendix B: Identification Instruments [39]
New South Wales (NSW)	Yes	Objective, valid and reliable measures, as part of formative assessment, should be used to assess high potential and gifted students and identify their specific learning needs [41]	Ability tests, achievement tests, adaptive tests, rating scales performance-based assessments, dynamic assessments, growth modelling assessments	None listed	High Potential and Gifted Education Policy [42]
Northern Territory (NT)	Yes	The department uses data and evidence to identify intellectual giftedness and/or academic talents by using both qualitative and quantitative identification tools [43]	Gifts (high potential): Rating scales, Checklists, Nominations, Standardised cognitive assessments. Talents (high performance): NAPLAN, Student achievement data/school reports, Portfolios of student work, Parent/teacher nomination	None listed	Gifted and talented students (G and T) [43]
Queensland (Qld)	No *	All Queensland state schools are committed to meeting learning needs of students who are gifted . . . The Department of Education has many awards, programs and initiatives to recognise students who demonstrate outstanding talents and show potential in academic and extracurricular activities [43]	None listed, no specific gifted and talented education policy–although P-12 CARF suggests use of "school wide processes to identify groups and individuals who require tailored support" [44]	None listed (no specific gifted and talented education policy).	Gifted and talented education [44], P-12 Curriculum, assessment and reporting framework (CARF) [45]
South Australia (SA)	No *	Government schools and preschools have programs for gifted and talented children as part of the standard curriculum. Specialised courses and programs: A number of schools offer specialised courses and programs for students: with a special interest who are well ahead of their peers demonstrating talent in a particular area.	None listed.	None listed	Student Support Programs–Gifted and talented education [46]

Table 1. *Cont.*

State/Territory	Specific Gifted Education Policy	Identification Notations	Identification Practices Assessment Types Listed	Examples of Assessment Instruments Listed	Source/s
Tasmania (Tas)	Yes	Implement processes to identify and make appropriate provision for gifted students in their school, including acceleration procedures and early entry to kindergarten [47]	None listed.	Early Entry to School WPPSI IV test required. None listed for other year levels.	Extended Learning for Gifted Students Procedure, Version 1.1 [47]
Victoria (Vic)	No *^ (Have a 'high-ability toolkit and related webpages)	Identification should: begin as early as possible, be flexible and continuous, utilise many measures, highlight indicators of underachievement, be appropriate to age and stage of schooling.	List of measures: response to classroom activities, self-nomination, peer-nomination, teacher nomination, parent nomination, competition results, above-level tests, standardised tests of creative ability, standardised cognitive assessments (IQ tests) observations and anecdotes, checklists of traits interviews (child or parent), academic grades. Assessment data (formative & summative): classroom-based assessment samples (e.g., tests, assignments), standardised achievement assessments (e.g., NAPLAN or the Progressive Achievement Tests–Reading/Mathematics), teacher observations, and/or other qualitative information, projects or portfolios, past assessment results (e.g., curriculum levels–previous year), above-level tests.	NAPLAN, Progressive Achievement Tests–Reading/Mathematics, Silverman's checklist and exemplar, Merrick's checklist and exemplar, Frasier's TABs and exemplar, Assessment audit template	Whole school approach to high ability [48] Identifying high-ability [49] High ability toolkit [48]
Western Australia (WA)	Yes	Principals will plan and implement strategies to identify gifted and talented students.	Identification processes for gifted and talented students should: Be inclusive, be flexible and continuous, use information from a variety of sources, including classroom teacher observation and assessment, as well as knowledge obtained from other people (e.g., parents and peers). Help teacher identify a student's intellectual strengths, artistic or linguistic talents, and social and emotional needs. Direct quality of the teaching and learning environment [50]	None for identification of gifted/talented students. For acceleration of students pre-primary to Year 10-examples: performance in classwork and classroom teacher observation, school assessments, information from other sources, such as parents and peers, IQ tests and psychological assessments, other standardised achievement tests, NAPLAN performance, Iowa Acceleration Scale, information about social-emotional readiness [51]	Gifted and Talented in Public Schools [50], Guidelines for the Acceleration of Students Pre-primary–Year 10 [51]

* No readily found or available published policy document. ^ Victoria have extensive publicly accessible information about "high-ability" students, see 'Source/s' column in the table for further details.

Four out of the eight states and territories specifically mention NAPLAN as an identification tool, while others infer NAPLAN could be used as an achievement (talent) assessment (e.g., achievement tests).

Interestingly, two of the four states and territories specifically distinguish NAPLAN as an achievement test, and/or list NAPLAN under talent (high performance) assessments, recognising the distinction between giftedness and talent evident in Gagné's model. It is heartening to see from the findings presented in Table 1 that most states and territories suggest using data from multiple sources in identifying giftedness, including both objective and subjective measures (i.e., comprehensive identification). However, whether these comprehensive identification practices filter down from policy to school practices is a question for another day.

Comprehensive identification practices refer to the use of multiple measures to identify giftedness and/or talent, with the expectation that appropriate educational support will follow identification. These practices should be accessible, equitable, and comprehensive to make sure identification mechanisms are as broad as possible to "triangulate information from multiple sources", ref. [52] (p. 113). Comprehensive assessment includes "norm-based, psychometrically sound, comprehensive intelligence and [individual] achievement tests and measures in all areas of suspected strengths" [53] (p. 113) and are particularly useful for identifying twice-exceptional students (gifted or talented students with disabilities). A comprehensive assessment usually includes a psychometric assessment (e.g., WISC-V), and a range of other individually administered assessments of achievement (e.g., the Wide Range Assessment of Memory and Learning-WRAML, and the Wechsler Individual Achievement Test-WIAT) [54].

Foley Nicpon et al. [55] state that comprehensive individualized identification practices should employ "an intra-individual, rather than inter-individual approach towards ability and achievement" (p. 7) (i.e., from an individual's own results), especially for twice-exceptional students. The important point here lies with the intra-individual approach to identification, unlike NAPLAN, which predominately focuses on inter-individual approaches (i.e., comparison of results between different students and different educational contexts).

6. Discussion

The use of NAPLAN as an identification tool for giftedness is commonly evident (or implied) across Australian educational jurisdictions. In the gifted education context, the main problem is in using NAPLAN results to identify giftedness: NAPLAN is an achievement test—at best identifying some narrow aspects of academic talent—rather than an assessment of potential (i.e., giftedness). The fallacy of using NAPLAN data for identifying giftedness will be delineated in this section, and the key points are summarized in Figure 1.

6.1. The Fallacy of Using NAPLAN Data to Identify Giftedness

There is evidence that Australian educational jurisdictions are advocating for the use of NAPLAN results for identifying gifted students as well as talented students. Although there is some evidence at this system level that there is a distinction between gifted as potential and achievement as talent (see Table 1). Nevertheless, there is evidence to suggest that NAPLAN results at the individual student level are being used for identifying giftedness to drive selection of students for gifted extension programs and enrichment programs, and also for entry into selective schools and private schools (see Table 1). NAPLAN predominantly focuses on inter-individual assessment approaches—school, state, and national comparisons—unless achievement across an individual student's NAPLAN results over successive year levels is accessible (i.e., comparison of an individual's results to prior NAPLAN achievement across Grades 3, 5, 7 and 9).

Figure 1. Key reasons why NAPLAN is unsuitable for identifying giftedness.

It is evident from school websites that some schools are using NAPLAN data as part of 'general' entry requirements (which seems particularly prevalent in private and independent schools), and for entry into selective schools (government schools that accept students based on academic achievement) [56,57]. Some Australian schools explicitly state on their websites that entry into gifted programs and enrichment classes requires NAPLAN results, often along with some other *measures* of achievement, such as results from an entry exam [56,57]. Furthermore, ACARA recognizes this in their advice to parents, stating that "Some schools may ask for NAPLAN reports . . . as part of their admissions process. NAPLAN assessments are not designed to be a school admission test", ref. [58] (p. 2).

As a standardised achievement test, NAPLAN relies heavily on taught and acquired knowledge and skills, meaning it is also not likely to identify underachieving talented students [59]. Indeed, the majority of gifted student participants (5 out of 6) in Haines's [60] study showed below average school results in NAPLAN across literacy and numeracy, while potentially impacted by disabilities (e.g., learning disabilities). These findings present further evidence of the problems of relying on NAPLAN data to identify giftedness or talent. Furthermore, it is well-recognized that Australian students underachieve in both NAPLAN and the OECD Programme for International Student Assessment (PISA) testing [61]. One of the problems with underachievement is that these students will not reach talent-level competencies [3], so inevitably if NAPLAN and other achievement measures are being used for identification, these students will be missed for talent development programs. There is, therefore, a real concern about using NAPLAN for the identification of students who are underachieving/at-risk of underachieving, and for potentially identifying students from traditionally underserved populations (e.g., low socio-economic backgrounds), as either gifted or talented. Indeed, Goss and Sonnemann [61] found that "bright students from poor backgrounds make less progress in total (5 years 10 months) than low achievers with highly educated parents (6 years 6 months) between Year 3 [Grade 3] and Year 9 [Grade 9]"

(p. 28); although they did not define what was meant by 'bright' students, the inference is about potential, or giftedness.

Moreover, the national minimum standards (NMS) for NAPLAN are set very low. For example, a student in Grade 9 "can meet the NMS even if they are performing below the typical Year 5 [Grade 5] student. They can be a stunning four years behind their peers", ref. [61] (p. 2), yet appear to be meeting the NMS. This has immense implications for using NAPLAN as a gifted or talented identification instrument when comparing students and student achievement on the tests (inter-individual, school-wide and national comparisons). With 'bright' students in disadvantaged schools showing the biggest learning gap with "high achievers in disadvantaged schools make[ing] *less* [emphasis in original] progress than low achievers in high advantage schools over the six years", ref. [61] (p. 2). Using NAPLAN for identification thus may even further disadvantage already disadvantaged 'bright' students from low socio-economic backgrounds.

Likewise, the restricted curriculum assessed in NAPLAN (e.g., writing persuasive or narrative text types) presents a potentially serious risk in that the curriculum, and subsequent teaching (i.e., teaching to the test), is being restricted to topics and concepts that are liable to be assessed in NAPLAN tests [62]. The implication of this is that gifted and talented students are not being extended by school curricula as they likely will not be able to focus on higher order concepts (e.g., mathematical goals and outcomes). The NAPLAN writing test tends to rely on the narrowness of formulaic writing to address the test structure [63], stifling creativity in the process and the teaching of writing, which has "subsumed the development of [students'] imaginative capacity", ref. [64] (p. 33). This observation adds further weight to the fallacy of using NAPLAN in identifying giftedness, because identification practices should be aligned with the characteristics and domains of giftedness (i.e., Gagné's aptitudes), and aligned with the characteristics and fields of talents (i.e., Gagné's competencies in specific fields of human endeavor). If identification practices are not thus aligned, then it is unlikely giftedness and/or talent can be identified (according to Gagné's definitions).

Moreover, NAPLAN tests have are reported to have a large margin of error; that is, a large variability in a student's test results compared to that individual taking similar tests [65]. Reportedly, results could potentially be 12% higher or lower at the individual student level, with variations in results said to be as much as ± 5.2, where the standard error of measurement (an estimate of how repeated measures of an individual's skills on the same test tend to be distributed around a person's 'true' score) is reported as 2.6 standard deviations [66]. Additionally, the mean/median true value has been reported as a confidence interval of 90% [67], meaning that more caution is needed when using the results. These confidence intervals and margins of error are important reminders of some further limitations of NAPLAN data.

6.2. Evidence of NAPLAN Use in Identification of Giftedness

Most importantly, when identifying giftedness and talent, the definition of giftedness and talent being used (and the operationalization of these definitions) needs to align with identification practices, assessment instruments, and, programming that schools provide (e.g., differentiated instruction) [53]. Thus, if educational jurisdictions and schools are using Gagné's definitions, then NAPLAN is most unsuitable for identifying giftedness because it only assesses achievement (i.e., talent) in narrow areas of knowledge and skills. NAPLAN cannot, nor was it designed to identify aptitudes or talents. However, it may identify narrow academic skills related to English (e.g., writing, reading, language conventions), and narrow academic skills related to numeracy presented in the tests (e.g., specific areas of mathematical knowledge, algebraic reasoning, measurement).

Indeed, the Parliament of Victoria Education and Training Committee Inquiry (henceforth the Inquiry) into the education of gifted and talented students [68] found that NAPLAN was a common practice used by schools for identifying gifted students, with schools increasingly relying on data from NAPLAN results to identify "student potential" (p. 79).

Indeed, the Inquiry found that there were "no systematic practices in place to identify gifted students in Victorian schools" (p. 79), a finding that likely has parallels in other states and territories.

The then Victorian Association for Gifted and Talented Children (VAGTC) Vice President, Mr. Michael Bond, commented to the Inquiry [68] that "up to 60 per cent of students will answer some of the more difficult questions on NAPLAN, so clearly this assessment has not been set up as an identification tool, nor was it designed to be that type of tool" (p. 85, reference 321). The VAGTC also identified with "great concern that some schools exclusively use NAPLAN results to 'identify' students for extension programs" (p. 85), which was becoming an "increasingly significant problem" (p. 85), and arguably remains a significant issue. There is some evidence from the review of Australian school websites that what are often touted as school giftedness programs are in actuality programs for high achieving students, rather than programs for developing the talents of gifted students. This further problematizes conceptions of giftedness and talent at the school level.

Overall, the Victorian Inquiry [68] found that there was immense concern from many participants that schools placed a "heavy reliance" (p. 85) on NAPLAN results (as well as other achievement tests) to identify gifted students. This is particularly problematic because these tests provide little information about the characteristics of gifted and talented students, and they identify achievement rather than potential [68].

Preliminary results from a recent pilot study investigation of a random sample of schools across three educational jurisdictions (two states and one territory) showed most of the schools that detailed identification practices used NAPLAN results [66]. Less than half of schools sampled mentioned any identification practices at all, with little to no information about actual gifted identification practices being used. This suggests some potential for NAPLAN continuing to be used in these schools for identification purposes. For example, some school website content used nebulous terms, such as "objective measures" and/or "standardised assessments" to identify gifted students. This suggests that NAPLAN may potentially still be used in these schools [69]. While these results are not conclusive of the widespread use of NAPLAN results in gifted identification, they are suggestive of three main issues: (1) There is limited transparent and publicly accessible information about identification practices that schools are using. (2) Where identification practices were specified on school websites and in documentation on those sites, there was evidence of the widespread use of NAPLAN results for the identification of giftedness. (3) A significant proportion of schools did not specify any identification practices on their websites, or within annual reports or other documentation available on their websites. There is need for clarity and transparency about decisions being made with regards to identifying and supporting the educational needs of these students. Identification is not an end in and of itself, it is undertaken to provide students with more targeted learning experiences through differentiation and personalization [70].

6.3. Comprehensive Identification Practices and the Potential Role of NAPLAN

NAPLAN may have some use in identifying intellectual (academic) talent when used as a part of a comprehensive identification approach. Indeed, the Australian Capital Territory (ACT) was one educational jurisdiction that had clarity between assessments of giftedness (as potential), and assessments of talent (as achievement). At least in the ACT there is evidence to suggest a clear understanding of Gagné's differentiation between giftedness and talent. Achievement assessments that the ACT suggested for identifying talent were the Test of Reading Comprehension (TORCH) [71], and the Progressive Achievement Tests (PAT) [72]. The TORCH can be used to identify a student's level of reading comprehension, to measure their progress in reading, and to identify any skills needing further instruction; it is suitable for students in Grade 3 to Grade 10 [72]. This test can also be used to track a student's progress over time, and is a useful intra-individual test. PAT assessments consist of a suite of tests covering mathematics achievement (PAT-M), reading comprehension and word knowledge (PAT-R), writing, spelling, punctuation, and grammar (PAT-SPG) [72]. These tests can be used collectively or separately to assess individual student's knowledge and achievement in order to monitor intra-individual progress over time [72].

There may be some promise in the proposed transition to NAPLAN online testing, for using it as part of comprehensive assessments for identifying talent. For example, tailored online testing could allow for students to be tested on a range of texts, from short and simple to longer and more complex texts [26]. The more adaptive nature of these tests, which are reportedly tailored to an individual student's responses [26], may have the capacity to increase the test ceiling. Perhaps the transition to NAPLAN online testing will offer some avenue for use of NAPLAN as one tool (from a suite of many) for identifying academic talent (as exemplified by achievement). However, potential issues with adaptive test types for gifted and talented students can be that these students can answer easy test questions incorrectly, and harder, more challenging ones correctly (if given the opportunity to access harder questions on tests). The adaptive test may not necessarily adapt, if the system perceives a student is answering easy questions incorrectly, it will likely adapt to presenting easier ones, rather than harder ones. This will likely not give an accurate picture of where the student's actual achievement levels lie in terms of the test items because they were never presented with harder questions during the testing to demonstrate their ability.

Overall, the aforementioned issues mean that NAPLAN should not be used to identify giftedness, since giftedness is about potential, not achievement (using Gagné's definitions). So, why is it then that some schools are using NAPLAN results in this way? It is conceivable that schools are increasingly relying on NAPLAN data to identify gifted students because they do not have timely and appropriate access to much needed testing instruments, or to suitably qualified personnel to administer comprehensive assessments. Perhaps Australian schools do not have personnel who have time available and the capacity to undertake comprehensive identification practices. The answer may also lie in schools not being fully aware of the differences between Gagné's conceptualizations of giftedness and talent in terms of how this applies to gifted programs, talent programs, and programs aimed at intellectually high achieving students; this is potentially a problem related to initial teacher education, educator in-service training, and ongoing teacher professional development.

7. Limitations

There are a number of limitations to findings discussed in this article. These will be outlined in this section.

The first limitation is that evidence of the use of NAPLAN in Australian government schools has been collected from outward facing public websites, and as such, there are limitations to data that is available in terms of actual in-school practices, and whether these follow the ascribed processes detailed on these jurisdictional websites.

The second limitation is in respect to the evidence gathered from disparate contexts (i.e., from the Inquiry, and school websites), which means it is commonly evident (or implied) across Australian educational jurisdictions that the use of NAPLAN for identifying gifted students may be widespread. Furthermore, there is a lack of detailed readily-available data about identification practices, despite continued reports of school-level use of NAPLAN results to identify gifted students.

Nevertheless, there is some preliminary data suggesting that NAPLAN, as an identification instrument, is being used to identify giftedness, at least in some schools. This confirms the findings of the Victorian Inquiry into the education of gifted and talented students [65], that NAPLAN results may be customarily used in schools for identifying gifted students. What is not yet known are the specific numbers of schools that are engaging in this practice. Thus, future research is needed to gauge this.

8. Recommendations for Future Research

For future research, it is recommended that in-depth data be gathered about the actual school use of NAPLAN data in identifying talented students. To this end, there are several avenues for further research in terms of the role that NAPLAN may or may not play, as part of a comprehensive identification approach in the Australian context.

First, there is a need to interrogate the potential of NAPLAN to inform an intra-individual factor as part of comprehensive practices for identifying talent; that is, to understand better how the results for individual students could be tracked from Grade 3 to Grade 9 testing, and then how these may be applied to inform identification practices for these students. This could then inform talent development programming, specifically aimed at tailoring learning to individual student needs.

Second, NAPLAN online tailored testing may conceivably offer some prospects for seeking out talented students. Future research may focus on this potential higher ceiling test, and how useful it could potentially be for identifying academic talent. This would inevitably assist in addressing the learning needs of some of Australia's academically talented students so they are in a better position to fulfil their potential (whatever that may be).

Third, future research could review a sample of schools in different education jurisdictions across Australia to understand the extent to which, and how schools are using NAPLAN results for supporting talent development. This could inform an action agenda to provide a more specific evidence base for any future application of NAPLAN results for talent development.

9. Conclusions

The use of NAPLAN results by some Australian schools for identifying giftedness is particularly problematic. Furthermore, concern has been expressed about the substantial dependence schools currently place on achievement test results, such as NAPLAN, for identifying gifted students. Furthermore, the focus on acquired knowledge in NAPLAN testing may likely miss some gifted students, underachieving (talented) students, and potentially students from diverse cultural backgrounds, socio-economic backgrounds, and twice-exceptional students.

As suggested in Gagné's [3] conceptualization of intellectual giftedness, evidence of actual achievement through using achievement tests, will be limited (or may be non-existent) because giftedness is not evidenced through achievement, but rather through potential [3]. It is apparent that gifted and talented identification practices need to be aligned with individual education jurisdiction and school definitions, conceptualizations, and practices of gifted and talented education, rather than confounding giftedness and talent as achievement. There is nothing inherently wrong with the intentions of the NAPLAN test, or standardised testing per se; it is definitely needed. Indeed, NAPLAN may be appropriate as part of a holistic comprehensive talent identification process, but emphasis should not be placed on the test results to identify giftedness (or even talent for that matter). The main problems lie in the way the data are being used, and misused, especially for identifying giftedness. Ultimately, as an achievement test, NAPLAN could only identify achievement in the restricted areas it assesses, rather than giftedness as potential.

In summary, NAPLAN assessments are not designed to be a gifted or talented identification tool, nor are they designed to be an admission test for schools, gifted programs, or extension programs. When used in isolation, or not as intended (i.e., as an identification tool for giftedness), NAPLAN results cannot provide a comprehensive view of a student's learning or potential. NAPLAN should definitely not be used as a primary gifted identification instrument; it clearly is not an identification tool for finding gifted students. What NAPLAN results can potentially contribute is another piece to the jigsaw puzzle in relation to a student's academic achievements and competencies as talent.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Data sharing is not applicable. No new data were created or analyzed in this study. Data sharing is not applicable to this article.

Acknowledgments: The author would like to acknowledge the generous support of the Arts, Education and Law group at Griffith University, in the awarding of an Academic Equity Development Program in support of this article.

Conflicts of Interest: The author declares no conflict of interest.

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education sciences

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Article

Top Achievers in Mathematics in the End of Upper Secondary School

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Abstract: Important questions regarding mathematical giftedness are how and when it is possible to identify. To be identified as gifted, the student must have natural potential but also an appropriate mix of motivation, support, and challenges. This study is based on longitudinal data following students from 3rd grade in primary school to the end of upper secondary school between 2005 and 2015. We focus on top achievers (<2% of age cohort) of the national mathematics final exam at the end of upper secondary school. We investigate how accurately top achievers at the end of secondary school can be identified in 3rd, 6th, and 9th grades using national tests. We identify mathematical tasks that predict future top achievement and analyze how attitudes, gender, and parental background factors relate to high proficiency. Most top achievers had already been identified by 3rd grade and almost all of them by 9th grade. However, recognizing future top achievers was not very accurate, as they were indistinguishable from many students whose performance did not reach the same level over time. The best predictor for future top achievement was a student's ability to solve non-routine and atypical tasks in early school years.

Keywords: giftedness; longitudinal research; mathematics; top achievers

Citation: Niemi, L.; Metsämuuronen, J.; Hannula, M.S.; Laine, A. Top Achievers in Mathematics in the End of Upper Secondary School. *Educ. Sci.* **2023**, *13*, 775. https://doi.org/10.3390/educsci13080775

Academic Editors: Kirsi Tirri and Valerie Margrain

Received: 24 May 2023
Revised: 19 July 2023
Accepted: 26 July 2023
Published: 28 July 2023

1. Introduction

Giftedness is an elusive concept and in educational contexts it is often difficult to separate from high achievement [1–3]. Researchers debate the definition of giftedness and the contribution of innate abilities and the social environment in its formation [2,4]. To define and identify mathematical giftedness can be viewed as essentially the same problem, and there is a lack of systematic and consistent research about it [5]. In this study, we presume that success in mathematics is not based on specific innate abilities alone and that giftedness is not a static feature of a person. We see success in mathematics as *potential* in the same manner as Leikin [6]; this potential develops in the interaction of individual and social environmental factors in accordance with the socio-cognitive theory (see [7]).

Although the definition of giftedness is debated and the identification of giftedness is difficult, we examine top-achieving students with an assumption that most of them would be considered gifted in mathematics. Our aim is to investigate at which stage of basic education top achievers in mathematics can be identified and whether there are any predictive factors that could be identified and used to support the development of children's mathematical potential.

The study is based on the longitudinal data collected by the Finnish National Agency for Education (FNAE) and the Finnish Education Evaluation Centre (FINEEC). The data consist of students who were followed from 3rd grade of primary school to the end of upper secondary school between 2005 and 2015. The data were collected for the needs of national evaluations, and several reports have been made about mathematics national learning outcomes [8–11].

Top-achieving students were identified based on the matriculation examination of advanced mathematics. It is one of the final exams that are held twice a year simultaneously in all general upper secondary schools. In the Finnish context, there are no other official final exams. The Finnish education system consists of early childhood education, pre-primary education, basic education (grades 1–9), upper secondary education, and higher education (for more details, see [12]). After 9th grade, students apply for vocational upper secondary school or general upper secondary school. From general upper secondary school, they usually apply for higher education. In general, in upper secondary school, a student chooses whether to study mathematics via an intermediate or advanced syllabus. In addition, at the end of general upper secondary school, the student decides whether they will participate in the matriculation examination of mathematics. Our target group of this study is the most successful students in the matriculation examination of advanced mathematics.

In Finland, research of mathematically gifted students has been limited. Niemi and colleagues [13–15] examined high-achieving 9th graders from the same longitudinal data without the data of matriculation examination. In [13], they investigated how high achievers' mathematical competence developed during basic education and what kinds of factors predicted a student's development into a high-achieving student. In [14], they examined high achievers' choices when transitioning to upper secondary school and how their mathematical competence developed there. In [15], the focus was on high achievers' attitudes toward mathematics and how they developed from primary education to the end of upper secondary school.

In this article, we examine the top achievers in mathematics at the end of secondary education, with the aim of investigating when and how these students could be identified years earlier. More specifically, we examine what kinds of mathematical tasks are best for identifying future high performers and what other individual and social factors predict future achievement.

2. Mathematically Gifted Students

Mathematical giftedness is an ambiguous concept, and there is no consensus regarding its definition. A student who does well in mathematics is not necessarily gifted; on the other hand, a mathematically gifted student does not necessarily achieve high results in mathematics [16,17]. Mathematical giftedness generally refers to a high ability in mathematics, and the concepts of giftedness, high ability, and high achievement are often used interchangeably [3]. It is relevant whether high mathematical skills are seen as innate and immutable or as skills that can be developed. Students who believe that their mathematical skills are completely innate (fixed mindset) succeed less well than average students who are aware that they can develop their skills (growth mindset) [18].

Genetic qualities are seen as the basis for giftedness development. Yet, genetic readiness is not a sufficient premise for giftedness. In addition, persistent training is needed, among other things [19,20]. Krutetskii [21] sees mathematical giftedness as consisting of an individual collection of mathematical skills that enable success in mathematics, but at the same time, the student's internal motivation and the teacher's role in arousing interest are key factors in the development of mathematical competence. For example, Mönks and Katzko [22] agree that the social environment and motivation are central in the development of giftedness. Krutetskii [21] sees that mathematical skills can be developed but that developing into a top mathematician requires certain genetic characteristics that are related to the structure and function of the brain, among other things. According to a more recent view, mathematical giftedness is a combination of mathematical expertise and creativity [6]. Mathematically gifted individuals are characterized by the ability to do multifaceted problem solving, which is accompanied by flexible mathematical thinking. In addition, the cognitive factors of mathematically gifted individuals, such as the use of working memory or the orientation of attention, are exceptional [3,6].

Alternative concepts have been presented alongside mathematical giftedness. Mathematical *potential* [5] is a concept that reflects the dynamic perspective of mathematical skills. Leikin [5] sees that mathematical potential can develop into mathematical talent if an individual with mathematical potential is offered challenging learning opportunities that match their individual abilities, personality, and affective characteristics. The U.S. National Council of Teachers of Mathematics (NCTM) developed the concept of mathematical *promise*, which also emphasizes the influence of circumstances on the development of competence [23]. The NCTM defines mathematical promise as consisting of four interacting components: ability, motivation, beliefs, and experiences/opportunities. All of these should be developed for the student to achieve their highest possible mathematical performance [23].

It is problematic to distinguish high performance from giftedness. Students who clearly do better than average in their studies are usually defined as gifted. An above-average performance on a single school mathematics test is not sufficiently reliable for identifying mathematically gifted students. We can identify excellent performance in school mathematics and talk about *high-achieving* students [24], but at the same time, we cannot recognize all students who, for example, underachieve on a specific test. Conventional mathematics tests do not recognize the diversity of high-achieving students and giftedness, because they often focus on measuring basic skills. For example, in Australia and New Zealand, mathematically gifted students have been identified by selecting those ranked at or above the 90th percentile on a mathematics multiple-choice test, the Progressive Achievement Test (PAT). The PAT has been found to have an accuracy of 78% in identifying gifted students [25]. Another common method used in gifted program identification is that the teacher nominates potentially gifted students for further testing, referred to as the nomination stage. However, studies have shown, e.g., [26], that the nomination stage can result in a false negative rate that easily exceeds 60%.

We need tools to distinguish exceptionally talented students from others, cl. [27]. In addition to high mathematical competence, to distinguish the gifted students from other well-achieving students, we need to detect more specific characteristics of the students. These characteristics may include the ability to apply mathematical thinking in novel situations. A distinction can be made between creative mathematical competence and competence of school mathematics [28]. Students with high competence in school mathematics have the potential to produce new results and achievements that also have social value. Mathematically gifted individuals are seen as capable of high-level problem solving and inductive thinking. They have a high ability for logical reasoning, high confidence in their own abilities, and internal motivation for mathematics [29,30]. Mathematically gifted students are often identified by their ability to solve complex problems and their ability to think mathematically well beyond that of their age group [31].

In the USA, the Scholastic Aptitude Test (SAT) has been used to identify participants aged 12–13 in the Study of Mathematically Precocious Youth (SMPY). The aim of the SMPY is to identify talented children and support the development of their exceptional skills [27,32,33]. One part of the SAT is the measurement of mathematical skills (SAT-M). Originally, the SAT was designed to measure students' readiness for university studies. For the purpose of the SMPY, the test measures skills such as algebra and geometry, which children have not yet been taught at this stage. Several children have been found to exceed the entrance requirements of many top universities [27]. Prior to the SAT, almost all students were required to earn scores within the top 3% on a conventional achievement test, and the final selection criteria has varied from a top-0.01% to a top-3% criterion [27].

Students who are successful in mathematics have been found to solve non-routine tasks better than others [34]. For routine tasks the student already has a familiar strategy to solve the task, but solving non-routine tasks requires a flexible use of strategies and demands creativity and originality to create new types of solution methods [34–36]. Abstract conceptualization has been found to be a significant predictor of success in mathematics, regardless of the type of task [37].

Among topics of mathematics content, knowledge of fractions and whole-number division in elementary school have been found to predict better algebra-related knowledge and mathematics achievements in high school [38]. In Finland, high achievement on the 9th-grade national testing of learning outcomes and high skills in geometry on the 6th-grade test predict high achievement in the upper secondary level [15]. The high-achieving 9th-grade students in mathematics have been found to perform clearly better than their age group in tasks related to plane geometry, the perimeter of a parallelogram, and the shape of a function, as well as tasks where an easy equation solution requires justification [39] (p. 49).

The reason to identify mathematically gifted students and support the development of their potential is that they have exceptional opportunities to contribute to society. Longitudinal studies conducted by the SMPY demonstrate that gifted individuals have reached leadership positions, and many of them are outstanding creators [27,40,41]. The SMPY is a significant longitudinal study, but it has been conducted within the unique context of the American education system. In other countries there has been much less longitudinal research regarding the identification and development of mathematically gifted students. In the SMPY, the identified individuals have been followed forward. However, there is a need for research that also looks backward, aiming to identify whether gifted students could have been predicted earlier. It is also important to investigate what kind of tasks would be suitable for identifying individuals in the context of a different educational system and to explore the effort of individual and environmental factors as well. Finland forms an interestingly different educational system for examining the development of giftedness, as there is hardly any streaming of students according to their achievement until grade 10 and variation of student achievement between schools is low.

3. Individual and Environmental Factors behind Mathematical Competence

According to Bandura's socio-cognitive model [7], mathematical skills develop in the interaction of individual and environmental factors. This study focuses on examining some central background factors and aims to find the factors that predict mathematical talent. Individual factors determine mathematical competence, but environmental factors are relevant for the manifestation and development of the competence.

3.1. Individual Factors

Individual factors include, for example, the individual's previous math skills, attitudes toward mathematics, and gender. A student's previous math skills in elementary school have been found to be a significant predictor for whether the student is among high-achieving students in 9th grade [13]. Strong mathematical skills in basic education predict that the student will do well in mathematics also at the upper secondary level [14,35].

Several studies have shown that there is a positive correlation between mathematical competence and math-related attitudes [7,42–45]. The relationship between attitudes and competence has been studied especially from the perspective of self-beliefs such as self-concept, self-efficacy, and self-confidence. Mathematical self-concept, that is, individuals' concept of their mathematical skills, has been found to explain proficiency better than other attitudes, as it controls individual behavior and choices [7,46]. Several studies, e.g., [47–49], have shown that those who trust their own abilities are the most successful in studies of mathematics. In the PISA 2012 study, mathematical self-concept and performance confidence have been found to be the strongest explanations for mathematical competence in Finland [50]. According to the international comparative analysis based on the PISA data [51], the effect of mathematical self-efficacy on competence is relatively small in Finland compared to other countries. On the other hand, the effect of mathematical competence on self-efficacy is one of the largest in Finland. According to the national longitudinal analysis, mathematical competence in elementary school affects mathematical attitudes in higher grade levels [52,53]. The better a student's competence is in 9th grade, the more positive their perception of mathematics as a school subject and the more likely they are to choose studies in general upper secondary school and advanced mathematics [10]. The connection between competence and attitudes becomes stronger with age when perceptions become more realistic [42].

Although the gender differences in mathematics have narrowed, girls generally apply for university places and jobs in the field of mathematics less often than boys, both internationally, e.g., [54,55], and in Finland [56]. In addition, boys are overrepresented among the best achievers in mathematics, e.g., [24,57,58]. In Finland, the proportion of boys among the best achievers in mathematics is slightly higher than the proportion of girls [59]. In general, there is more variation in skills among boys than girls [60,61]. According to a meta-analysis by O'Dea and co-researchers [61], the greater variation among boys has remained the same over the past 80 years, and it is especially visible in mathematics and science subjects. For such a variability hypothesis, it has been suggested that a partial explanation can be found in heredity [62]. An alternative explanation for the smaller proportion of girls among the best math performers is that girls are giving up mathematics [63] to focus on and invest in other subjects. This can be seen very early on [64].

Mathematics is associated with strong gendered stereotypes that determine girls' and boys' perceptions of themselves as math learners from an early age. Already at the beginning of school, girls estimate that they are weaker than boys in mathematics, even though there is no difference in the mathematical skills between girls and boys [65,66]. According to Oppermann and co-researchers [67], gender affects the desire to study mathematics already in 2nd and 3rd grade. Girls' perceptions of their own mathematical competence deteriorate more strongly than boys' as the school years progress and the gap between genders increases [10,52,66]. Gender differences in self-confidence were larger in Finland than in many other PISA countries [51]. Girls' weaker self-confidence can be seen, for example, in the choice between intermediate and advanced math in upper secondary school and STEM choices [68,69]. In addition, in the end of upper secondary school, female students experience more negative emotional states than male students at every proficiency level [11]. On the other hand, Niemi [24] showed that the high-achieving girls' attitudes developed in different ways than girls' attitudes in the average. In the study, high-achieving girls' attitudes developed in the upper level of comprehensive school and in upper secondary school to a higher level than high-achieving boys' attitudes. In elementary school, high-achieving girls might not have received as much support with their attitudes and motivation as boys, which could explain their less positive attitudes at an early stage [24].

3.2. Environmental Factors

Environmental factors include, among others, parents' socioeconomic status and learning environment. In this study, we focus on students' parental background, which includes information on whether the parents have completed a matriculation examination and students' perceptions of parental support for studying mathematics. Several studies have shown that the students' parental background and socioeconomic status strongly explain students' mathematical competence, e.g., [70,71]. According to the study based on PISA data, the connection between socioeconomic background and the learning outcomes of Finnish students has strengthened in recent years [60,72,73]. However, there is reason to approach the inequality of learning outcomes with caution. There is considerable measurement error in the PISA data regarding parents' education [39] (p. 29), [74]. This is related to the response bias of the parents' education level when the information is collected from the students and researchers ignoring the documented increase in the education level of Finns [74]. In addition, recent measurement of socioeconomic background has become more precise [39].

Variables measuring socioeconomic background are considered to be stronger explanations of variation in learning outcomes than the student's gender [75]. The latest TIMSS and PIRLS studies show that the starting level of 4th graders is related to socioeconomic background, and basic education can only partially equalize these differences [75]. However, the connection between socioeconomic background and learning outcomes is weaker when the student's cognitive skills or previous skills are considered [76,77].

Socioeconomic status is defined in different ways in different contexts, and there is no generally accepted way of measuring socioeconomic status [78,79]. The definition is mostly based on the parents' income, education, and information about their profession, i.e., social and economic status. In the PISA studies, socioeconomic status is defined with the ESCS index, which includes cultural status in addition to social and economic dimensions. Parents' education is considered one of the key components of socioeconomic status and has been used in national evaluations of learning outcomes as a simple indicator of socioeconomic status. In Finland, parents' completed matriculation examination has clearly explained differences in competence in different national studies, e.g., [8–11,80,81]. Parents' education seems to play a key role in the development of mathematical competence from 3rd grade up to the upper secondary level [9,10].

In addition to socioeconomic background, studies have shown that the importance of parents' support for learning is central, e.g., [10,82,83]. The support, attitudes, and influences given by parents are reflected in the child. If the parents give the child support and are interested in the child's schooling, the child will do better in school, e.g., [82]. The connection of support to competence has been studied among the students of the upper secondary level on the national evaluation of mathematical competence [10]. According to the results, support significantly explains competence in both general upper secondary school and vocational upper secondary school. In general upper secondary school, the connection can be seen more strongly: The more the student felt they had support for their studies, the higher their competence was. The difference in competence between the extreme groups who received parental support corresponded to two years of studies. Educated and high-income parents invest especially in boys' education and guide them more strongly to go to general upper secondary school [83].

4. Research Questions

The aim of the study is to find out at which stage mathematical talent can be identified and what kinds of factors predict students' development into top achievers in mathematics. We explore how well the different methods identify top achievers. Such identification has two types of potential errors: false negative and false positive. A false negative is an outcome where the model does not identify all the top achievers. A false positive is an outcome where the model incorrectly predicts someone be a top achiever.

1. At which stage of basic education can the top achievers in mathematics be identified?

Hypothesis 1. *The majority of top achievers in mathematics can be distinguished from other students of advanced mathematics during elementary school. In 9th grade, the group is formed most clearly when the students have made the decision about whether they will apply to general upper secondary school or to a vocational education track and whether they intend to study intermediate or advanced mathematics if they go to general upper secondary school* [10,13].

2. What kinds of factors predict students' development into a top achiever in mathematics?
    - 2.1 What kinds of mathematical tasks predict development into a top achiever in mathematics?

    Hypothesis 2.1. *Mathematically talented students stand out in their ability to solve atypical and non-routine tasks for their age* [34,37]*. Mathematically talented students are characterized by the ability to solve multiple problems and have flexible mathematical thinking* [40].

    - 2.2 What background factors predict development into a top achiever in mathematics?

Hypothesis 2.2. *The majority of the top achievers are boys* [24,57,58,63]*. The best predictors are probably the parents' education, e.g.,* [70,71,75]*; parental support, e.g.,* [10,82]*; and the student's positive self-concept, e.g.,* [47–50].

5. Methodological Solutions

The data consist of two different types of data: the data of the national longitudinal evaluation of mathematical learning outcomes and the data of matriculation examination results of advanced mathematics at the end of upper secondary general education (grade 12). The national longitudinal data were collected by FNAE and FINEEC. The different datasets are sample-based and nationally representative. The data consist of the same students' mathematics test results, attitudes toward mathematics, and background factors that were collected in grade 3 (2005), grade 6 (2008), grade 9 (2012), and at the end of upper secondary school (grade 12) (2015). The results are mainly based on these longitudinal data.

Longitudinal data were supplemented by the students' grades on the matriculation examination of advanced mathematics in 2015. This study examines the students who were the most successful on the national matriculation examination of advanced mathematics.

5.1. The Data Set and Participants

The total sample of the national longitudinal data consists of 3896 students. From this total sample, we examined the students who attended general upper secondary school and passed the matriculation examination of advanced mathematics in the spring of 2015 (n = 490). The students who passed the matriculation examination of advanced mathematics were a selected group of students. Of those who completed their matriculation examination in the spring of 2015, 39% completed the exam of advanced mathematics.

The target group in this study was selected of the most successful students in the matriculation examination of advanced mathematics in the spring of 2015. They received the best grade ("laudatur") on the matriculation examination (n = 37). We call them top achievers in mathematics. The best grade was given to 7.4% of those who took the exam of advanced mathematics. That represents 2.9% of all matriculation graduates and 1.4% of the entire age cohort. Researchers [84–86] have defined that students who score in the top five percent of standardized academic tests are high achievers. Heller [87] has suggested that the best 6–10% of an age cohort are referred to as academically gifted, the best 3–5% as highly gifted, and the top 1–2% as extremely gifted. Applying similar criteria to our sample, students who received the highest grade on the matriculation examination of advanced mathematics were considered mathematically extremely gifted. The top achievers were a limited and selected group of mathematics-oriented and motivated students. Getting the highest grade requires problem-solving skills and skills in applying mathematical knowledge, which are seen as one part of mathematical giftedness. Additionally, it requires motivation to study mathematics and receiving appropriate support to develop mathematical skills.

The comparison groups in this study were the students who achieved the second-best grade ("eximia cum laude approbatur") on the matriculation examination of advanced mathematics (n = 109) (high achievers in mathematics) and other students who completed the matriculation examination of advanced mathematics (n = 344). The comparison is primarily focused on the top achievers and the others, but in order to gain a deeper understanding of the phenomenon, we also seek to uncover differences between top achievers and the high-achieving students.

5.2. Measurements

The national evaluation of learning outcomes in mathematics was based on the targeted learning outcomes, content areas, and criteria set in the curricula of basic education and upper secondary school in this study [88–90]. The national achievement tests of mathematics measured competence in three content areas in every grade: (1) numbers, calculations and algebra, (2) geometry, and (3) data processing, statistics, and probability. In addition, in the upper secondary level, algebra and functions were their own content areas. The tasks, assessment criteria, and scoring instructions for the tests have been drawn up by a group of experts. In addition, experts and pre-testing have been used to evaluate the quality of the task sets. The tests include three task sections: mental math (A), multiple-choice tasks and short answers (B), and tasks that require justification (C). In addition, the tasks are classified into different categories in terms of content area, difficulty level, and depth of knowledge required [91,92]. Because of the linking requirements in the national tests, the test items are not released. Hence, they cannot be published as such in this study. Table 1 shows the number of sections corresponding to the areas of mathematics, the maximum scores, and reliabilities in the tests given to different grades.

Table 1. The contents of mathematics in the tests given to different grades.

	Grade	Number of Items	Maximum Raw Score	Reliability (α)
Overall mathematical competence	3rd	38	44	0.86
	6th	39	52	0.85
	9th	68 [1]	84 [1]	0.94
	General upper secondary school	29	52	0.87
	Vocational upper secondary school	33	46	0.84
Numbers, calculations, and algebra	3rd	22	24	0.81
	6th	21	28	0.78
	9th	36	40	0.88
	General upper secondary school	3	3	0.27
	Vocational upper secondary school	3	3	0.26
Geometry	3rd	10	14	0.67
	6th	10	14	0.66
	9th	16	22	0.83
	General upper secondary school	7	14	0.73
	Vocational upper secondary school	7	14	0.65
Data processing, statistics, and probability	3rd	6	6	0.55
	6th	8	10	0.47
	9th	7	9	0.61
	General upper secondary school	2	2	0.34
	Vocational upper secondary school	5	5	0.56
Algebra	General upper secondary school	6	8	0.71
	Vocational upper secondary school	6	8	0.71
Functions	General upper secondary school	11	31	0.82
	Vocational upper secondary school	12	22	0.66

[1] Contains five tasks of functions.

In order to be able to compare the results of tests from different grades and different versions, the scores of the tests were compared, i.e., brought to a common standard by FINEEC. IRT modeling, based on Item Response Theory [93,94], was used in the comparison. In the data of this study, the test in 9th grade was chosen as the base level for comparison because it serves as the last common measurement point before the transition phase to secondary education (for details see [10] (pp. 213–214)).

The tasks of the matriculation exam of advanced mathematics are based on the curriculum of advanced mathematics of general upper secondary education [88,91] and their targeted learning outcomes and content areas. The curriculum of advanced mathematics includes 10 compulsory courses, but in practice, students taking advanced mathematics complete at least 12 courses. The minimum number of courses for the curriculum of intermediate mathematics is six courses. It has been observed that students who have completed more than 13 courses have a clear increase in their level of mathematical competence during their studies in general upper secondary school [11]. In addition, a varying number of elective courses is available depending on the school. The minimum number of all courses required to complete general upper secondary school is 75. The matriculation examination of advanced mathematics is one of the final exams that are held twice a year simultaneously in all general upper secondary schools. The exams are drawn by the Matriculation Examination Board (MEB), and the MEB assesses the tests of all students after a preliminary assessment by teachers. Because we had access only to the final grades, we were not able to calculate reliabilities on the task sections as we did with the national tests.

A shortened version of Fennema's and Sherman's [95] attitude scale adapted to national needs has been used in investigating students' attitudes toward mathematics [96]. The shortened version has three dimensions: liking mathematics, self-concept of mathematics, and experience of the usefulness of mathematics; each of them is measured by five statements. For 3rd grade, a shortened version of the standard scale was used, and the wording was modified to be more concrete. The aspect of finding the subject usefulness was not included for grade 3 because the questions were largely related to postgraduate studies and working life. Attitudes were investigated according to the dimensions shown in Table 2. The table also shows the number of sections corresponding to the dimensions, maximum scores, and reliabilities according to the different grades.

Table 2. The dimensions of the attitude measurements in different grades.

	Grade	Number of Items	Maximum Score	Reliability (α)
Overall attitude toward mathematics [1]	3rd	8	32	0.86
	6th	15	60	0.88
	9th	15	60	0.91
	General upper secondary school	15	60	0.92
	Vocational upper secondary school	15	60	0.91
Self-concept	3rd	4	16	0.79
	6th	5	20	0.82
	9th	5	20	0.88
	General upper secondary school	5	20	0.86
	Vocational upper secondary school	5	20	0.87
Liking mathematics	3rd	4	16	0.88
	6th	5	20	0.89
	9th	5	20	0.90
	General upper secondary school	5	20	0.92
	Vocational upper secondary school	5	20	0.91
Usefulness of mathematics	6th	5	20	0.81
	9th	5	20	0.53
	General upper secondary school	5	20	0.83
	Vocational upper secondary school	5	20	0.83

[1] Contains self-concept and liking mathematics in 3rd grade.

Information about students' background factors was collected by questionnaires in connection with the achievement tests. In this study, explanatory factors were examined from the perspective of individual and environmental factors. Individual factors included the data describing the student's test success (competence by tasks and overall), attitudes toward mathematics, and gender. Environmental factors were related to parental background, which included parental support for studying mathematics and information on whether the parents had completed a matriculation examination.

5.3. Statistical Analysis

We used logistic regression analysis with stepwise selection to find out which factors separated top achievers from other students of advanced mathematics [97–99]. Some of the explanatory variables were dichotomized (e.g., matriculation examination completed by parents, parental support). The significance of the factors in the model was tested with Wald's X^2 test. However, using the Wald test size involves the risk of rejecting variables because the Wald test size remains small as the standard error increases [98] (pp. 746–747), [100]. In this study, the risk of variable rejection remained small.

The effectiveness of the models produced by the regression analyses was described using Nagelkerke's measure [101]. It should be noted that Nagelkerke's R^2 value does not give an exact degree of explanation of the model like the square of the co-correlation coefficient in a linear regression model, but it gives a sufficiently reliable estimate of the proportion of the observation that the model is able to explain. The effect size was measured using the odds ratio. The value of the odds ratio $Exp(B)$ is a coefficient that indicates the risk level of belonging to the studied group when the explanatory variable increases by one unit. The odds ratio was used to describe how far two probabilities or relative proportions are, but the odds ratio does not directly describe the relationship between the probabilities [102].

When possible, we computed effect sizes using Cohen's d and Cohen's h values [103]. Cohen's d can be used as a measure of the effect size between two independent sample means, and it describes the standardized difference. Cohen's h can be used as a measure of the effect size between two proportions. It describes the arcsine-transformed difference. For a large effect, Cohen's values should exceed 0.80.

6. Results

First, we investigated the top achievers' mathematical competence in 3rd, 6th, and 9th grade. The aim was to find out at what stage the top achievers can be identified and how well we can identify them at an early stage. Second, we investigated the kinds of mathematical tasks in 3rd, 6th, and 9th grade that predict development into a top achiever in mathematics and how well it can be predicted. Third, we explored the connection between attitudes and high mathematical proficiency and the connection between gender and high mathematical proficiency. Finally, from the environmental factors, we investigated which kinds of parental backgrounds explain high mathematical skills.

6.1. Top Achievers' Mathematical Competence during Basic Education

The top achievers were partly identified from others in 3rd grade (Figure 1). The figure shows the percentages of each student group. We found that 54% of top achievers ranked in the decile describing the highest competence in 3rd grade. The rest of the top achievers ranked in deciles 6–9.

When we examined the distribution of the highest decile of 3rd graders more closely, it consisted of 14.8% top achievers (n = 20), 33.3% high achievers (n = 45), and 51.9% other students (n = 70). Hence, most of the students in the highest decile in 3rd grade were students who later completed the exam of advanced math but did not achieve the best grade.

Further analysis with logistic regression showed that the mathematical competence in 3rd grade explained 6.1% of the development into a top achiever on the exam of advanced math (Nagelkerke's R^2 = 0.061). The odds ratio of the effect was 3.46 (B = 1.24; $S.E.$ = 0.35; $p < 0.001$).

Sixth grade seemed to be a meaningful stage to identify top achievers; 73% of the top achievers were in the highest decile based on the 6th-grade test (Figure 2). The other top achievers were placed in deciles 6, 8, and 9. The high achievers and the other students succeeded quite well in 6th grade.

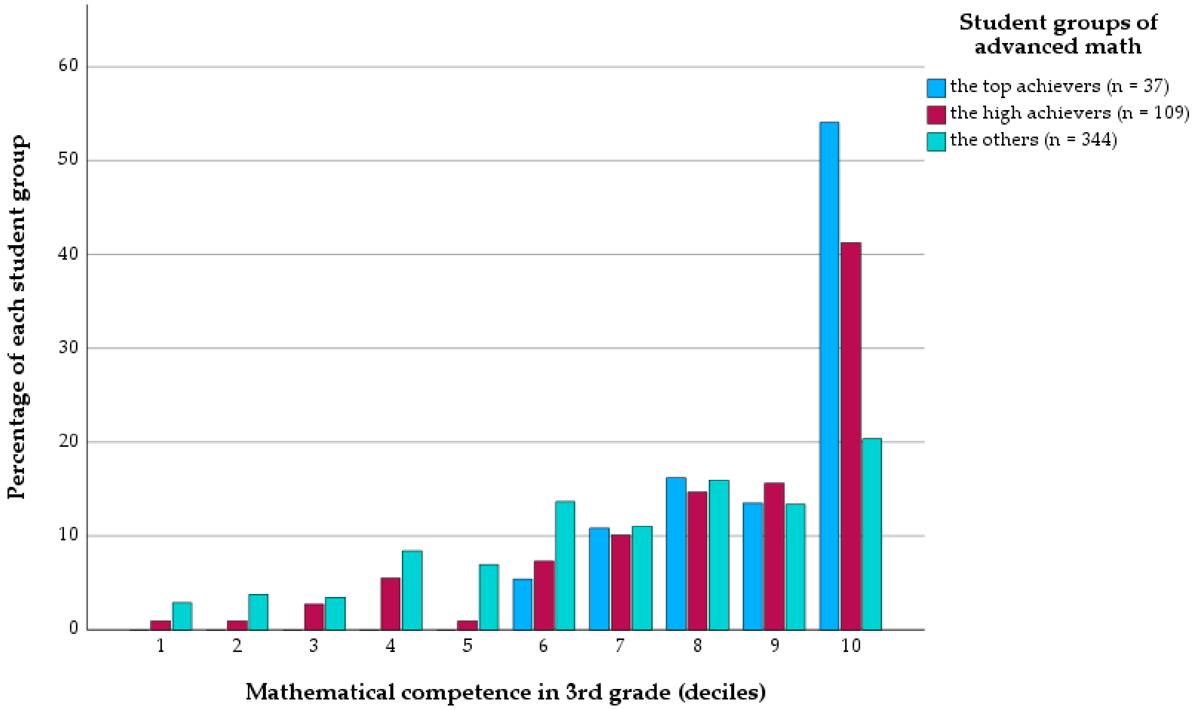

Figure 1. Mathematical competence in 3rd grade.

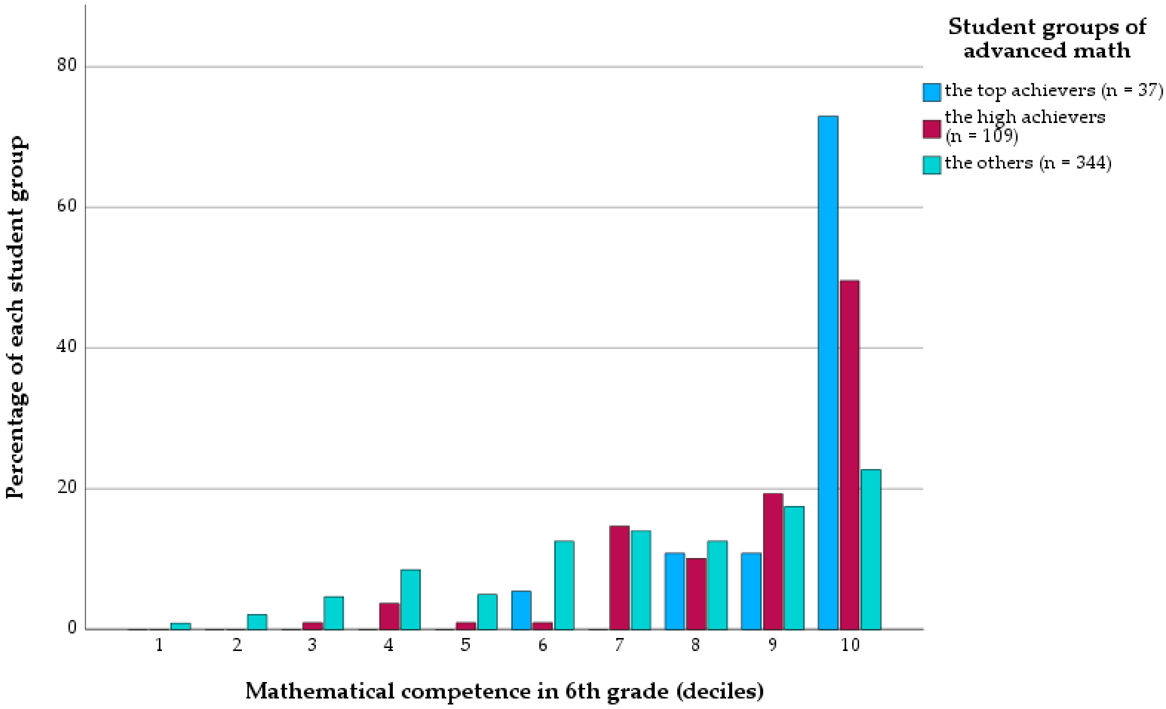

Figure 2. Mathematical competence in 6th grade.

When we examined the distribution of the highest decile more closely, it consisted of 17.0% top achievers (n = 27), 34.0% high achievers (n = 54), and 49.0% other students (n = 78). Hence, the highest decile was a mix of all students completing the advanced math exam, with only some achieving the best grade on the final exam.

Further analysis with logistic regression showed that the mathematical competence in 6th grade explained 13.3% of the better performance on the exam of advanced math (Nagelkerke's R^2 = 0.133). The odds ratio of the effect was 6.57 (B = 1.88; $S.E.$ = 0.38; $p < 0.001$). The odds ratio almost doubled from 3rd grade to 6th grade.

The top achievers were identified even more clearly in 9th grade (Figure 3). Of the top achievers, 86% ranked in the highest decile in 9th grade.

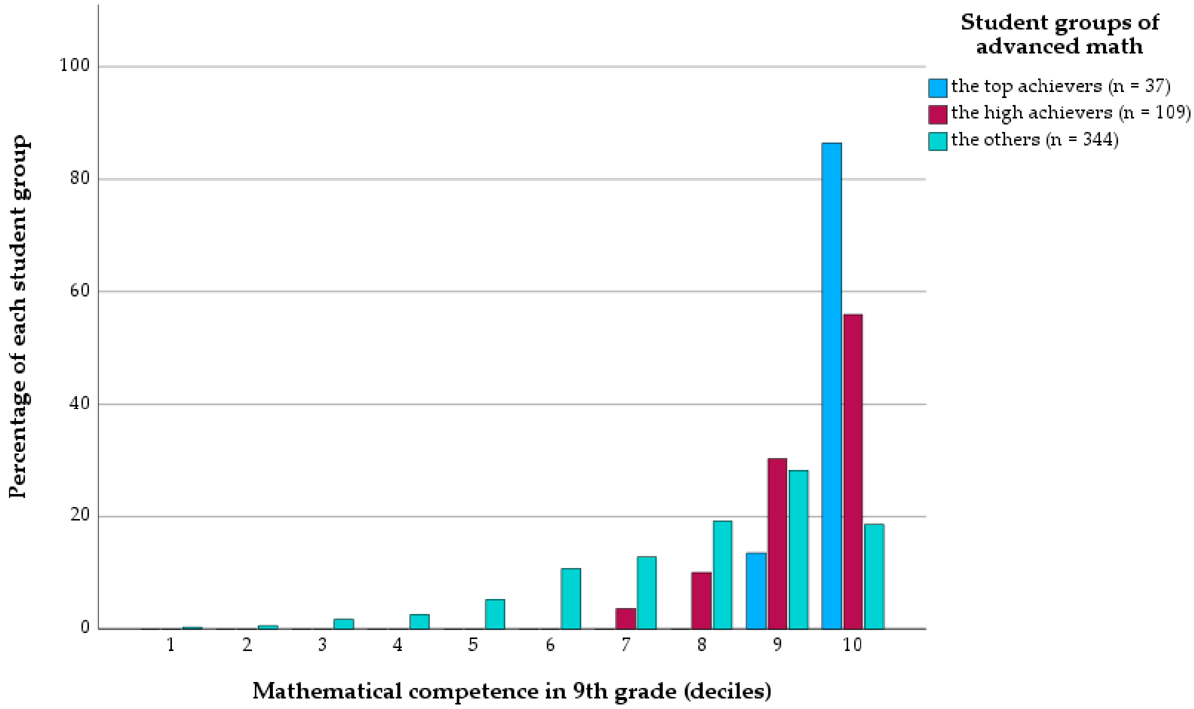

Figure 3. Mathematical competence in 9th grade.

When we examined the distribution of the highest decile of 9th grade more closely, it consisted of 20.4% top achievers (n = 32), 38.9% high achievers (n = 61), and 40.8% other students (n = 64). In the highest decile of the 9th-grade test, one-fifth were future top achievers, but this group included so many students that top achievers could not be identified as better than others based on the 9th-grade test. There were only four future top achievers in the highest decile, whose grade was higher than the highest of non-top achievers.

Further analysis with logistic regression showed that the mathematical competence in 9th grade explained 24.1% of the better performance on the exam of advanced math (Nagelkerke's R^2 = 0.241). The odds ratio of the effect was 16.79 (B = 2.82; $S.E.$ = 0.49; $p < 0.001$). The odds ratio almost tripled from 6th grade to 9th grade and was five times larger in 9th grade than in 3rd grade.

In summary, we can state that the top achievers were identified partly as a different group already in 3rd grade but recognizability improved by the end of 9th grade. Only five top achievers remained unidentified in 9th grade. However, it should be noted that the tests also identified students who did not achieve the best grade on the matriculation exam.

6.2. Tasks That Predict Future Achievement in Mathematics

Among the tasks of the national test of 3rd grade, the tasks presented in Table 3 best predicted development into a top achiever. The table shows the basic statistics for these tasks, including how large a proportion of top achievers, high achievers, and other students was able to solve the tasks. According to the model, the variables that best predicted higher future achievement were the tasks involving addition with crossing hundreds (Exp(B) = 4.98) and conceptual and abstract understanding of geometric concepts (Exp(B) = 4.73). These variables demonstrated quite strong statistical significances.

Table 3. Math tasks in 3rd grade that predicted high proficiency of advanced math.

Variable	***B***	***S.E.***	***Exp(B)***	***p***	***Percentage of Correct Answers (Top Achievers/High Achiever/Others)***
Addition task with crossing hundreds	1.61	0.76	4.98	0.034	93.5%/76.5%/79.0%
Conceptual and abstract understanding of geometric concepts: line segment and infinite	1.55	0.51	4.73	0.002	83.9%/55.1%/50.9%
Pre-algebra, missing number task (a · b = c +__)	1.32	0.51	3.72	0.010	83.9%/68.4%/49.5%
Conceptual and visual understanding of geometry	1.07	0.40	2.92	0.007	61.3%/45.9%/27.5%
Constant	−6.44	0.98	0.002	<0.001	

Nagelkerke's R^2 = 0.205.

The tasks can be seen as measuring algebra skills, mastery of mathematical concepts (e.g., line segment, edge, infinite), and visual understanding. The tasks required non-routine mathematical skills. Further analysis showed that the odds ratio between the *sum* variable consisting of these non- routine tasks in 3rd grade and the top achievement was 3.70 (B = 1.31; $S.E.$ = 0.25; $p < 0.001$).

Of the top achievers, 35.5% completed each of the above non-routine tasks correctly and the rest of them completed at least half correctly. Of the students who completed all of the non-routine tasks correctly, 25.0% were top achievers, 22.7% were high achievers, and 52.3% were other students.

Table 4 shows the kinds of tasks in 6th grade that best predicted development into a top achiever. According to the model, the variables that most accurately predicted higher future achievement were the tasks involving understanding of means (*Exp(B)* = 7.46) and understanding of complementary events in probability (*Exp(B)* = 7.46). The odds ratios for these variables were stronger compared to the tasks in 3rd grade. However, there was also greater uncertainty (*S.E.* = 1.03), which indicates a higher potential for false positives and false negatives.

In 3rd grade and in 6th grade, tasks were characterized by non-routineness and understanding of mathematical concepts. Further analysis showed that the odds ratio between the sum variable consisting of these non-routine tasks in 6th grade and the top achievement was 3.11 (B = 1.13; $S.E.$ = 0.22; $p < 0.001$). The explanatory power remained almost the same as in 3rd grade.

Almost half of the top achievers (48.6%) completed each of the above non-routine tasks correctly. Of all the students who completed all of the non-routine tasks correctly, 20.9% were top achievers, 36.0% were high achievers, and 43.0% were other students. The proportion of other students decreased by about 9 percentage points, and the proportion of high achievers increased by about 13 percentage points. The proportion of top achievers remained almost the same.

Table 5 shows the kinds of mathematical tasks in 9th grade that best predicted high proficiency in mathematics. The tasks in 9th grade exhibited the highest odds ratios, indicating a strong association with future higher achievement. At the same time, the statistical significances were relatively low. According to the model, these tasks demonstrated lower levels of uncertainty. Notably, the ability to solve the task involving the area of a trapezium presented almost a 12-fold increased likelihood of being among the future top achievers.

Table 4. Math tasks in 6th grade that predicted high proficiency of advanced math.

Variable	***B***	***S.E.***	***Exp*(*B*)**	***p***	***Percentage of Correct Answers (Top Achievers/High Achiever/Others)***
Understanding of mean, multiple choice	2.01	1.03	7.46	0.05	97.3%/84.4%/70.0%
Understanding of complementary event in probability, multiple choice	2.01	1.03	7.46	0.05	97.3%/80.7%/70.8%
Choosing the correct unit of measure	1.11	0.50	3.05	0.03	86.5%/71.6%/53.9%
Conceptual and visual understanding of geometry (same task as in the 3rd grade test)	1.09	0.55	2.97	0.05	89.2%/78.0%/62.5%
Quotative division task, mental math	0.76	0.38	2.13	0.05	67.6%/54.1%/32.7%
Constant	−8.21	1.51	0.00	<0.001	

Nagelkerke's R^2 = 0.208.

Table 5. Math tasks in 9th grade that predicted high proficiency of advanced math.

Variable	***B***	***S.E.***	***Exp*(*B*)**	***p***	***Percentage of Correct Answers (Top Achievers/High Achiever/Others)***
Area of trapezium	2.45	1.04	11.53	0.02	97.1%/76.4%/51.4%
Estimating and computing powers	2.12	0.75	8.32	0.01	94.1%/59.4%/53.8%
Problem solving with equations and multiple steps	2.03	0.48	7.63	<0.001	83.8%/41.3%/24.1%
Geometric task with volume (problem solving)	1.56	0.77	4.77	0.04	94.6%/78.0%/59.3%
Constant	−8.75	1.41	0.00	<0.001	

Nagelkerke's R^2 = 0.386.

The 9th-grade tasks represented the importance of problem solving and geometric skills. The tasks resembled non-routine tasks, as in 3rd and 6th grade. Further analysis showed that the odds ratio between the sum variable consisting of these 9th-grade non-routine tasks and the top achievement was 7.62 (B = 2.03; *S.E.* = 0.32; $p < 0.001$). The explanatory power was 2.5 times higher than in 3rd and 6th grade.

Of the top achievers, 73.5% completed each of the above non-routine tasks correctly. Of all the students who completed all of the non-routine tasks correctly, 36.2% were top achievers, 29.0% were high achievers, and 34.8% were other students. The proportion of top achievers and other students was almost the same.

In summary, it can be stated that non-routine tasks predicted future top achievement. The explanatory power was the highest in 9th grade, but not all of the top achievers could be primarily identified based on their ability to solve these tasks.

6.3. Attitudes That Predict Future Achievement in Mathematics

We did not find a statistical model of the attitudes of 3rd graders that could explain development into a top achiever in mathematics.

Among the attitudes of 6th graders, positive self-concept best predicted becoming a top achiever in mathematics (Table 6). The table shows top achievers', high achievers', and other students' mean levels of self-concept. According to the model, self-concept showed statistical significance; however, it did not effectively differentiate between achievers, as the odds ratios were low. The top achievers' perception of themselves was in line with almost the highest rating on the scale. The high achievers and the other students rated their self-concept at a high level.

Table 6. Attitudes toward mathematics in 6th grade (sum variables) that predicted high proficiency of advanced math.

Variable	*B*	*S.E.*	*Exp(B)*	*p*	*Mean of Attitude (1–5) (Top Achievers/High Achievers/Others)*
Self-concept	0.07	0.02	1.07	<0.001	4.6/4.3/4.1
Constant	−8.30	1.50	0.00	<0.001	

Nagelkerke's R^2 = 0.114.

Of all the attitude statements of the 6th graders, the statements presented in Table 7 best explained the development into a top achiever in mathematics. These individual statements showed moderate discriminability, particularly with the statement involving the perception of solving difficult math tasks (*Exp(B)* = 2.32). Although self-concept as a sum variable best predicted high proficiency in mathematics, among the attitude statements, the statement related to liking mathematics became one of the explanatory factors ("*Mathematics is one of my favorite subjects*."). The top achievers were more confident than others in their ability to solve difficult tasks and considered mathematics one of their favorite subjects more than others.

Table 7. Attitude statements in 6th grade that predicted high proficiency of advanced math.

Variable	*B*	*S.E.*	*Exp(B)*	*p*	*Mean of Attitude (1–5) (Top Achievers/High Achievers/Others)*
"*I can solve even difficult math tasks.*"	0.84	0.29	2.32	0.004	4.5/4.0/3.9
"*Math is one of my favorite subjects.*"	0.38	0.16	1.39	0.037	4.1/3.5/3.2
Constant	−7.29	1.31	0.001	<0.001	

Nagelkerke's R^2 = 0.112.

In 9th grade, a positive self-concept best explained a high proficiency in mathematics (Table 8). As in 6th grade, the self-concept showed statistical significance but did not effectively differentiate between achievers (*Exp(B)* = 1.03). The self-concept of all students who completed the exam of advanced math was at a high level. The gap between different groups decreased. High achievers' and other students' self-concept remained at the same level, but top achievers' self-concept decreased a bit.

Table 8. Attitudes towards mathematics in 9th grade (sum variables) that predicted high proficiency of advanced math.

Variable	*B*	*S.E.*	*Exp(B)*	*p*	*Mean of Attitude (1–5) (Top Achievers/High Achievers/Others)*
Self-concept	0.03	0.01	1.03	0.030	4.4/4.3/4.0
Constant	−4.88	1.12	0.01	<0.001	

Nagelkerke's R^2 = 0.029.

In the attitude statement of 9th grade, one statistically significant variable was found to distinguish the top achievers from others (Table 9). The top achievers identified themselves as good at mathematics. The odds ratio of that variable was the highest of all attitude statements in 6th and 9th grade. The difference was clearest between the top achievers and the other students.

Table 9. Attitude statements in 9th grade that predicted high proficiency of advanced math.

Variable	*B*	*S.E.*	*Exp(B)*	*p*	*Mean of Attitude (1–5) (Top Achievers/High Achievers/Others)*
"I think I am good at math."	0.98	0.33	2.66	0.003	4.7/4.5/4.1
Constant	−6.87	1.55	0.001	<0.001	

Nagelkerke's R^2 = 0.060.

In summary, we can state that the explanatory power of self-concept remained almost at the same level in 6th and 9th grade, and the effect on high proficiency was not very large. It is difficult to predict high proficiency in mathematics based on attitude levels because all the students who graduated with the exam of advanced math had a positive attitude toward mathematics.

6.4. Gender Differences among Top Achievers

A clear majority of top achievers of advanced math (73 percent) was boys (Figure 4). High-achieving students and other students had a more even gender distribution.

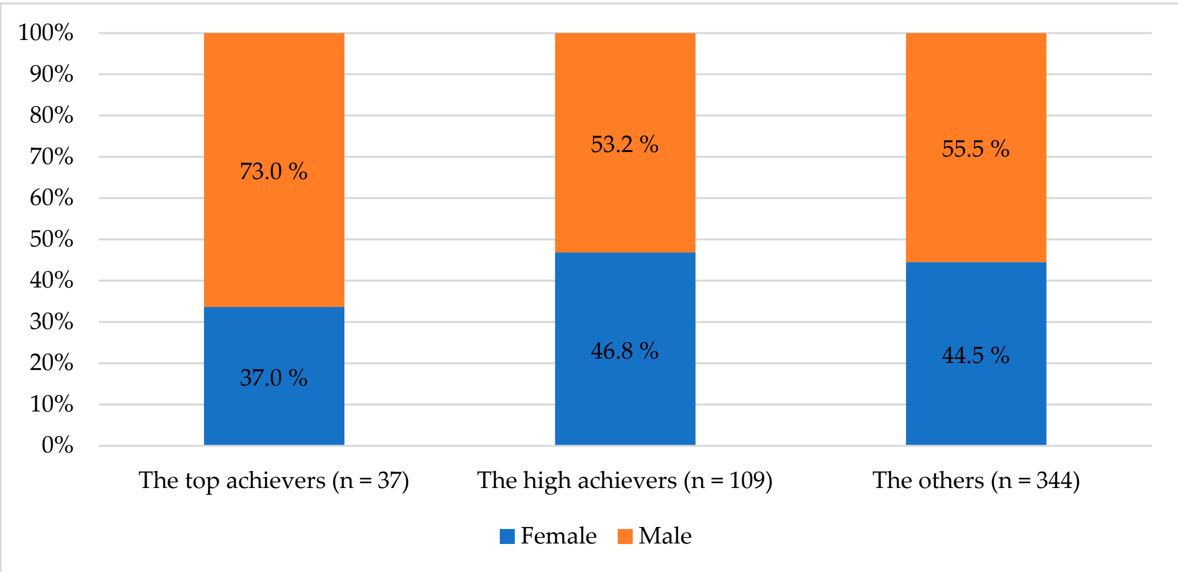

Figure 4. Gender distribution among students of advanced mathematics.

According to the binomial probability, the difference between top-achieving girls and top-achieving boys was statistically significant, and the effect size of the difference was large (*BIN* = 0.03; *Cohen's h* = 1.1).

Table 10 shows the proportion of boys and girls in the highest deciles in 3rd, 6th, and 9th grade.

Of top-achieving boys, 14.6% could be identified in 9th grade, and their proportion in the top decile increased by about 4 percentage points from 3rd grade. Of top-achieving girls, 5.7% could be identified in 9th grade, and their proportion in the top decile increased by 1.3 percentage points. Gender distribution was almost at the same level in all achiever groups.

Table 10. The proportion of top-achieving boys/girls, high-achieving boys/girls, and other boys/girls in the highest decile of 3rd, 6th, and 9th grade.

	Top-Achieving Boys/Girls	High-Achieving Boys/Girls	Other Boys/Girls
The highest decile in 3rd grade (n = 135)	10.4%/4.4%	21.5%/11.9%	31.1%/20.7%
The highest decile in 6th grade (n = 159)	12.6%/4.4%	21.4%/12.6%	34.0%/15.1%
The highest decile in 9th grade (n = 157)	14.6%/5.7%	24.2%/14.6%	27.4%/13.4%

6.5. Differences in Parents' Education and Support among Top Achievers

Both parents of about half of the top achievers and high achievers graduated with the matriculation examination (Figure 5).

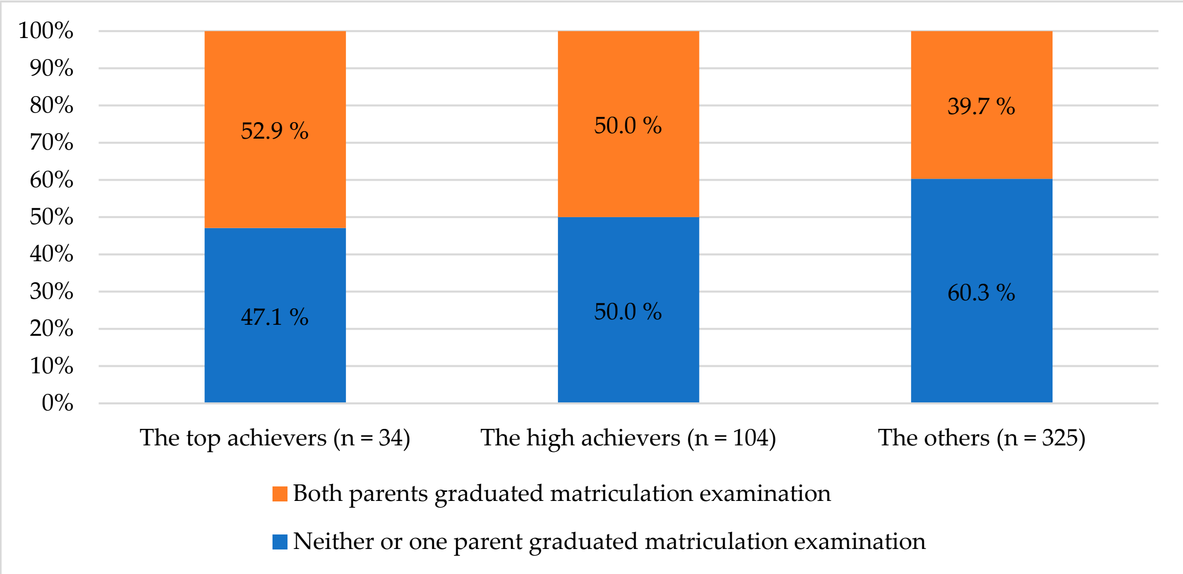

Figure 5. Distribution of parents' education among students of advanced mathematics.

Both parents of about 40% of other students graduated with the matriculation examination. Although the difference between the groups among other students seemed large, it was not statistically significant according to the binomial probability (*BIN* = 0.127; *Cohen's h* = 0.48). It should be considered that the expected value affected the result. According to that, 43% of other students' parents would have belonged to the group in which both parents graduated with the matriculation examination.

In relation to parental support, we did not find any statistical model to explain high proficiency in mathematics. In other words, the parental background of all students who completed the exam of advanced math seemed to be similar, and neither the parents' education nor parental support differentiated the competence among the students.

7. Discussion and Limitations

In this study, we investigated the development of top achievers' (< 2% of the age cohort) mathematical competence and at what stage in basic education they could be identified. In addition, we studied the kinds of mathematical tasks and individual and environmental factors that predicted development into a top achiever in mathematics. Next, we provide some implications and limitations of this study.

7.1. Implications of the Results

The results of this study have significant implications for understanding the development of top achievers in mathematics and their identification at different stages of basic education.

The top achievers were partly identifiable in 3rd grade from other students who graduated with the matriculation examination of advanced math. The ability to identify top achievers strengthened in 6th grade and was most clear in 9th grade, when students decided whether to apply to general upper secondary school and whether to choose an intermediate or advanced syllabus of mathematics. This confirmed previous research results, e.g., [10,13]. The mathematical content areas deepen and become more difficult when moving to a higher grade. It is easier to identify mathematical talent when comparing to one's own age cohort.

The results show that the ability to solve certain types of math tasks was a better predictor for identifying future top achievers. According to the results, top achievers did better in non-routine tasks than their age cohort on the national tests of 3rd, 6th, and 9th grade. These non-routine tasks required algebra skills, understanding of mathematical concepts, geometry skills, and problem-solving skills. This confirmed previous results that mathematically gifted students are characterized by the ability to solve an exceptionally diverse range of problems and have flexible mathematical thinking compared to their age cohort [29,31,34,37,40]. The predictive power of these non-routine tasks was highest in 9th grade. The ability to solve certain types of tasks yielded a good assessment of top achievers, but only 36% of those who solved all of the non-routine tasks in 9th grade were top achievers.

According to previous studies, e.g., [47–50], mathematical self-concept has a strong connection with mathematical skills. In this study, students' self-concept in 6th and 9th grade was related to high proficiency of mathematics, but the differences in self-concept between top achievers and others were not large. All students who graduated with the exam of advanced math had basically positive attitudes toward mathematics. The top achievers' perception of their ability to solve difficult tasks and their perception of themselves as being good at mathematics were stronger than others.

The proportion of boys among top achievers was higher than that of girls, and boys had more variation in their skills. The gender distribution was almost at the same level from 3rd to 9th grade, but boys were more likely to be identified than girls. We think that the higher proportion of boys is partially explained by some kind of selection. Girls give up studying mathematics and focus on and invest in other subjects instead of mathematics, cf. [63].

Referring to previous studies [10,70,71,75,82], we hypothesized that having parents who graduated with the matriculation examination and receiving greater parental support for studying predicted higher proficiency in mathematics. According to this study, whether the parents graduated with the matriculation examination or whether students had some parental support for studying did not have an effect on development into a top achiever in mathematics. However, we can consider that parents' education and parental support had effects on a student's decision to apply to general upper secondary school and to choose the syllabus of advanced mathematics.

Mathematical giftedness requires, among other things, the ability for flexible and abstract mathematical thinking and the ability to solve different kinds of mathematical problems. Mathematically gifted students can be identified, to a notable extent, as having higher mathematical skills and a higher ability to solve atypical and non-routine mathematical tasks compared to their age cohort. From this point of view, the matriculation examination of advanced mathematics is a good measure to identify mathematically gifted students with reliable accuracy. The proportion of those with the best grade from the exam of advanced mathematics was only 1–2% of the entire age cohort. Other researchers [84,85] have assumed that students who scored in the top 5% on academic tests were high achievers, and according to Heller [87], those scoring in the top 1–2% were extremely gifted.

7.2. Limitations

The study highlights that early identification of top achievers based on single tests is not highly accurate, and some top achievers may remain unrecognized. More than half of top achievers were in the highest decile in 3rd grade. The proportion of top achievers was 73% in 6th grade, and in 9th grade almost all top achievers were in the highest decile. The limitation suggests the need for additional assessment methods and comprehensive approaches to identify potential mathematical achievers at an early stage.

The highest decile in 9th grade included about 80% of high achievers and other students of advanced math, and the top achievers could not be identified to be better than others. We can believe that all students in the highest decile have potential, but not all of them are able to develop into top achievers. Only six percent of these students who graduated with the matriculation exam of advanced math achieved the best grade.

Identifying mathematical giftedness at an early stage is problematic, and a single test may not find all potential mathematical achievers, comp. [25]. For example, underachievement is possible for many different reasons. In addition, such a retrospective study is easily misleading. Mathematical potential can appear at an early stage, but some environmental factors are relevant for the development of the potential. Systematic studies of how we can actually predict mathematical skills would be beneficial. Important would be to control the interaction of many different individual and environmental factors. This complicates the designs notably.

Regarding the sample and methods, some limitations can be mentioned. It should be noted that the definition of top achievers is best suited to serve the Finnish education system with the matriculation examination system. It is a selected group that applies to general upper secondary school and chooses to study advanced mathematics, and the gifted individuals are those who achieve the best grade on the matriculation examination. The categorization data may result in some information loss, but on the other hand, the categorization data have enabled a different perspective and the use of analysis methods such as logistic regression analysis and the associated odds ratio. The study examined the predictability of different factors on future higher achievement. It should be noted that the phenomenon can also be explained by alternative models. It would be justified in future research to use several models, each including different or additive predictors compared these side by side, and to test whether adding individual factors increases the predictive power.

8. Conclusions

The results show that the ability to solve non-routine mathematical tasks in early years best predicted future high proficiency in mathematics. Then, a relevant question is whether it would even be possible to develop a diagnostic test that could be used accurately to identify mathematically gifted students in early grades. However, if we could identify potential students, we could offer them additional challenges, support, and encouragement to develop their potential. The test should consist of non-routine tasks that are atypical for the age level and measure things that have not yet been taught in school at that stage. Those tasks require conceptual understanding and problem-solving skills.

However, our results provide no justification for trying to identify top achievers from others in 3rd grade and separate them into special programs. The results show that it was also possible to become a top achiever from an average or lower level. Many other students had potential, scoring in the highest decile in 3rd, 6th, or 9th grade, yet did not achieve the best grade on the matriculation exam of advanced math. If students are separated into different groups by their skills, the mathematical potential of many students would remain easily unrecognized, and they would not have support to develop their potential. In addition, heterogeneous groups have been found to strengthen the self-concept of high-achieving students [24].

According to the results, the factors related to the student's parental background were not significant variables predicting high proficiency in mathematics. It was possible to develop into a top achiever regardless of only the parental factors. It is important to provide relevant challenges, support, and encouragement to develop mathematical potential.

Author Contributions: Conceptualization, L.N., J.M., M.S.H. and A.L.; methodology, L.N., J.M., M.S.H. and A.L.; validation, L.N. and J.M.; formal analysis, L.N. and J.M.; investigation, J.M.; data curation, J.M.; writing—original draft preparation, L.N.; writing—review and editing, L.N., J.M., M.S.H. and A.L.; visualization, L.N. All authors have read and agreed to the published version of the manuscript.

Funding: Open access funding provided by University of Helsinki.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Data were anonymized and pseudonymized by FINEEC. At the time of collecting the data, consent for reusing national achievement data was not needed from students.

Data Availability Statement: The data utilized for this research were provided by FINEEC. The data are not open source.

Conflicts of Interest: The authors declare no conflict of interest.

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Article

Adapted Education for Gifted Students in Norway: A Mixed Methods Study

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Abstract: In this article, we describe the mixed methods research (i.e., quantitative survey and qualitative interviews) we conducted to investigate adapted education for gifted students in Norway. The survey results showed that the teachers (n = 132) used differentiation strategies and agreed that gifted students need an adapted education that extends beyond the regular curriculum. We identified three themes related to adapted education based on an analysis of the student interview data (n = 17, aged 12–15) and four themes based on an analysis of the teachers' responses to the open-ended survey question regarding adapted education. We also investigated similarities and differences between teacher and student themes: both groups reported similar enrichment strategies applied within adapted education and similar barriers and systematic challenges to its facilitation.

Keywords: adapted education; mixed methods; teachers; students

1. Introduction

In Norway, interest in gifted students and the differentiation and adaptation of education for this student population is increasing [1]. The myth that gifted students can manage on their own is being debunked as educators increasingly recognize that gifted students need facilitation from teachers to develop their gifts properly [2–4]. When the guidance they need is absent, they are in danger of developing, for example, socioemotional difficulties, behavioral issues, negative relations with peers and teachers, and negative self-value [5].

In the literature concerning gifted and talented students, there seem to be almost as many different definitions of giftedness or gifted students as there are scholars [6]. In the study displayed in this article, we used the following definition: "Gifted students are students with a strong need and potential in academic subjects like mathematics, reading/writing/language, science, technology, social sciences, or creative/esthetic subjects and who can transform their potential to talent only if their needs are met in a rich and responding learning environment" [7].

In this article we look specifically at adapted education within the Norwegian context. Adapted education is regulated in the Education Act § 1–3, which states: "Education must be adapted to the abilities and aptitudes of the individual pupil, apprentice, candidate for certificate of practice and training candidate." Adapted education is understood as an overarching principle, which guides teachers and schools in Norway, and is not an individual right for each pupil or student.

Frantz and McClarty [8] demonstrated through their study of 38 Organization for Economic Co-operation and Development (OECD) countries that cultural characteristics contributed strongly to how each country managed gifted education. The policy approaches they identified were differentiated on a scale ranging from egalitarianism to meritocracy. The egalitarian doctrine involved three distinct approaches: (a) providing

Citation: Lenvik, A.; Jones, L.Ø.; Hesjedal, E. Adapted Education for Gifted Students in Norway: A Mixed Methods Study. *Educ. Sci.* **2023**, *13*, 774. https://doi.org/10.3390/educsci13080774

Academic Editors: Kirsi Tirri and Valerie Margrain

Received: 30 May 2023
Revised: 18 July 2023
Accepted: 20 July 2023
Published: 28 July 2023

differentiated or adapted education for all students, (b) including gifted education within special education, and (c) implementing inclusive strategies for underrepresented groups in gifted education [8]. Specialized gifted schools have been established as part of the public education system within the meritocracy doctrine. Seven countries, including Norway, Sweden, Denmark, and Finland, have not enacted any laws that address gifted education, have less knowledge about gifted students, and place less focus on this aspect of public education [1,8,9].

Despite the increasing attention that gifted education receives in Norway, teachers still have little information on how to facilitate strategies to adapt and differentiate education for gifted students [1]. The current mixed methods study considered both the teacher and the student perspective to investigate the differentiation and adaptation of education in primary and secondary schools for gifted students in Norway.

1.1. Differentiation and Adapted Education for Gifted Students

Education for gifted students can be adapted in many ways. Rasmussen and Lindgard [10] classified educational provisions for gifted students into three types: segregation, acceleration, and inclusion. Under segregation and acceleration provisions, gifted students are identified and taught in segregated or accelerated classes, which are separated from the ordinary classes. Other forms of acceleration include skipping grades, early entry into higher school levels, or personalized accelerated pacing of the curriculum [11].

Myths and negative connotations surround both acceleration and segregation. Segregation in the form of special classes and full time ability grouping can be considered elitist, and teachers and parents may view acceleration as harmful to the student's psychological well-being and social development [12–14]. A longitudinal study recently demonstrated that acceleration did not negatively affect the student's psychological well-being [12]. At the same time, acceleration has been shown to positively and significantly impact achievement. Moreover, gifted students have been shown to benefit from grouping within the class, grouping across grades in particular subjects, and unique grouping for the gifted population [14]. Students support the notion of acceleration for high-ability learners and believe it benefits the accelerated student, the teacher, and other students [13].

The substantial empirical support for acceleration and ability grouping has not necessarily translated into practice in education [11,15–17]. Nevertheless, teachers may have misconceptions about acceleration and ability grouping [12,14,16]. A study in Finland uncovered that teachers supported differentiated education for gifted students but held more negative views toward acceleration and ability grouping [18]. Since teachers may perceive acceleration and ability grouping negatively, enrichment strategies that can be implemented within heterogeneous ability groups must be considered.

Gifted students in homogenous age groups need inclusive provisions that involve differentiation and enrichment strategies [10,19,20]. Differentiation can involve utilizing advanced content from higher grade levels and higher-level questions from Bloom's taxonomy that require students to use critical thinking and problem-solving skills, develop different projects, and engage in problem-based learning [19–21].

A recent meta-analysis found that enrichment programs positively impact academic achievement and socioemotional development [22]. According to Gagné (who used the term "enrichment" in place of "differentiation"), best practices for enrichment programs include the enriched K–12 curriculum, systematic daily enrichment, full-time ability grouping, customized/accelerated pacing, personal excellence goals, highly selective access, and early interventions [23].

Teachers can enrich (i.e., differentiate) the curriculum via the four Ds: density, difficulty, depth, and diversity [23]. Density, the most crucial of these four, entails compacting or condensing the curriculum. Difficulty relates to enriching the assignments, depth is allowing the students to deep dive into topics, and diversity requires teachers to provide variation. Systematic daily enrichment requires teachers to challenge gifted learners each day. Full-time ability grouping (special classes or groups for gifted students) is a sensitive and controversial subject and is not allowed under Norwegian educational law [23,24]. Flexible grouping where gifted students are grouped together part-time is allowed according to the Education Act, as long as it is not the majority of the time. Customized acceleration or pacing demands that enrichment programs also heed student diversity. Gifted students are not a homogenous group, which obliges teachers to identify each gifted student's unique needs and predispositions. Personal excellence goals are set by either the gifted student or the teacher and may change when necessary. Highly selective access ensures that the enrichment program reaches the student group that will benefit most from it. Finally, early interventions are strategies implemented early in the gifted learners' educational journey, ideally as soon as teachers discover their giftedness [23].

1.2. The Norwegian Context

The educational approach in Norway is built to promote equity, inclusion, and adapted education [25]. Providing an equitable education involves ensuring that all students are met with appropriate challenges and that no students are excluded based on their preconditions. However, it does not require that every student receives the same education; on the contrary, equity requires differentiation and adaptation [25]. Adaptation in this context requires that the education is adjusted according to the students' individual needs.

Inclusive education in Norway has its roots, among others, in the Salamanca Statement by UNESCO in 1994, in which gifted students are among the various student groups specifically mentioned [26]. To ensure the provision of an inclusive education, schools and teachers must consider the diversity in the student group. The matter of inclusive education also raises essential questions that are addressed by different and sometimes opposing positions [27]. These questions ask who, as in which groups need inclusion or which are considered excluded, and how, as in how can we adjust pedagogical and organizational elements to provide an inclusive education. These questions also touch on the relationship between inclusion and special education, regarding which two strong, opposing positions exist: special education as a means to inclusive education and special education as incompatible with inclusive education [27].

Adapted education is one way to provide inclusive and equitable education for all. Adapted education is defined as variation and differentiation according to the needs and predispositions of each student. Norwegian educational law dictates that education be adapted to meet all students' needs and abilities [24] (§ 1–3). According to the Norwegian Directorate for Education and Training (NDET), adapted education is not an individual right of each student; instead, it is realized through variation and differentiation in instruction in line with the needs and predispositions of the entire student group [28].

Special education is regulated in § 5-1 in the Education Act, which states that all students who do not or cannot get a satisfactory yield from ordinary education shall receive special education [24]. However, the Act does not define a "satisfactory" yield; such determinations require an assessment based on the student's needs and available provisions. The NDET has established that gifted students already achieve a satisfactory yield; thus, they are not covered by special education [29].

Adapted education, as a principle, encompasses both ordinary and special education [25]. Teachers might adapt education through individual educational plans or by applying general principles for a good education and differentiating the instruction [30]. In this article, "adapted education" refers to the legal term based on § 1–3 in The Education Act [24]. In that sense, adapted education is not an individual legal right: it does not entitle all students to receive individualized education plans tailored to their specific needs. Instead, adapted education is a strategy implemented within the classroom to the extent the teacher can manage. Implementing adapted education is a lofty goal that schools should strive to achieve to the greatest degree possible [31].

Teachers report that they lack the necessary time and resources and are unsure of the space available to support differentiated instruction for students with special needs within ordinary education [25,32]. "Space" in this sense reflects all the necessary resources for differentiation, including physical space, time, staff, and digital and physical resources.

Gifted students are not considered to have special needs; however, they require differentiation. Pre-service teachers have described gifted students as diverse and have reported difficulties in developing and implementing differentiated teaching targeting this student group [33].

The Norwegian Official Report entitled "More to Gain–Better Learning for Students with High Learning Potential" [34] recognizes three main systematic issues that impact the education of gifted students. First, comprehensive education is not appropriately adapted to enable gifted students to realize their full learning potential. One of the reviewers for this article commented "how is this different from a satisfactory yield"? This is an interesting and important comment in relation to special education. According to NDET [29], gifted students have a satisfactory yield, even if they are not realizing their full learning potential. This distinction is an educational, ethical, and political discussion, which unfortunately is beyond the scope of this article. Secondly, the official report states that opportunities exist for implementing pedagogical and organizational differentiation that schools are not utilizing. Third, the national and local educational systems need to operate according to a joint knowledge base regarding measures to differentiate instruction for gifted students [34].

1.3. Current Study

This study investigated adaptation and facilitation for gifted students in Norway. We used a convergent mixed methods design to understand adapted education from both the teacher and student perspectives. The overarching research question guiding this research—How is education adapted for gifted students in Norway?—was supported by the following quantitative, qualitative, and mixed methods sub-questions:

Qualitative: How do gifted students experience adapted education?

Quantitative: How do teachers report that they facilitate education for gifted students? How do teachers report the use of differentiation, the available space for differentiation, and their school's prioritization of differentiation for gifted students?

Mixed: How does the thematic analysis of gifted students' experience of adapted education confirm or differ from the survey results regarding how teachers facilitate their students?

2. Materials and Methods

This research involved the analysis of data gathered for a study that followed a convergent mixed methods design [35]. Two sub-studies, one quantitative and one qualitative, are included in the study [36,37]. The design is not parallel because the studies were not conducted simultaneously. It has a sequential element, whereby results from the first quantitative phase influenced the development of the interview guide used in the qualitative phase. The research design is illustrated in Figure 1. Still, the research remains convergent, as the studies were primarily conducted separately, and the merging or mixing of the data happened in the integration phase. However, the combination of quantitative and qualitative data was not equal in this design, as the purely quantitative data were supplementary to the qualitative data driving the research. Hence, this study falls on the qualitative side of the mixed methods scale [38,39]. The study is explorative and descriptive, seeking to investigate adapted education from two perspectives. Including quantitative and qualitative data and the teacher and student perspective captures a broader view of adaptation in Norway's educational system. Combining the teacher and student perspectives allows us to examine this issue through different lenses. According to Creswell [35], utilizing different analysis units is efficient when comparing multiple perspectives.

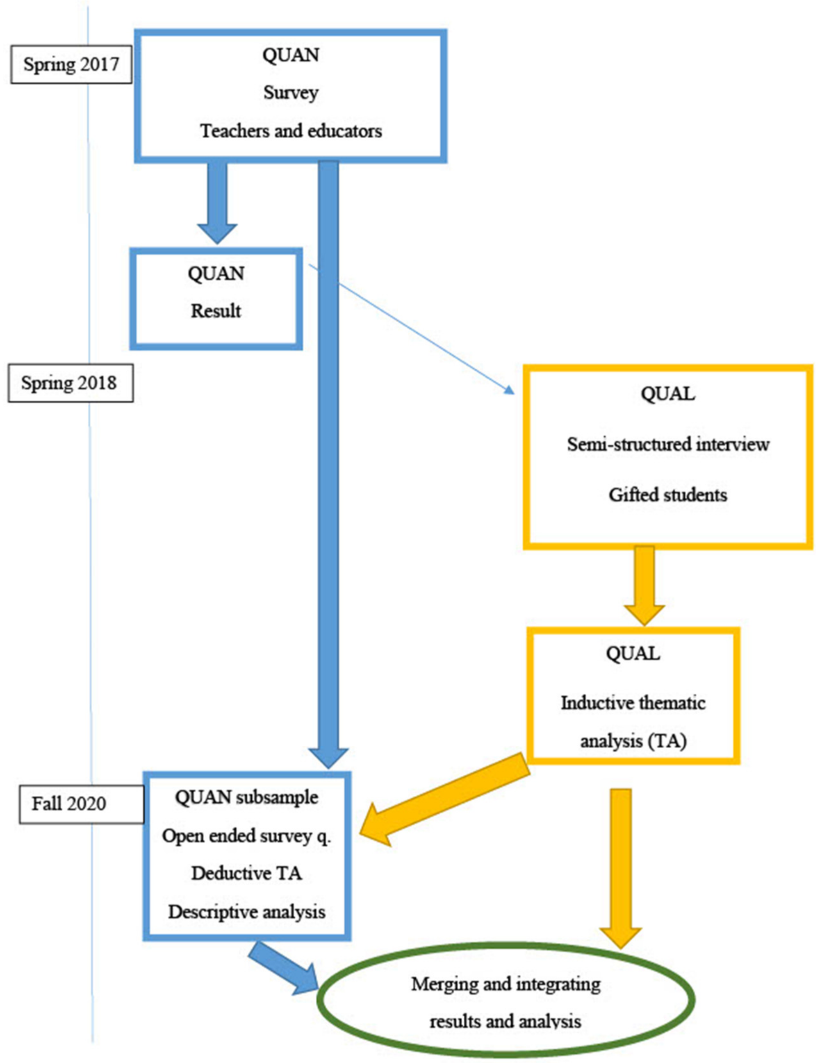

Figure 1. Timeline and illustration of data collection and analysis.

2.1. Quantitative Phase with Teachers

In the quantitative study, we collected data through a web-based survey of n = 339 teachers from Norway. We recruited the participants in two cycles. Initially, we intended to conduct a national survey; however, a low response rate from both schools and teachers in the first cycle challenged us to use other methods to recruit participants. The first sample included 144 participants from a national inquiry sent to all combined primary and secondary (1–10) schools in Norway (650 schools). The response rate from schools was approximately 5%, with a 20% teacher response rate. In the second cycle, we contacted different municipalities in Norway and received positive replies from one in Eastern Norway and one in Western Norway. The survey was sent to the head of the school district and further distributed to teachers. The eastern municipality added 18 participants, while the western municipality provided 177 participants from 15 schools. The response rate from the western municipality was 63%. Thus, the sample population is considered a convenience sample [40], so we cannot generalize the findings to all primary and secondary school Norwegian teachers.

For the current study, we analyzed a subsample of teachers from the original study who reported having a student with extraordinary learning potential in their classrooms at the time of the survey (n = 132). This decision was made to better compare the experiences between the teachers and students. If we include the teachers who did not have gifted students, they will answer more based on hypotheticals than on experience. This might give skewed results compared to the students' actual experiences with their education. We included in the survey a definition of "extraordinary learning potential," which is the term commonly used to refer to gifted students in Norway (this definition is given in the article's introduction). See Table 1 for background information and statistics on the study subsample. No significant differences were observed between the background statistics for the subsample and the same statistics for the survey's total sample.

Table 1. Descriptive background statistics of teachers.

	n	%
Total	132	100
Gender		
Female	97	73
Male	35	27
Education		
Bachelor (4 years)	47	36
Bachelor (4 + 1 year)	58	44
Master (5 years)	3	2
Master (5 + 1 year)	9	7
Another	15	11
Teaching level		
Primary school	80	61
Secondary school	35	27
Across all grades	17	13
Administration	1	1
Public school	117	89
Private school	15	11
School size		
<100 students	28	21
100–199 students	27	20
200–399 students	54	41
>400 students	21	16
Contact teacher		
Yes	87	66
No	45	34

Note: This sample is teachers who answered yes to the question "Do you currently have gifted students?" There are some missing answers as not all teachers answered all questions.

2.2. Instrument and Procedures

We administered a web-based survey through SurveyMonkey (www.surveymonkey.com, accessed on 25 January 2017) to gather the quantitative data. The survey consisted of 25 questions, including background questions and questions related to gifted students. The first author developed the survey with help from the second and third author as well as the statistician Ole Johan Eikeland. The questions were developed to give a descriptive overview of the situation regarding education for gifted students in Norway, and the questions were based on a literature review of gifted education in Norway [7,41–43]. This article focuses on the responses to five questions regarding differentiation (see Table 2) and to responses to an open-ended question about educational strategies used with gifted students (see Appendix A for a copy of the survey).

We performed a pilot test with 48 teachers who completed the survey and shared feedback on the questions and formulations. Based on that feedback, we made minor changes to the study; we did not include data on the informants from the pilot in the final survey calculations.

Table 2. Percent (frequency), M, and SD on questions regarding differentiation. $n = 132$.

	Totally Disagree (1) % (*n*)	Somewhat Disagree (2) % (*n*)	Neither Agrees nor Disagrees (3) % (*n*)	Somewhat Agree (4) % (*n*)	Totally Agree (5) % (*n*)	Mean	SD
Q 1 Possible to work with differentiated instruction	4.5 (6)	7.6 (10)	3.8 (5)	44.7 (59)	39.4 (52)	4.1	1.1
Q 2 Use differentiated instruction	1.5 (2)	3.8 (5)	3.0 (4)	54.5 (72)	37.1 (49)	4.2	0.8
Q 3 Gifted students need facilitation beyond ordinary education	3.0 (4)	5.3 (7)	0.8 (1)	42.4 (56)	48.5 (64)	4.3	1.3
Q 4 School allow space for adaption	9.8 (13)	25.0 (33)	18.9 (25)	30.3 (40)	15.9 (21)	3.2	1.3
Q 5 School prioritize adaption for gifted students	16.7 (22)	36.4 (48)	19.7 (26)	19.7 (26)	7.6 (10)	2.7	1.2

2.3. Qualitative Phase with Students

In addition to the quantitative survey, we performed individual, face-to-face, semi-structured interviews [44] with 17 gifted students in Norwegian secondary schools. For more information on this study see: [37]

2.4. Interview Guide

The main research question for the qualitative study was "How are Norwegian gifted secondary school students experiencing school?" This question guided the development of the semi-structured interview guide. The first author developed the interview guide with help from the second and third authors. The interview guide is explorative and seeks to investigate the experiences of gifted students in secondary school in Norway. The main topics addressed were experience and strategies in school, adapted education, family and friends, underachievement, social-emotional issues, and involvement in their education. The interview guide had 18 main questions with sub questions. The duration of the interviews was approximately one hour. The first author conducted all interviews. Before we collected the data, the first author conducted a pilot interview, which prompted some wording changes to the interview guide.

2.5. Recruitment and Selection Criteria for Informants

Participants in the qualitative study included 17 gifted students between 12 and 15 attending secondary school in Norway. Eleven participants were male, and six were female.

We pursued multiple avenues to recruit gifted students to participate, including connecting with Happy Children, a Norwegian parental network for parents with gifted kids, contacting a talent center in math and science, reaching out to all secondary schools in our municipality, and posting messages on social media. To participate, the student had to be nominated by a teacher or parent and score at the 95th percentile or above on one or more subscales in the WISC-IV (Weschler Intelligence Scale for Children, fourth edition): verbal comprehension (VC), perceptual reasoning (PR), working memory (WM), or processing speed (PS). The participants were gifted either in VC (exceptionally talented in language/reading/writing) or PR (talented in logical fluid reasoning and visual–spatial skills). The first author assessed 13 participants; the other four had previously been evaluated. Some had high scores in all domains, while others scored substantially higher on VC or PR.

2.6. Ethics

The Norwegian Centre for Research Data approved both studies presented in this article. All informants in the quantitative survey and all informants and parents involved in the qualitative study provided their informed written consent [45]. We informed the participants that they could withdraw from the studies anytime, even after completing the interviews or the survey. To preserve the participants' privacy, we removed all names and locations.

2.7. Analyses

This article presents the analyses from each of the two primary studies and responds to the central mixed research question that serves as the guiding force of this article: "How does the thematic analysis of gifted students' experience of adapted education confirm or differ from the survey results regarding how teachers facilitate their students?" To answer this question, we employed an inductive thematic analysis of gifted students' experiences as reported during their interviews; we then used the codes regarding facilitation and adaptation in the deductive thematic analysis of teachers' answers to the open-ended survey question: "What kind of facilitation would you as a teacher provide to students with extraordinary learning potential?" Because the students reported their actual school experiences, we decided to include those teachers who indicated that students with extraordinary learning potential were represented in their classes at the time of the study (132 teachers). The students reported on their recent experiences in secondary school and recalled experiences from primary school.

The analyses in this study reflect a combination of qualitative and quantitative approaches. We used inductive thematic analyses [46,47] in the qualitative study to examine the data from the student interviews, following the six steps listed by Braun and Clarke [47]: we familiarized ourselves with the material, generated initial codes, searched for themes, reviewed the themes, defined and named them, and produced the report. The qualitative student codes were then used deductively to analyze teachers' responses to the open-ended survey question on facilitating differentiation and adaptation (see the codebook, Appendix B). Using the student codes as our deductive framework, we searched for themes, defined them, and named them (see Table 3). We used NVivo 12 pro (QSR International), a computer-assisted qualitative data analysis software [46], for our analysis. During the thematic process we looked at the data and codes from students and teachers separately to generate themes from both sets. In this process, we moved back and forth from the codes to subthemes and overarching themes to generate the themes we agreed captured the essence in each set. This process is not neutral and is of course colored by our experience with the field and previous research. However, we have tried to stay as close to the material as possible.

We used descriptive statistics to answer the quantitative research question regarding teachers' self-reported use of differentiation. The respondents were asked five questions regarding differentiation and adaptation. Responses to these questions were indicated using a 5-point Likert scale, with answers ranging from "totally disagree" to "totally agree". We used IBM SPSS 25 for frequency analyses.

Both the survey and the interviews were conducted in Norwegian. Translation of quotes and codes to English have been performed to preserve the original meaning; however, as in all translations there might be some nuances and context that was lost in this process.

Table 3. Relationship between themes and subthemes.

Overarching Teacher Theme	Subtheme
Individually adapted education	Enrichment Acceleration less repetition challenges
Instructional practices	Varied instruction digital tools gifted groups student responsibility
The supporting teacher	Student-teacher conference guidance and support teacher competence
Systematic challenges	Large classes other students' needs not enough help from the administration difficulties grouping by level
Overarching student theme	Subtheme
Adapted education	Enrichment Acceleration Schoolwork
The teacher as a promoter or inhibitor	Competent teachers Teacher relation Overbearing teachers Understanding teachers
Barriers regarding facilitation	Classroom environment Grouping by level Boring assignments Primary school

2.8. Validity, Reliability, and Triangulation

To enhance the validity of the survey, we conducted a pilot test and included a definition of extraordinary learning potential (the term used regarding gifted students in Norway) to ensure that the teachers had comparable backgrounds when answering the survey. Intercoder reliability was addressed through first separate and then collective coding between all authors. All main codes and themes were discussed collectively.

In the qualitative interview study, we conducted a member check on the qualitative themes we developed. The students who participated in the member check agreed that the themes represented their experiences.

The mixed research question is the main form of triangulation. This research question allows us to compare the teachers' and students' perspectives on adapted education for gifted students. The datasets are compared for convergence, complementarity, and divergence. The coding framework from the student interview helps us compare the data, especially considering convergence and complementarity. However, it also distinguishes places where the data is divergent. A framework for deductive coding will, of course, be focusing the data; however, we are also using inductive coding for the data, which did not fit the deductive framework.

3. Results

3.1. Quantitative Findings–Teachers

We asked the teachers five questions regarding differentiation and adapted education to gain insights into the teachers' views on differentiated instruction for gifted students. Table 2 presents the results for each question.

A large majority (84%) of the teachers reported that they could utilize differentiated instruction in their classrooms, and 92% confirmed employing it in their teaching practices. Nine out of ten teachers agreed that gifted students need facilitation beyond ordinary education. Regarding the availability of space for adaptation, the teachers were more split: only 46% agreed with the claim that schools provide space for adaptation. Space reflects all the necessary resources for adapted education, not just physical space. The teachers were also divided in their perceptions of their schools' priority on adapted education for gifted students, with 53% indicating that their school does not prioritize these strategies.

Of the 132 teachers in the subsample, 108 responded to the open-ended survey question, "What kind of facilitation would you as a teacher give to students with extraordinary learning potential?" The responses, which were not restricted to a limited number of characters, ranged from short two-word replies to long answers containing 300–400 characters. All but two teachers referred to some form of facilitation. Some teachers described vivid and diverse forms of facilitation, while others only wrote "adapted education." We used the codes developed from the qualitative analysis of how gifted students experience adaption and facilitation as a deductive coding framework. In addition to the 26 student codes, we developed nine extra codes from the teachers' answers that did not fit the initial student codes. In the analysis, we found, on average, 1.9 codes in the teachers' answers, with a maximum of 5 codes and a minimum of 1. See the codebook (Appendix B) for all codes and example quotes. Some codes in the codebook are marked with 0; these are codes developed from the student interviews that we did not find in the teacher material.

3.2. Qualitative Findings–Students

In the interviews, the students mentioned both proper adaption and challenges with facilitation. Following the procedure for the inductive thematic analysis [47], we developed three themes related to facilitation: *adapted education, the teacher as a promoter or inhibitor,* and *barriers regarding facilitation*. See Table 3 for the relationships between themes and subthemes. The central phenomenon that emerged was that gifted students experienced adapted education through enrichment strategies; however, systematic barriers existed that sometimes hampered the implementation of these strategies, such as the lack of proper facilitation and teachers who do not differentiate the curriculum. The quotes we present are chosen because they display the essence of the theme. Each theme is established across the dataset.

The qualitative data analysis uncovered various strategies that teachers and students used to adapt gifted students' education classified under the theme *adapted education*. "You do not get anything out of doing the same assignments all the time; it's better to skip further on and to a higher level" (*student*). In the quote the student talks about the necessity of being able to move forward. The students also reported enrichment strategies, such as consulting web pages, completing additional assignments, working on projects that align with their interests, and making adjustments to enrich assignments themselves. In addition, they preferred assignments that developed reflective and logical thinking and projects involving art and design. Furthermore, the students mentioned acceleration in different subjects and accelerating by skipping grades.

Our analysis further revealed gifted students' experiences with distinct types of teachers: *the teacher as a promoter or as an inhibitor*. The informants stated that they enjoyed competent teachers who conveyed the different elements of their instruction to all students. "Teachers who are very flexible and know their subject well . . .can facilitate [learning] for all students" (*student*). According to the students, competent teachers who promote student learning establish good relationships with students and give them proper feedback. These teachers can adapt their instruction and facilitate learning for all students.

On the other hand, teachers who inhibit gifted students' learning do not adapt the curriculum, refuse to allow gifted students to skip ahead and do other work, and patronize the students. "They (gifted students) won't get the challenges they need and are stuck with the teacher holding them back . . .they (may) lose motivation for the subject" (*student*). The students perceive these teachers as not understanding what the gifted students can manage and holding them back.

Analysis of the data related to the last theme, *barriers regarding facilitation*, revealed various challenges. The informants viewed group work negatively because they typically get stuck doing the lion's share. In addition, instead of being assigned different and more challenging learning activities, the students reported being assigned extra work of the same caliber. Some students referred to a lack of communication between teachers and less adaptation in primary school. The students who had received subject acceleration also experienced organizational barriers and recalled often being placed in a room alone to work. The students indicated a desire for more freedom to choose an accelerated education with less repetition, more variation, and grouping by levels. They perceived the education they were receiving at the time of the study to lack these types of facilitation strategies.

3.3. Qualitative Findings–Teachers

We used the codes from the inductive thematic analysis [47] from the qualitative study in a deductive thematic analysis of the teachers' answers to the open-ended question, "What kind of facilitation would you as a teacher give to students with extraordinary learning potential?" In the deductive analysis, we developed four themes: *individually adapted education*, *instructional practices*, *the supporting teacher, and systematic challenges*. See Table 3 for the relationships between themes and subthemes. The central phenomenon that emerged was that the teachers in our study adapted the curriculum for gifted students by assigning them challenging work geared toward a higher grade level, varying their instruction, and supporting and motivating their students. Teachers identified a large student body and a lack of support from the school administration as challenges to facilitating differentiation and adapted education appropriately.

Analyzing the responses classified under the theme *individually adapted education* showed how the teachers adapted gifted students' education and instruction by giving them challenging assignments designed for a higher grade level. "I wish to adapt the assignments so the students become motivated and challenge themselves" (*teacher*). Acceleration was implemented through books or assignments from a higher grade level. The teachers mentioned open-ended and problem-solving assignments that allow gifted students to reflect and analyze as fruitful for differentiation and enrichment. The teachers also described asking gifted students to ponder philosophical questions and questions they, themselves, do not know the answer to as an additional enrichment technique employed.

The analysis revealed that *the supporting teacher* facilitates adapted education by supporting and motivating students. "First and foremost, give them support to show what they can achieve. Not all these students have the structure and self-discipline to show their potential" (*teacher*).

Some teachers noted that allowing gifted students to skip repetitive and easy assignments is vital for their motivation. A few teachers commented that gifted students should complete assignments that they can manage individually, making them more independent so that the teacher can dedicate time to other students in the class. The teachers also identified support and teacher–student conferences as essential to facilitating adapted education, so they are not alone in designing and implementing the related strategies.

The analysis of *instructional practices* conveyed the techniques teachers use to vary their instruction for gifted students. "Group work or projects where the gifted students get to work together. They often speak the same language and need to stretch themselves further" (*teacher*). Teachers cited digital tools, reversed education (or flipped learning), differentiating teaching materials, and grouping the gifted students to work on assignments as ways they vary their instruction.

The data analysis related to the theme of *systematic challenges* demonstrated that teachers experience obstacles that hinder them from facilitating adapted education for gifted students in real-world settings, such as being singly responsible for many students. "You can give them extra challenges, but you don't have time to follow up with them during a typical day" (*teacher*). Some teachers expressed a desire to group students by achievement level more often, and some wished for more teachers in the classroom, while others reported a lack of support from the school administration.

3.4. Mixed–Teachers and Students

The mixed methods research question guiding this study was as follows: how does the thematic analysis of gifted students' experience of adapted education confirm or differ from the survey results regarding how teachers facilitate their students? Table 3 presents the themes from the student interviews and those developed by analyzing the teachers' responses to the open-ended survey question.

The teachers described both practices they actively employed and methods they wanted to employ to facilitate adapted education for example "More difficult assignments that also demands reflection and interpretation" (*teacher*); however, they do not explicitly refer to the measures they are not implementing. Similarly, the students reflected on their experiences and visions for their ideal educational design. Still, the mixed analysis revealed many similarities in how the student and teacher participants described the facilitation of an adapted and differentiated education. For example, both students and teachers mentioned giving gifted students open assignments that require reflection, problem-solving, and the consideration of philosophical questions. The teachers referred to grouping gifted students with others on the same level. "I wish there was space to create groups on each grade so students with extraordinary learning potential could get their own instruction" (*teacher*). In contrast, the students wanted to be grouped by levels but were often put in mixed ability groups where they did the lion's share. "You get placed in a group where it's quite different how motivated you are. So you get stuck with a lot of work, and I don't like that" (*student*). The teachers highlighted assigning gifted students reading materials and exercises intended for a higher grade level as acceleration strategies that can be employed for subsets of students within the same class. The students mainly discussed acceleration by skipping grades or advancing in a specific subject.

The teacher as a promoter or inhibitor theme encompassed ways a teacher can promote or inhibit gifted students' education and potential. Naturally, the teachers only addressed how they promote their students' learning. The analysis indicated that students reported needing competent and flexible teachers who establish good relationships with students and adapt their instruction. At the same time, the teachers referred to creating fruitful relationships with students through student–teacher conferences and by supporting their students, guiding them, and letting them skip ahead to more advanced work.

The analysis further uncovered negative feedback from teachers and students regarding grouping students by levels. The students expressed a desire for their education to be provided in a more homogenous setting regarding ability. At the same time, the teachers indicated a desire to create such groups but noted that they encountered challenges in doing so. "They are not allowed to do that, my teacher said. Because it shouldn't be elites and such, so they are not allowed to make groups by level (...). Instead, they mix people who are on a level of two or three with people who get five and six. And I don't think that works out for either of them" (*student*). Some teachers identified systematic issues, such as being alone with a large student group, that contribute to these challenges. The gifted students also identified systematic issues and barriers to the facilitation of adapted education, including a lack of communication between teachers, difficulties in organizing accelerated programming, and receiving an education that has not been adapted to their needs and potential.

4. Discussion

This study aimed to investigate how education is adapted for gifted students among our selection of teachers and students. The teachers included in this study reported having gifted students in their classrooms when they completed the survey; however, the students and teachers were not from the same schools. The results from this study display that teachers are utilizing different methods for adapting and differentiating the education for gifted students. By triangulating the data in the mixed analysis, we found that teachers and gifted students mention similar types of strategies for enrichment, such as open assignments, reflection, group work, and more challenging assignments. This result points to convergence and complementarity. However, we also found divergence in the mixed analysis; for example, students mention acceleration by skipping grades, and teachers do not. We also found that teachers want to create homogenous ability groups in group work, and the students only have experience with heterogeneous ability groups.

The literature review shows that gifted students are diverse and need different supports and adaptations to properly develop their gifts or potential. Suppose they do not receive the proper support. In that case, they may risk developing various problematic behaviors, losing interest in school, developing negative self-esteem, and even dropping out of school [3–5]. The quantitative results from our study show that teachers agreed that using differentiated instruction for gifted students in their schools was feasible, and many reported incorporating it into their teaching practices. In the following section, we will discuss the different enrichment strategies we found in our study.

4.1. Enrichment Strategies within Adapted Education

As Rasmussen and Lindgård [10] present, educational provisions for gifted students can be categorized into acceleration, segregation, and inclusion. Inclusion is the default for all students in the Norwegian educational system [24] (§ 1-1). However, establishing an inclusive and diverse classroom requires teachers to differentiate and enrich the instruction and curriculum to fit the gifted students' needs. Our quantitative results reflected a consensus among the teachers that incorporating differentiated instruction was possible in their schools and that they, themselves, employed this strategy. The teachers also agreed that gifted students need an adapted education to be facilitated that extends beyond the scope of ordinary education. They were split on whether the educational system prioritizes this kind of facilitation.

Gagnè [23] presented seven criteria that define best practices for enrichment programs. In the following section, we will discuss if adapted education for gifted students in Norway follows these best practices based on the results from our study. The first criteria are enriched K–12 curriculum and systematic daily enrichment. As these two are highly intertwined, we combined them for this discussion. Gagnè [23] described four enrichment types, called the four Ds: difficulty, depth, diversity, and density (the most important of the four). Density refers to compacting the curriculum so gifted students learn more in a shorter time frame. In the themes of *adapted education* and *individually adapted education*, we found different assignments, more challenging assignments, projects, reflections, and art and design. These responses fit the other three Ds, primarily difficulty and depth. Some teachers in our study referred to utilizing books from a higher grade level to assign more complicated work but did not mention compacting the curriculum. Our results indicate that density is not an enrichment provided for gifted students in Norway. These results align with the findings reported in a study in Sweden, where teachers differentiated instruction through challenging and open-ended tasks [47].

Density can also be an acceleration strategy. Acceleration can be achieved in multiple ways, such as beginning school at a younger age, skipping grades, accelerating in a specific subject, or following an accelerated personal curriculum [10,11]. Analysis for the theme *adapted education* showed that students reported full-time acceleration (skipping grades) and subject acceleration. In contrast, teachers only reported acceleration strategies involving books from a higher grade level. This result points to a divergence in the data material.

In the theme, *barriers regarding facilitation*, challenges encountered with subject acceleration were highlighted. The barriers mentioned include organizational difficulties, communication issues between teachers and students, and a lack of actual instruction. Is the education genuinely accelerated if the student completes all work alone using a book from a higher grade level? We do not know why the teachers in our study did not mention acceleration strategies. It may be because of the organizational difficulties we uncovered under the student theme or related to the myths and misconceptions concerning acceleration [12]. In this study, 35% of the teachers disagreed with the claim that schools allow space for adaptation, and 53% indicated that schools do not prioritize adaptation for gifted students. These results may indicate the same organizational difficulties we found in the student data. The lack of mention of different forms of acceleration by the teachers aligns with previous studies on teacher attitudes toward gifted education that have suggested that teachers are skeptical or even hostile toward acceleration strategies [16,18].

Gagné [23] further presents criterion 3, full-time ability grouping. In our results, *barriers regarding facilitation* revealed the students want to be grouped by levels more often. In Norway, schools and teachers are restricted by law from making permanent groups based on ability [24] (§ 8-2). However, flexible grouping is allowed. Nevertheless, our study indicated that students and teachers had not experienced this flexible grouping.

The students or teachers did not mention criteria 4 and 5. The analyses found no references to customized pacing or personal excellence goals for gifted students. Teachers addressed guiding their students in the survey responses highlighting *the supporting teacher* theme, but not through individual plans or goals. Generally, teachers display a broad understanding of adapted education with less individualism [30]. None of the students in our study mentioned that their teacher developed personal goals for them. Criterion 6, highly selective access, is irrelevant in Norway.

Moreover, the analysis revealed that criterion 7, early interventions, was mentioned by some students relative to skipping grades in early primary school. However, the analysis also demonstrated that students reported only minor adaptations in primary school; none of the teachers mentioned any early intervention strategies. Thus, we see indications that early intervention is lacking for gifted students.

4.2. Barriers within an Egalitarian Education

As noted in the introduction, the Norwegian educational system is built on equity, inclusion, and adapted education. This principle is true for special, ordinary, and gifted education. An equitable education requires differentiation for all. The teachers in our survey agreed that gifted students need the facilitation of an adapted education that surpasses ordinary education. Adapted education within ordinary education is not an individual legal right but a high ambition [31]. Is it possible to differentiate the education appropriately for gifted students within ordinary adapted education? Both inclusive and adapted education require that schools and teachers heed the diversity in each student group and differentiate and adapt accordingly. However, seeking to provide an inclusive and adapted education does not necessarily mean that all schools and teachers manage to fulfill this ambition for all students. Indeed, whether it is even possible may be a topic for discussion.

According to Frantz and McClarty [8], the three distinct approaches to gifted education within egalitarian cultures include (a) adapted education for all students, (b) including gifted education within special education, and (c) inclusive strategies for underrepresented groups. Norway utilizes the approach of adapted education for all students. The results and analysis in this study indicate that adapted education within ordinary education does not provide the best practice for gifted students in Norway [23]. The analysis in this article shows that students and teachers point to difficulties and systematic challenges in providing gifted education. Some challenges relate to issues with ability grouping, for example, with how they interpret § 8-2 in the Education Act. Other challenges relate to lack of communication between teachers, issues with single subject acceleration, lack of instruction, mixed-ability group work, slow progress, and too much repetition.

Including gifted education within special education is considered an egalitarian approach [8]. The official report uncovered that pedagogical and organizational differentiation opportunities exist that schools are not utilizing [34]. Flexible grouping by ability is possible; however, neither teachers nor students in our study reported experiencing such groupings.

Perhaps defending these *special* groups for the gifted students would be easier if Norway considered gifted education part of special education. However, as a study from Sweden suggests these special groups might also be considered to conflict with inclusive education [27]. The egalitarian culture may be the barrier to appropriately adapting education for gifted students.

Gifted students need proper educational strategies to help develop their potential [3,4]. Of course, gifted students are not a homogenous group, so they need individual differentiation based on their unique needs and predispositions. However, some best practices have been established for educational strategies, including accelerated pace, ability grouping, enrichment, or differentiation within heterogeneous ability groups. Utilizing the results of our study, Norway may have a way to develop an appropriate education program for gifted students.

4.3. Limitations and Implications for Further Research

This research offers a glimpse into an educational system that lacks specific programs for gifted students and showcases how gifted students and teachers work to differentiate the education within that system. This article presents the results from a quantitative survey and a qualitative interview mixed methods study that captured both teachers' and students' perspectives. Our study highlighted trends and results that may be necessary for other teachers and policy makers in Norway and other egalitarian educational cultures to consider. The quantitative survey participants constituted a convenience sample; hence, we cannot generalize the results to all Norwegian teachers in primary and secondary schools. Furthermore, the teachers in this study self-evaluated their teaching and instructional practices, so the data may be biased.

Additionally, the gifted students only reported on their own experiences; other students in Norway may have had vastly different experiences. However, we found similarities between the student and teacher material concerning the facilitation of adapted education and the challenges with adaptation. These similarities lend credibility to our results. Moreover, utilizing a mixed methods approach adds strength. Thus, the blind spots regarding barriers and challenges may not have been as profound in a purely qualitative or quantitative sample.

Author Contributions: Conceptualization, A.L.; methodology, A.L., L.Ø.J. and E.H.; software, A.L.; validation, A.L., E.H. and L.Ø.J.; formal analysis, A.L.; investigation, A.L.; resources, A.L., E.H. and L.Ø.J.; data curation, A.L.; writing—original draft preparation, A.L.; writing—review and editing, A.L., E.H., L.Ø.J.; visualization, A.L.; supervision, L.Ø.J. and E.H.; project administration, A.L.; funding acquisition, A.L. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and was approved by SIKT (protocol code Ref.nr. 260230, 7 September 2020).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available in Norwegian on request from the corresponding author. The data are not publicly available due to privacy.

Acknowledgments: Thank you to Ole Johan Eikeland for technical help with the survey design.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A. Survey Design

Appendix A.1. Survey Design: Students with Extraordinary Learning Potential

Information

Dear Teacher

Request to attend the research project "Students with extraordinary learning potential in Norway".

[Identifying author information hidden in this document]

What does it mean to participate in this study?

Participation in the study means to answer a web-based survey. The survey takes approximately 15 min to answer. There will be no collection of personal identifying information other than gender and years of experience as a teacher. The questions will first and foremost be on knowledge about the student group, adaption, characteristics you deem appropriate, and if you have or have had students you feel fit the definition.

What will happen with your information?

All personal information will be confidential. The only indirect personal information that are stored temporarily is the IP address. The IP address will not be connected to the answers but will be used to identify how many answers we get from each school. If the survey is answered when you are connected to the school network, it is not considered an indirect personal information. All data will be anonymized and quantified. It will not be possible to recognize single participants from the survey in the publication.

Voluntary

It is voluntary to participate in this study, and you can withdraw your consent at any time without providing a reason. If you have questions, please contact [author information hidden]. The study is approved by NSD.

Consent

I have received information about the study and is willing to participate.

Answering the survey is considered active consent.

Welcome to the survey

Thank you for participating and sharing your view, it is an important part of the research on this student group. It is important that you answer based on your own perception of the phenomenon, and not what you think others want to hear. Your considerations are anonymous and will not be able to identify you, or your school.

In this survey we will use the term "extraordinary learning potential". This term also covers terms such as *begavet* (gifted) and *evnerik*. The term is in line with the new terminology used in NOU 2016: 14 "More to gain, better learning for students with high learning potential".

> *Students with extraordinary learning potential are students with a strong need and potential in academic subjects like mathematics, reading/writing/language, science, technology, social science or creative/esthetic subjects, and who can transform their potential to talent only if their needs are met in a rich and responding learning environment.*
>
> (Idsøe, 2014, p. 14, my translation)

Appendix A.2. Background Information

Information about your education, experience as a teacher, and general information about the school

1. Gender?
    a. Male
    b. Female
2. What education do you have?
    a. Teacher education (4 year)
    b. Teacher education with an extra year
    c. Master degree (5 year)
    d. Master degree with an extra year
    e. Other (please elaborate)
3. How long have you practiced as a teacher?
    a. Open-ended question

4. Are you a contact teacher?
    a. Yes
    b. No
5. What age level do you teach?
    a. Open-ended
6. How many students are there in your school?
    a. Open-ended
7. What ownership does your school have?
    a. Public
    b. Private
8. How many residents are there in your school municipality?
    a. Under 2000
    b. 2000–4999
    c. 5000–9999
    d. 10,000–19,999
    e. 20,000–49,999
    f. 50,000 or more

Students with extraordinary learning potential. In this part of the survey, you will answer questions related to students with extraordinary learning potential. The definition used in this survey is *Students with extraordinary learning potential are students with a strong need and potential in academic subjects such as mathematics, reading/writing/language, science, technology, social science, or creative/esthetic subjects, and who can transform their potential to talent only if their needs are met in a rich and responding learning environment* (Idsøe, 2014, p. 14, my translation).

9. To what degree do you agree or disagree that there is space to work with differentiated assignments in school?
    a. Totally disagree
    b. Somewhat disagree
    c. Neither agrees nor disagrees
    d. Somewhat agrees
    e. Totally agrees
10. To what degree do you agree or disagree that you as a teacher use differentiated assignments in your instruction?
    a. Totally disagree
    b. Somewhat disagree
    c. Neither agrees nor disagrees
    d. Somewhat agrees
    e. Totally agrees
11. Where have you gained knowledge about students with extraordinary learning potential?
    a. Open-ended
12. To what degree to you agree or disagree that you need more knowledge about students with extraordinary learning potential?
    a. Totally disagree
    b. Somewhat disagree
    c. Neither agrees nor disagrees
    d. Somewhat agrees
    e. Totally agrees

13. To what degree do you need more knowledge about adaption for students with extraordinary learning potential?
    a. Not at all
    b. To a small degree
    c. Neither nor
    d. To a medium degree
    e. To a high degree
14. What characterizes students with extraordinary learning potential in your view?
    a. Open-ended
15. Here are different statements about students with extraordinary learning potential, which we want you to evaluate. This will of course vary from student to student, but we want you to, from your knowledge about the students, evaluate the statements. If you have little or no experience with this student group, we want you to answer based on your thoughts and opinions.

To what degree do you agree or disagree that students with extraordinary learning potential are

a. Performing well in school
b. Disruptive
c. Unsocial
d. Creative
e. Energetic
f. Diligent
g. Curious
h. Silent
i. Annoying
j. Extroverted
k. Social
l. Show an advanced language
m. Know-it-all
n. Willing to learn
o. Introverted

The teachers could answer on a five-point scale from totally disagree to totally agree.

16. Have you had students with extraordinary learning potential?
    a. No
    b. Yes
17. If yes, how many?
    a. Total
    b. How many boys?
    c. How many girls?
18. Do you currently have students with extraordinary learning potential?
    a. No
    b. Yes
19. If yes, how many?
    a. Total
    b. How many boys?
    c. How many girls?
20. To what degree do you agree or disagree that students with extraordinary learning potential need adaption beyond the scope of ordinary adapted education?
    a. Totally disagree
    b. Somewhat disagree

   c. Neither agrees nor disagrees
   d. Somewhat agree
   e. Totally agree
21. To what degree do you agree or disagree that the school as a system have space to adapt the instruction for students with extraordinary learning potential?
   a. Totally disagree
   b. Somewhat disagree
   c. Neither agrees nor disagrees
   d. Somewhat agree
   e. Totally agree
22. To what degree do you agree or disagree that the school as a system prioritize adaption for students with extraordinary learning potential?
   a. Totally disagree
   b. Somewhat disagree
   c. Neither agrees nor disagrees
   d. Somewhat agree
   e. Totally agree
23. What kind of subject adaption would you as a teacher give students with extraordinary learning potential?
   a. Open-ended
24. How has the students with extraordinary learning potential been identified? (Several answers possible)
   a. Haven't had students with extraordinary learning potential
   b. Have identified them myself
   c. Other teachers have identified them
   d. Parents have identified them
   e. The student themselves have told me
   f. PPT/BUP or other professionals have identified them
   g. Other please elaborate
25. Do you have any comments?
   a. Open-ended

Thank you so much for your participation!

Appendix B. Codebook

Codes and References in the Teachers' Answers to an Open-Ended Survey Question			
Student codes	**Codes developed from the inductive thematic analysis of interviews with 17 gifted students**	0	0
Enrichment	"Adaption beyond what the rest of the class is working on Problem-solving, philosophical, and challenging assignments."	32	33
Discussions		0	0
Being an extra teacher	"Let them teach others what they know (be an extra teacher) without taking absolute control."	4	4
Extra assignments	"When the original assignment is done, they will get new and more challenging assignments."	3	3
Acceleration	"Faster progression in a subject. In mathematics, they get assignments from older students' curriculums when they have showed they know everything in the ordinary curriculum."	16	16
Issues with acceleration		0	0
Group-work	"Group-work or projects where the gifted students work together. They often speak the same language and have a need to stretch themselves further."	2	2

Codes and References in the Teachers' Answers to an Open-Ended Survey Question			
Compacting curriculum	"Let them skip work they already know."	1	1
Grade-scores		0	0
Homework	"Adapted homework." "Homework on their level."	5	5
Motivation	"Do not let them work on more and more assignments on the same level; that will influence their motivation negatively."	2	2
Problematic Issues	"Ideally, I would make own assignments and give these students extra challenges. However, in practice, this is difficult to do, because of a large student-body. You can give them extra challenges, but you do not have time to follow them up during a normal day."	7	7
Kept back		0	0
No instruction		0	0
Boring assignments		0	0
Grouping by levels	"I wish there was space to create groups on each grade so students with extraordinary learning potential could get their own instruction."	4	4
Repetition	"Reduce all repetition and stuff that they easily learn by reading."	3	3
Moving too slow		0	0
Varied instruction	"Vary instruction by using several teaching materials."	2	2
Projects		0	0
Reflection	"Make space for students' own reflection. More difficult assignments that also demand reflection and interpretation."	3	3
Writing		0	0
Asking for help		0	0
Adapted education	"Adapted education." "Adapt the difficulty on assignments, more advanced reading, adapt assignments online, online materials in math etc." "I wish to adapt the assignments so the student becomes motivated and need to challenge themselves."	44	45
Challenges	"Challenging questions, assignments, and homework." "Give them assignments with a more challenging wording, give them assignments I know will be challenging for them."	47	47
Make your own challenges	"I often let the student themselves create their own questions."	2	2
Teacher codes	**Codes generated from the teachers answers that did not fit any of the student codes.**		
Digital tools	"When you use digital tools, it is easier to differentiate the instruction in different levels."	1	1
Student-teacher conference	"Talking with the student about the subject."	4	4
More teachers	"More teachers so there is space to work with the different students who need it."	1	1
Support from teacher	"First and foremost, give them support to show what they can achieve. Not all of these students have the structure and self-discipline to show their potential. Guidance and support if necessary."	10	10
More knowledge	"More knowledge in the subject for myself."	1	1
Misunderstood the question	"Work with the goals in the IEP."	2	2
Social competence	"Emphasize social competence, cooperative skills, and contact with the class."	1	1
Special talents	"Utilize special talents In, e.g., music when possible."	1	1
Instructional practices	"Reverse teaching."	3	3

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education sciences

Review

Transforming Gifted Education in Schools: Practical Applications of a Comprehensive Framework for Developing Academic Talent

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Abstract: The foundation for talent development as a framework for gifted education can be found in a synthesis of the psychological literature on creativity, eminence, giftedness, and high performance. The talent development framework acknowledges the contributions of both general cognitive ability and domain-specific abilities to achievement, as well as the malleability of these ability constructs. Talent development is also consistent with research on the contributions of non-cognitive or psychosocial factors to school achievement, as well as studies on factors that influence the attainment of scholarly productivity and artistry within specific domains of non-academic talent. Although there are several theoretical frameworks and models of giftedness, talent development, ability, and intelligence, each with varied areas of emphasis and desired outcomes, the research base and practical applications for the talent development megamodel (TDMM) can serve as a guide to leaders and school administrators in making fiscal and programmatic decisions that maximize short- and long-term impacts for individuals and society. In this article, we discuss some of the practical implications of the model for assessment, curriculum and instruction, and psychosocial development within a school context.

Keywords: talent development; domain-specific abilities; domain trajectories; psychosocial skills; high performance; gifted education

Citation: Subotnik, R.F.; Olszewski-Kubilius, P.; Corwith, S.; Calvert, E.; Worrell, F.C. Transforming Gifted Education in Schools: Practical Applications of a Comprehensive Framework for Developing Academic Talent. *Educ. Sci.* **2023**, *13*, 707. https://doi.org/10.3390/educsci13070707

Academic Editors: Kirsi Tirri and Valerie Margrain

Received: 31 May 2023
Revised: 6 July 2023
Accepted: 7 July 2023
Published: 12 July 2023

1. Introduction

Talent development, as a framework for gifted education, is gaining traction among scholars and practitioners. Its foundation can be found in a synthesis of the psychological literature on creativity, eminence, giftedness, and high performance [1]. The talent development framework acknowledges the contributions of both general cognitive ability or intelligence and domain-specific abilities to achievement, as well as the malleability of these ability constructs [2–4]. Talent development is also consistent with research on the contributions of non-cognitive or psychosocial factors to school achievement [5,6], as well as studies on factors that influence the attainment of scholarly productivity and artistry within specific domains of non-academic talent [1,7]. Talent development is attractive to practitioners because it is easier to conceptualize talent in specific areas (e.g., mathematics, language) than the abstract concept of giftedness based on general cognitive ability, and it is also easier to address instructionally. Importantly, this framework puts a greater focus on the development of emergent talent and potential, which offers more opportunity and direction to educators and teachers to address the needs of a wider range of learners, including minoritized groups of students.

Although there are several theoretical frameworks and models of giftedness, talent development, ability, and intelligence, each with varied areas of emphasis and desired outcomes, the talent development megamodel (TDMM) is one of the most comprehensive and "the most explicit in stating that giftedness starts as potential in all domains and, with opportunity and psychosocial skills, can be developed into competencies, expertise, and scholarly productivity and artistry" [8] (p. 358). The TDMM emphasizes the provision of systematic and continuous academic opportunities for growth across the lifespan, as well as the introduction of psychosocial skills such as taking on challenges and setbacks associated with creative growth [6]. Its research base and practical applications can serve as a guide to leaders and school administrators in making fiscal and programmatic decisions that maximize short- and long-term impacts for individuals and society. In this article, we discuss some of the practical implications of the model for assessment, curriculum and instruction, and psychosocial development, within a school context.

2. The Talent Development Megamodel

The TDMM is broadly applicable across diverse domains, including academics, athletics, visual and performing arts, and professions. In the context of education, specifically the field of gifted education, the authors of the megamodel proposed that outstanding achievement or scholarly productivity and artistry ought to be the main goal of gifted education [9] because "aspiring to fulfill one's talents and abilities in the form of transcendent creative contributions will lead to high levels of personal satisfaction and self-actualization as well as produce yet unimaginable scientific, aesthetic, and practical benefits to society" [1] (p. 3).

Having outstanding achievement as a goal does not mean that schools should focus attention only on those students deemed capable of reaching the highest levels of achievement, which is not even possible to do. This goal means that schools should focus on preparing students with the content knowledge and psychological skills that will enable them to take full advantage of presented opportunities and reach the levels of achievement they desire and are capable of, including the highest levels. Paths towards high achievement begin with nurturing talent from early childhood and continuing through adulthood through school-based and supplemental programs that balance challenge (academic content and skills) and support (psychological skills).

The major tenets of the TDMM are presented in Figure 1. The TDMM emphasizes the deliberate cultivation of ability in specific domains and yields a framework for designing educational programs and services that address academic content and skills, psychosocial skills, and psychosocial needs at each stage of talent development. It is grounded in the idea that talent development occurs over time and that a young person's learning needs, growth trajectory, and domains of ability vary, necessitating a range of rigorous enrichment and accelerated learning and support services, including academic planning and career counseling. This range of services must be articulated—systematically and continuously—to help as many young people as possible reach their full potential.

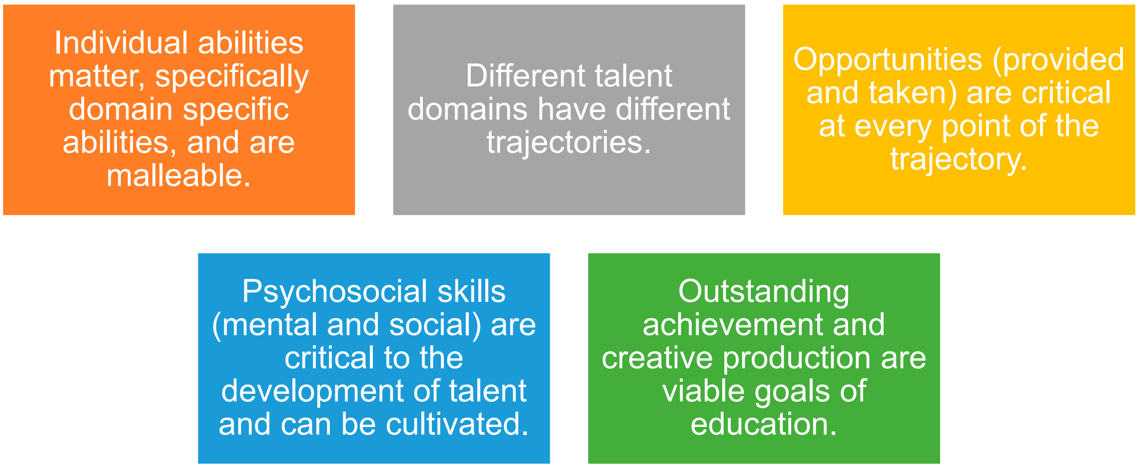

Figure 1. Tenets of the talent development megamodel.

3. Implications of the Talent Development Megamodel for Educational Programming

Rather than focusing solely on the mastery of a set curriculum or assuring basic knowledge of core subjects, education using a talent development approach aims to provide authentic experiences in specific domains, attending to individuals' interests and strengths [10], as well as the different timing of different domains. Early learning experiences expose young people to a variety of subjects, often using an interdisciplinary approach, and they are designed to pique sufficient interest to maintain a commitment to building domain-relevant skills and knowledge that takes place at the next stage, enabling learners to advance at a pace and level commensurate with their abilities. Additionally, engagement with real-life problems and projects nurtures motivation, self-efficacy, and persistence, and serves to assuage young people's need for control over a rapidly changing environment [11]. Programming at the later stages of talent development connects students to domain professionals and experts to build a scholar identity, impart knowledge about career and educational paths, and begin to cultivate a supportive network. In sum, talent development programming aligns with readiness and interests, and it includes a focus on short- and long-term goals.

There are several advantages of adopting a talent development model for school programming. First, introducing children to the specific abilities and skills associated with domains helps them become ready for enrichment and accelerative opportunities and to maximize their learning. It also promotes a growth mindset and encourages motivation and academic risk taking. These early experiences are especially critical for children who have fewer opportunities for formal learning in their early environments and can enable children to "catch up" in their achievement and demonstrate their learning potential to teachers [12]. Second, providing domain-specific activities and enrichment programming can assist in identifying children's potential more effectively than relying on general ability measures or achievement scores. While keeping options open for a change in direction, identifying and defining pathways allows students to reach higher levels of achievement in their areas of interest and strength.

Third, balancing the acquisition of content knowledge and skills with the development of psychosocial skills necessary for high performance helps young people learn the skills needed to persist in the face of difficulty and fears, eventually propelling them to higher levels of achievement and creative productivity in adulthood. Fourth, meeting the needs of a larger range of students—that is, both those with emerging talent and those already demonstrating advanced achievement—creates broader access to opportunities for growth and improvement. Finally, a talent development approach gives more students from diverse backgrounds the opportunity to embark on paths toward eminent levels of achievement, helping to address the equity concerns associated with traditional gifted education.

4. Components of Talent Development Programming

Consistent with the tenets of the TDMM presented in Figure 1 [13], there are several components of a comprehensive talent development program. These can be grouped into six main categories for the purposes of planning and evaluation. These include (1) focusing on domain-specific knowledge and skills, (2) considering domain-specific trajectories, (3) recognizing that abilities are not fixed and need to be developed, (4) teaching psychosocial skills, (5) planning for academic and career pathways, and (6) taking advantage of opportunities when they present themselves.

4.1. Focus on Domain-Specific Knowledge and Skills

In the TDMM, general ability is considered foundational to the development of more specific, domain-relevant abilities such as mathematical, verbal, or spatial abilities [1,14,15]. However, in contrast to traditional gifted education models, measures of general cognitive ability may have limited utility to identify learners with advanced potential for domain-specific talent development opportunities (e.g., advanced mathematics courses). Rather, in a talent development approach, measures of specific abilities should be used that can reveal the relative strengths of each student in order to guide them toward engaging and appropriately challenging courses and programs that capitalize on and further develop their particular profile of abilities.

Research supports the importance and predictive validity of domain-specific abilities for achievement. Studies have shown, for example, that a verbal versus quantitative tilt in abilities—that is, high scores on tests of verbal versus mathematical reasoning ability in middle school students—is related to differences in domains of adult accomplishment. Typically, verbal tilt increases the probability of accomplishments in the humanities and quantitative tilt increases the probability of accomplishments in STEM fields [16,17]. Moreover, not only do domain-specific abilities matter, but the pattern of abilities is useful in determining future educational and career paths for students. For example, high mathematical ability along with high spatial ability is associated with success in STEM fields, particularly engineering and physics [18]. More unique factors associated with an academic subject like mathematics, such as number sense or mathematical cast of mind, have accumulated a large quantity of supporting literature [19–22]. Other subjects need this level of detailed research to expand the possibilities of identifying potential abilities.

From the talent development perspective, general ability can be an initial indicator of talent and academic potential, while domain-specific academic abilities become increasingly important as abilities naturally differentiate with development. Many students are outstanding academically but have not identified a domain of special interest. Measures of general ability can be useful to educators as they can reveal the necessity for a faster pace of learning, and, combined with achievement indices, highlight the potential for grade or subject area acceleration before students' interests coalesce or for those talent domains that emerge later (e.g., psychology or leadership). Providing the appropriate level of challenge through pacing and advanced content will keep students engaged in learning and help them develop important psychosocial skills such as a growth mindset or presentation and study skills so that students are prepared to take advantage of opportunities in the domain that eventually emerges as a good fit with their interests and abilities.

4.2. Different Domains Have Varied Trajectories

Because of its emphasis on domain-specific abilities, the TDMM acknowledges that various academic fields have unique trajectories [1,15]. Some domains can be introduced very early in a child's academic or home experience as part of the building blocks to other domains or because they are developmentally appropriate and accessible through daily activities—mathematics, some musical instruments such as violin, or some sports such as gymnastics—whereas other domains may not become known, at least in depth, until schooling during late adolescence or even university (see Table 1). This can relate to the level of prerequisite knowledge and skills (e.g., leadership, philosophy) needed or even physical development required.

Table 1. Domain trajectories.

Domain	Childhood	Adolescence			Adulthood		
		Early	**Mid**	**Late**	**Early**	**Mid**	**Late**
Music							
Violin	Start						End
Vocal Arts				Start			End
Athletics							
Gymnastics	Start			End			
Football		Start				End	
Academic							
Math	Start						End
Psychology				Start			End

Mathematics, for example, lends itself to early precocity, and children can begin formal study at the start of school or even earlier. Other areas, such as psychology or history, require a longer period of building foundational knowledge and skills, including analytical writing and critical reading, such that serious study can only begin much later, for example, at secondary school or college [1,14]. Of course, access to certain subjects is controlled by the structure of current schooling, which typically and somewhat arbitrarily limits students' access to subjects such as psychology until high school, or philosophy or engineering until college. These unique trajectories influence when identification should occur and when programming might begin for different academic subjects.

Factors such as access to opportunity have an impact on talent development trajectories. For example, some children start formal education having had considerable exposure to books, music, mathematics, and science from their early environments. They are ready to start with an advanced curriculum and accelerated placement in schools and supplemental programs, sometimes in settings with older learners. Other students, particularly those from more economically disadvantaged backgrounds, may have exceptional learning potential that is not obvious or demonstrated through advanced knowledge or school achievement because of a lack of early stimulation and exposure. These children can benefit from early enriched instruction and curricula to both nurture and reveal their potential, followed by subsequent opportunities to access high-level courses and programs and/or accelerated placements.

4.3. Abilities Can Be Developed

In the traditional gifted child approach, exceptional ability and/or high intelligence are viewed as all-or-none traits of an individual—"you have it or you don't" [23,24]. From the talent development perspective, individual differences in initial abilities are recognized; however, these abilities are not static and need to evolve over time. In its earliest manifestation, talent is best described as potential for future achievement in a domain. As children develop and grow—and with nurturance, opportunity, effort, study, and practice—potential is developed further into competence and expertise that is increasingly demonstrated in exceptional levels of creative achievement. The pinnacle of talent development, typically achieved in adulthood, is the generation of a transformative idea or performance [1,14].

When creating programs that support talent development, the first step is to select the domains in which opportunities will be provided, including the distinction between the development of performers (e.g., actors, singers, athletes) and producers (e.g., composers, writers, scientists) [1]. The next step, which is the responsibility of the research community working in collaboration with domain experts, is to identify the knowledge and skills necessary for achievement at the highest levels in each domain, which requires working with professionals and domain experts. This step may include making explicit what is often viewed as implicit knowledge shared among those with expertise and experience.

With the knowledge of what is required at the highest levels, educators can then develop an articulated sequence of programs within domains that will enable students to progress through the stages of talent development that their school serves, which is typically moving potential through competence or early expertise.

For children and adolescents, academic domains can be introduced within generalized areas of study and become more specialized with interest and achievement. There are several implications for school-based programming: If an ability can be developed, then it must be cultivated continuously (exposed, observed, assessed). If learning is contextual, then looking for evidence of ability outside of school and typical classroom environments is important. For example, relationships with community organizations such as clubs, museum classes, or scouting can allow for the cultivation of special abilities such as leadership. If psychosocial skills matter, then designing opportunities for coaching and practice can be integral parts of the talent development program.

4.4. Psychosocial Skills Are Critical to Talent Development

Psychosocial skills are those that enable a person to marshal environmental, social, and technological resources deliberately, ethically, and productively in the service of attaining goals. These include the skills typically grouped under social and emotional learning (e.g., self-awareness, social awareness, self-management), but also include a much broader range of constructs. In the TDMM, psychosocial skills are considered essential for transducing ability and potential into creative productivity in adulthood, with certain skills being more important at particular stages of talent development [25,26].

Research has shown that psychosocial skills, such as growth mindsets, self-regulation, and self-efficacy, have become increasingly critical determiners of whether students progress to higher levels of talent development, and that these skills can be taught and developed by instructors and other adults [1,27]. However, which psychosocial skills are important vary with the stage of talent development. For example, growth mindsets that emphasize the role of effort and practice on achievement, and teachability, which involves being open to instruction and feedback, are critical when children are learning the foundational techniques and knowledge of their talent field. However, independent thinking, confidence to challenge and question instructors, and knowing one's strengths and weaknesses become important when individuals are more advanced in their fields [7]. The talent development framework emphasizes the deliberate cultivation of psychosocial skills that support high achievement, rather than leaving these to chance.

Specialists and others can help children acquire these psychosocial skills by building their development into programming and curricula and through their interactions with students [5]. For example, teachers can make sure they convey, through their verbal messages to children and feedback on projects and assignments, the importance of effort and study, as well as the practice of a variety of learning strategies. Dweck [28] proposed some recommendations for the kinds of praise that promote malleable, as opposed to fixed, mindsets in children. Educators can provide opportunities for children to take intellectual risks, such as projects that are difficult and require them to work on the edges of their current competency level, or ones that allow them to put novel ideas forward in a supportive context. Educators can provide emotional scaffolding to gifted children at critical transition points, such as when they move to more challenging and competitive academic environments and assist parents in learning how to support their child at home during these times. It is also key that educators model resiliency and strategies to cope productively with perceived failures, setbacks, and threats to self-esteem and confidence [14,26].

A second category of psychosocial skills comes from the world of performance, where these skills are used to enhance the effectiveness of elite athletes or musicians [29]. These skills, such as addressing performance anxiety, screening out distractions, and strategic risk taking are also useful for academic environments that include presentations, competitions, and critical examinations. Academic talent development mirrors music and sports performance psychology in recognizing that the ability to engage in ongoing deliberate practice in "low stakes" situations and the ability to self-regulate mental focus and emotional arousal in high-stakes situations are critical for long-term success and peak performance. Explicitly drawing these connections for students and teaching concepts that are transferable across multiple talent domains may be effective strategies to increase academic achievement and improve performance in other areas [30].

Parents and teachers can facilitate the development of the skills needed at each stage of talent development (Figure 2) with proper training and access to the right resources, keeping in mind that, in order for students to acquire self-regulation learning strategies, they must be taught them explicitly; moreover, they must practice them in relevant domain-specific learning contexts using content that is appropriately advanced [31] (Zeidner and Stoeger, 2019).

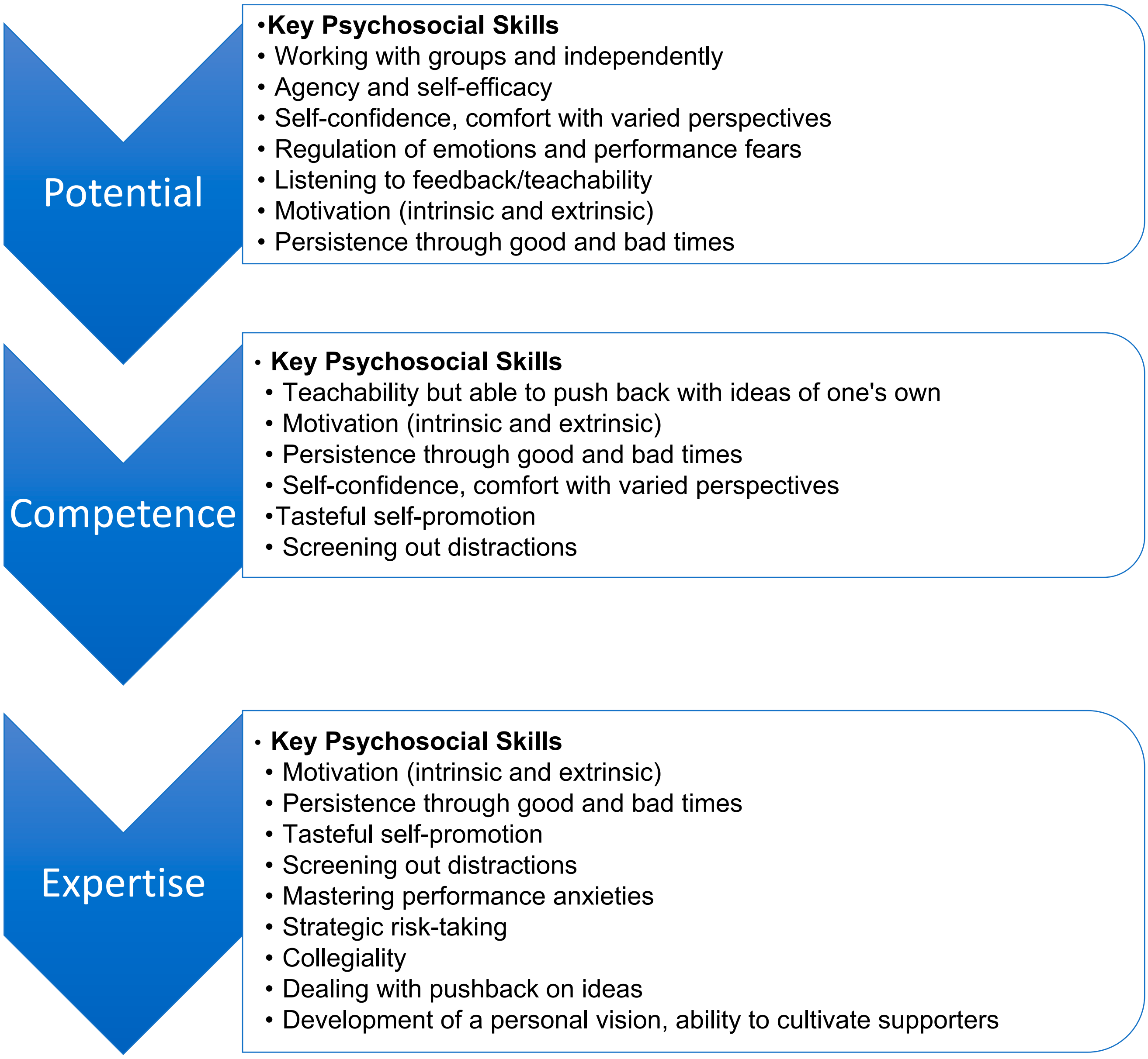

Figure 2. Transition from psychosocial skills to high-performance skills over time.

4.5. Planning for Academic and Career Pathways

Young people need help in identifying and attaining academic and career goals and access to insider knowledge about careers and educational paths from professionals in the field. This process starts with the ability to recognize their interests, strengths, and needs in cognitive and psychological areas. This is followed by an awareness of domains of study and related professions that align with these interests, strengths, and needs. In addition, insight into how one learns and the influence of culture, traditions, values, and opportunities, as well as insider knowledge about careers and educational pathways, is often learned implicitly from family or community members but can be made explicit, particularly for students from disadvantaged circumstances or families with less social capital.

A talent development approach to programming has deliberately incorporated academic and career planning in an effort to help young people attain expertise and set the stage for scholarly productivity and artistry in adulthood. However, academic and career planning is not all generic, and the availability of domain expertise becomes increasingly important at higher stages of talent development.

Relatedly, talent development does not occur spontaneously. Talent development requires vision and the creation of both short- and long-term goals. Educators need to be knowledgeable about how to prepare students at each stage and which types of knowledge, skills, and experiences will maximize potential and achievement and enable students to successfully progress to the next higher stage. In some academic domains, outside-of-school opportunities play a significant role in transforming abilities into competencies and expertise (e.g., sports, music, arts); therefore, "personnel with deep knowledge and expertise in a domain, community resources and talent trajectories in each domain should be part of the gifted education team" [32] (p. 44). Program staff and administrators are integral to creating systematic and continuous services, including access to clubs, competitions, mentors, courses, higher education, and other means of cultivating talent. In addition, they help young people and parents track participation and growth, set goals for achievement, advocate for opportunities at school, and create peer networks.

4.6. Opportunities Must Be Offered and Taken

Though schools will provide students with some talent development opportunities, particularly in academic subjects, many domains of study will require access to supplemental programming and coaching. Whenever possible, it is helpful to create collaborations, or at least to facilitate communication, among schools, families, and community organizations to expand access to opportunities and keep students consistently on their talent development trajectories.

Other considerations are potential barriers to program access, including schedules, transportation, lack of parental awareness or support, cost, language, disability, or student perceptions that programs are not for "people like me". Many of these barriers can be addressed with proactive planning and creative resource allocation. Organizations that provide supplemental programs can help arrange transportation, offer online or alternative site programming, and provide scaffolds and supports for students who have a disability or who are language learners. Well-coordinated and delivered marketing and communication activities and partnerships between schools and other community organizations can provide information to parents, while parent education can be offered through workshops, newsletters, webinars, and other means.

Sometimes, resistance to taking advantage of opportunities comes from within the student. Most often, the reasons include a lack of interest, negative peer or parental pressure, and a lack of confidence in their ability to be successful, particularly in a new activity. This lack of interest may be genuine, or it may derive from not knowing enough about the interesting components of a field outside of the mandated school curriculum. Peer pressure can be alleviated through mentoring and an introduction to new peer groups with similar passions [33]. Dealing with parental pressure is often the most difficult for students as well as for the professionals who work with them in talent development, especially when the family is depending on their child to follow a professional path that may help to move them out of poverty or low-income status. In this case, guidance on keeping options open, including boundary crossing between science and the arts and humanities, might be helpful.

Hearing from students involved in the programs and having a chance to try an activity without extended commitment, formal evaluation, or incentives can help with these sources of resistance. Small external, extrinsic rewards can be effective, particularly at the beginning of the talent development journey or when trying to encourage students to engage in the practice of basic skills. In the long term, though, students will need to develop a sufficient commitment to sustain their engagement into adulthood.

5. Building a School-Based Talent Development Program Based on the TDMM

5.1. Identify Needs and Monitor Talent Development

A strategic approach to developing a high impact set of talent development services within a school begins with an assessment of local needs, school or district priorities, school and community values, and resource capacity. This macro-level assessment is about understanding stakeholder priorities, setting goals and objectives aligned with the priorities, and allocating resources appropriately. It also sets the groundwork for an evaluation of effectiveness. The assessment of needs also includes collecting and analyzing student data to determine levels of ability and achievement, interests, and learning needs, as well as how each will be served through programming.

5.2. Assessment of Learning Needs and Growth

Learning depends on students experiencing optimally matched challenges—curriculu m and instruction that exposes them to concepts and skills beyond those they have already mastered and psychological supports that help them cope effectively and thrive when challenged. This approach [34] supports continuous growth, motivation for learning, and helps learners develop the executive functioning skills needed for success in higher education and the workplace. When it comes to the assessment of learning needs, there are two main purposes. The first is to identify a student's current level of achievement and/or ability, which can inform decisions about the type and level of service that is required (e.g., enrichment with age-level peers, accelerated pacing, and advanced content typically provided to older students). The second is to inform instructional activities in the classroom, helping the teachers differentiate content, approaches to instruction, or pace of learning.

Educators in talent development programs should engage in three types of assessment: preassessment, formative assessment, and summative assessment. Preassessments serve two purposes: for placement into a particular program or course and for planning responsive instruction once a student is placed. Once students are enrolled in programs, the preassessment helps the teacher customize the program to students' readiness level as well as differentiate within the program for learners with different previous exposure or knowledge of the content.

Formative assessment, or assessment for learning, should take place regularly over the course of a program. It is an assessment of student understanding and provides feedback to the student and teachers on the learning process. Formative assessments occur quickly so that both the teachers and the student can respond and make changes that will increase the effectiveness of the instruction. Formative assessment can also afford opportunities to identify areas of student interest within the curriculum and capture information about learning modality preferences that teachers can use to help teachers tap into students' intrinsic motivation and more effectively differentiate instruction.

Summative assessment, or a teacher's assessment of student learning, is needed at the end of a course or program of study to measure progress toward learning objectives (growth) because of the experience that has been provided. These summative assessments document levels of mastery and growth from the start of the program and result in recommendations for future instruction. A summative assessment might also include opportunities for students to reflect on their learning experience to develop a deeper awareness of their own interests and abilities as well as reflect on the efficacy of their approach to mastering the unit of curriculum to refine their study and metacognitive skills.

For the program leaders, being able to collect and analyze assessment data about students is important for progress monitoring, providing a "big picture" view of how students are moving along their trajectories and moving from stage to stage; for example, are the program experiences preparing students for further advanced learning at the next stage of talent development? Assessments at each stage of talent development can function as checkpoints after students have received services and participated in programs, both in school and outside of school, and can be used in academic and career planning. Ideally, each subject area would have access to gatekeepers or other professionals in the field who can advise or mentor students and discuss non-standardized methods of assessment with the program staff or ways to seek out more niche indicators of creative talent.

5.3. Assessment of Interests

Talent development is maximized when curriculum and instruction connect to learners' own interests and goals and when their efforts are supported and reinforced by peers, teachers, family members at home, and the community at large. Therefore, assessing all learners' interests and values is useful in planning talent development programs and services. Approaches to assessing student interests range from practitioner-designed interest surveys, standardized assessments of interests, and "action research" approaches that sample non-test data (see Table 2). Subject matter experts may want to consider topics that are not available in the school curriculum that are more attractive to some talented students. For example, Krutetskii [20], in his pathbreaking study of mathematically talented students, recognized that students might be gifted in approaching mathematics spatially, such as in topology, rather than formally through numbers and symbols.

Similarly, family and community support are invaluable to building a sustainable set of services for talent development supported by the school community. Surveying and interviewing families about the fields they would like their children to explore, advanced learning opportunities they would like their children to have, their perceptions of their children's strengths and interests, and what obstacles they perceive and encounter in helping support their children in pursuing their interests and aspirations can all be highly informative.

When soliciting family and community input, it is important to be mindful of potential barriers to participation that students and families may experience, such as inflexible work schedules that limit attendance at meetings to inform families of talent development programming, uneven access to telecommunications technologies, home language, or logistics that impact participation in extracurricular or outside-of-school opportunities. Equitable participation in stakeholder input is vital to process validity, as an inconsistent response from stakeholders to requests for input often leads to some perspectives being underrepresented (or unrepresented altogether) in the data, which are then used to inform decision-making processes. Therefore, the provision of multiple opportunities to provide input through multiple means will help ensure that organizational leaders have a clear and accurate understanding of community perspectives. Programming for parents can be instituted to help them deal with the challenges their children may encounter when participating in advanced programs such as fears of failure, perfectionism, or anxiety as well as address issues such as parental expectations for students to pursue particular fields of study rather than following their true interests and passions.

Table 2. Assessment to support talent development in specific subject areas.

Admission and Placement Options	Preassessment for Learning	Formative Assessment for Learning	Summative Assessment of Learning and Growth Monitoring
Cognitive Ability • Assessment of learning skills in verbal, quantitative, nonverbal domains • Cognitive Abilities Test (CogAT) Establishing preferences and strengths profiles Purpose: Assessment of content in domains (Reading, Language, Mathematics, etc.) • Measures of Academic Progress (MAP)	Formal • Unit preassessment • Prior unit test • Standardized test • Writing prompt • Work samples and products • Concept maps • Self-evaluations	Formal • Rubrics • Quizzes • Writing prompts • Concept maps • Graphic organizers • Exit tickets • Homework	Traditional Formats • Standards-based assessments • Benchmark tests • End-of-unit or end-of-course tests • Above-grade-level assessment
Purpose: Aptitude (above-grade-level) • Readiness for advanced instruction (acceleration) in domains • An ability or achievement test given 2 or more years ahead of schedule. The SAT is given to students aged 12–15	Informal • Questioning • Observation of learning activities • Inventory of what students know, want to know, have learned (KWL) • Turn and talk with peers • Show of hands	Informal • Questioning • Observation of learning activities • Discussions with peers • Show of hands • Reflections • Check-ins	Performance Based • Projects or products • Portfolios • Performances • Rubrics
Portfolio Purpose: • Products, performance, grades, recommendations indicating ability and achievement in specific domains Interest Inventories Purpose: • Insight into passion areas, motivation, depth of knowledge	Purpose: • Identify holes in learning • Identify current knowledge and skills, strengths in the course content • Areas of intense interest and levers for motivation • Opportunities for differentiation (compacting, tiered lessons, complexity, rigor)	Purpose: • Check student understanding • Effectiveness of instruction • Areas for greater guidance • Opportunities for differentiation (compacting, tiered lessons, complexity, rigor)	Purpose: • Assess the learning that has occurred • Monitor growth over time • Determine readiness for future study • Academic planning

5.4. Program Evaluation

As stated previously, assessment and evaluation at the school level is about understanding stakeholder priorities, setting goals and objectives aligned with the priorities, allocating resources appropriately, and determining effectiveness in meeting goals and adhering to the talent development model. As with the assessment of students, program assessment—looking at the quality and impact of programming—has formative and summative components (see Table 2).

Establishing a consistent, ongoing process for formative assessment allows school leaders and key stakeholders to learn about program strengths and challenges to determine recommendations that lead to improvements. These ongoing assessments—surveys, observations, and discussions with stakeholders—help ensure that programs adhere to evidence-based practices and meet the needs of the students. The goal of formative evaluation is not to pass a holistic judgment on the quality of education for students, but rather to help build consensus around desired outcomes for programming efforts and provide valid baseline data to guide future program development and continuous improvement efforts.

Full-scale summative program evaluations, scheduled on a regular cycle, are helpful for documenting impacts over time and managing resources. They serve as the basis for strategic planning and as a benchmark for continuous improvement. Summative evaluations typically require both internal and external stakeholders to balance insider knowledge with global research and standards of quality. These full-scale summative evaluations are generally recommended to take place every five years unless a significant issue or change precipitates a need for a shorter or longer cycle.

6. Building a Continuum of Services within a School

The TDMM is responsive to students' interests, goals, and assessed needs. Programming and support services intensify as young peoples' abilities (academic, behavioral, and social-emotional) and motivation increase. Movement among levels of service may change over time and through the stages of talent development and should be supported by data from assessments, interest inventories, progress monitoring, and how an individual responds to services. The most challenging to manage is the TDMM principle that domains start at different times. This means that students in later starting domains, those that require more understanding of human behavior, or those who are simply offered later in the school curriculum need to maintain their motivation for learning until they are introduced to the spark that begins the talent development process. For this reason, programming and instruction for traditionally identified intellectually and high achieving students who may be engaged in later starting domains may be maintained through the middle grades, followed by advanced classes in specific domains in upper secondary school.

School leaders are encouraged to see their role as crafting "talent developing" opportunities for all students that match their particular stages of development—and not a single gifted program. This can consist of all types of enrichment programs for students whose talents, motivation, and interests are just emerging while simultaneously having accelerative programs for students with high achievement and motivation [14]. Table 3 describes a framework for a talent development curriculum's scope and sequence.

Table 3. Talent development across grade bands but starting at different grades.

Potential	Competence	Expertise
Students are afforded opportunities for exploration through mostly "low stakes" activities that prioritize hands-on activities, thinking aloud with others, and short opportunities for quiet reflection and independent work. Enrichment focuses on exposing students to a variety of topics, domains, and experiences. Cultivating positive risk-taking, intrepidness, and social skills are important goals. Students who show early indicators of ability and interest in a topic or domain are afforded opportunities for deeper exploration. Exposing students to authentic vocabulary in these fields is a priority. Capacity for self-directed learning is cultivated through center-based learning and choice-based differentiation.	Enrichment begins to shift focus from breadth to depth within students' areas of interest and strength, but opportunities to explore new domains continue. Some activities and experiences related to the talent domain should tap into the rising importance of effective social interaction. Competitions and public exhibitions of student work can be one way to provide opportunities for interaction and cultivate relevant communication skills. Structured simulation activities based on authentic problem scenarios provide opportunities to introduce authentic practices of professionals in domains and values and the "tools of the trade" they use in a safe environment. Students receive early exposure to higher education and career opportunities in the talent domain. Student capacity for self-directed learning is cultivated through short-term, project-based, and problem-based learning. Include match up with mentors who can provide insider knowledge and contacts.	Enrichment focuses on providing opportunities for advanced learning in areas of strength and interest. Co-curricular, extracurricular, community-based, and informal learning are high priorities. Opportunities for career exploration, including extended authentic learning experiences, are core components of the curriculum. Tapping professionals with expertise or experience in fields related to students' talent domains to provide authentic audiences and authentic feedback and integrating community-based learning experiences into programming can help students learn the cultures, values, and specialized language of fields related to their talent domains. Long-range academic planning is a core parallel service alongside curriculum-based program experiences. Capacity for self-directed learning is cultivated through significant online learning experiences and guided independent study. Facilitating student's early entry into a domain of talent is a top priority, especially for students from populations underrepresented in those domains. Students are explicitly taught how to navigate cultures and values of fields related to their domains and are supported in building networks of peers and mentors. Supportive peer affinity groups foster a sustained commitment to talent development in domains of strength and provide networks for emotional support and collaboration. Support from performance psychologists (through counseling and/or expert-designed programs implemented by other facilitators) is available to participants approaching elite competitions, public performances, exhibitions, and auditions to develop mental focus, cope with stress, and develop resilience in the face of setbacks. Mentors pick mentees they want to work with and cultivate and guide them toward niche development.

6.1. Talent Development at the Potential Stage

Keeping in mind that different domains start at different ages, at the potential stage, assessment can include informal observation of interest and ability in response to more advanced or enrichment-oriented programming. More formal assessment through achievement or ability tests can be used for students who demonstrate significant knowledge or advanced skills for the purpose of appropriate placement or acceleration. Enrichment programming should continue to be offered in a variety of domains or subject areas, with an emphasis on the exploration of ideas, authentic materials, self-directed learning, inquiry, and STEM methodology and developmentally appropriate instructional strategies such as hands-on learning with manipulatives.

These early enrichment opportunities should serve as a conduit to an articulated scope and sequence of courses and content for each subject area—that is, vertical pathways from potential to expertise (see Table 4). Although the emphasis is primarily on exposure, measurable outcomes for learning and psychosocial skill development should be defined, and best practices within gifted education, such as accelerative options, should be used for students who demonstrate advanced skills. Psychosocial skills such as openness to feedback and persistence can be developed through appropriately challenging learning activities that require higher levels of thinking, problem solving, collaboration with peers, and feedback for improvement from teachers.

Table 4. Services at the potential stage.

Assessment	Curriculum and Instruction	Psychosocial Skill Development	Insider Knowledge
Observations of response to challenges and enrichment activities Interest inventories General ability and achievement assessment, when appropriate	Foundational knowledge and skills in a variety of domains Academic skill development through hands-on, collaborative learning activities	Adopting a growth mindset Learning to be open to instruction and feedback about strengths and weaknesses Developing attention, focus, and persistence through good and bad times Developing a sense of agency, self-efficacy Demonstrating executive functioning skills (time management, organization, etc.) Socializing with peers. Working well alone and with others	Invitations to specialists in the fields in question to give informal talks about how they attained their current position and what they wish they knew then that they know now. Moreover, how the field has changed since they were in school.

6.2. Talent Development at the Competency Stage

Although each stage of talent development is important to high levels of achievement and creative productivity in adulthood, the competency stage is a pivot point for many young people. Opportunities for both in-school and outside-of-school enrichment and acceleration play a significant role in moving students through the competency stage to the expertise stage and helping them find specializations within domains that appeal to them for advanced education and careers (see Table 5). The effort to develop foundational knowledge and skills often requires study and practice, which talented students may not be used to or enjoy, presenting a unique challenge to students who may have always found learning easy and effortless.

Table 5. Services at the competency stage.

Assessment	Curriculum and Instruction	Psychosocial Skill Development	Insider Knowledge
Domain-specific assessments of knowledge and interests Projects and performance assessments in content areas Opportunities for above-level assessment of advanced learners Career interest and strength inventories	Content-specific approaches that support "thinking like an expert" and content acquisition Application of reasoning models for critical and creative thinking Accelerated and enriched learning (based on assessment of readiness and learning needs) using problem-based and inquiry-based activities Differentiated learning activities Use of concepts and themes to organize ideas Academic skill development, focus on metacognitive skills (thinking about one's learning) Authentic products that include specific criteria for evaluation/feedback	Balancing extrinsic and intrinsic motivation, particularly when it comes to practicing important skills. Taking responsibility for addressing weaknesses and building on strengths. Demonstrating executive functioning skills (time management, organization, etc.). Seeking out feedback and critique. Taking guided academic risks. Learning to manage competition and overcome failure or setbacks. Focusing on positive emotions such as optimism and hope. Finding a peer group in the domain. Demonstrating empathy.	Mentors share who are the gatekeepers in the field Make it explicit that extracurricular and post-secondary experiences should be considered and planned for Possible sources of finances to support more specialized opportunities The range of subfields possible within a domain and related educational and career paths

In the process of reminding teachers that different domains start at different ages, the assessment of interests and abilities via formal interest surveys, or more informal teacher observations, should continue at this stage so as not to miss "late bloomers." Additionally, domain-specific assessments can be used more frequently for purposes of student placement and program planning (e.g., mathematics assessments for advanced math classes). Above-grade-level assessments should be provided for students who are already performing at the ceiling of achievement tests for their age or grade level.

Accelerative options become increasingly important at this stage and can be applied for an individual student (e.g., several grade skips for a particular subject) or for groups of students, (e.g., an accelerated math or language arts track that compresses several years of content into a smaller time period).

Accelerative options are also necessary at this stage because student competencies become more variable across domains and grade-level classrooms may have students functioning at many different grade levels, making it increasingly problematic to rely on age as a proxy for readiness for specific curriculum. Enrichment options are still important, particularly if they offer advanced content learning and skill development with an emphasis on authentic materials and experiences (e.g., competitions, projects), self-directed learning, inquiry, and STEM methodology. At this stage, programming should begin the process of exposing students to more authentic work in a domain through projects, exposure to adult professionals, and exposure to the tools and values that domain experts employ in their work. Additionally, less advanced enrichment options can be used as extracurricular activities to allow late bloomers to shine and demonstrate interest and potential.

Psychosocial skill development can be fostered at this stage in several ways:

- The use of authentic materials that result in learning experiences that require application and problem-solving in the domain;
- The designing of courses for more advanced learners;
- Constructive feedback given by experienced teachers to students about their problem-solving, creativity, and motivation;
- Opportunities for regional, national, and international competitions to allow students to benchmark their skills against other students, practice important communication and interpersonal skills, and learn to manage setbacks or success productively.

6.3. Talent Development at the Expertise Stage

Not everyone aspires to achieve eminence nor is able to reach that level of talent development; however, when well matched to careers aligned with their interests and strengths, far more people have the potential to experience a lifetime of achievement and fulfillment and reach expertise. At this stage of talent development, assessments of ability and potential should be solely domain specific, including the participation of adult professionals within the domain who have considerable knowledge about the content expertise needed but also other characteristics that are important for success in their field. These individuals may be more open to individuals viewed as having atypical profiles and how they might succeed in a particular area of their domain. Assessments at this stage can also include career interest inventories and leadership surveys to assist with career guidance and goal setting and offer recommendations or plans based on results.

At the stage of expertise, talent development programming should consist of opportunities that provide in-depth, authentic learning experiences that develop the skills necessary for achievement in careers (public speaking, leadership, communication) taught by practitioners with expertise in the subjects they are teaching—that is, they are connected to institutions of higher learning, industry, community organizations, etc. (see Table 6). In alignment with the talent development model, the program can deliberately incorporate career exposure and planning into each offering, explore and provide mentorship and internship services in the various tracks, and include entrepreneurial programming for the incubation of ideas. Psychosocial skills are best fostered at this stage through contact with adult professionals in the domain and through mentors.

6.4. Academic and Career Pathway Planning

Academic planning and career pathway exploration can start early in talent developm ent—as young as elementary school [35] (Wood et al., 2018) when it comes to mathematics. This does not mean academic tracking or early specialization, but rather exposure to a variety of domains, leveraging strengths and interests to maximize engagement and motivation, as well as establishing both short- and long-term goals for learning and achievement.

Academic planning and career exploration are valuable for young people at the potential and competency stages of their talent development, as they begin to envision possibilities for the future based on their interests, skills, and exposure to domains. Once a student's abilities and needs have been identified—through achievement or aptitude tests, observations, conversations with family members, engagement with challenging curricula, or other means—a plan for systematic and continuous educational plan for courses and talent development opportunities through secondary school, university, and beyond should be developed with the assistance of subject matter specialists from inside and outside of the school system, as well as respected practitioners in related fields. For students who are accelerating through high-level curricula at a pace faster than age-level peers, it is important to plan out course sequences to allow for mentorships or internships, or other career pathways.

Table 6. Services at the expertise stage.

Assessment	Curriculum and Instruction	Psychosocial Skill Development	Insider Knowledge
Domain-specific assessments (skills, knowledge) Assessment by professionals through authentic tasks	Advanced, in-depth content on majors and professions Exposure to related content or skills needed for high-level achievement in the domain Entry into professional and creative domains (internships, apprenticeships) Work with experts, authentic tasks	Capitalizing on strengths while shoring up weaknesses Being comfortable with intellectual tension and with varied perspectives Strategic risk-taking Self-promotion, learning the rules of the field (explicit and tacit) Social skills, including arriving on time, being prepared, being courteous, and accepting success and failure with resilience Ability to manage competing priorities. Knowing when to ask for assistance. Collegiality and networking with peers	Where to go next for the next period of academic learning (e.g., institutions that are renowned for training in a particular domain or area of research) Who are the gatekeepers and current leaders and innovators in desired domains What are the typical obstacles they might encounter and how to manage them (e.g., finding a mentor, crossing disciplinary boundaries) Prioritizing time and mental resources How to build and capitalize on a network of colleagues

Specific to career exploration, young people in the potential and competency stages need opportunities to do the following:

- Compare and contrast different fields of study and related careers within a domain;
- Examine how careers or fields of study are connected to the things they are learning in their classes and workshops;
- Interview professionals about their work and pathway (education, experience) to learn:
    - What someone in the career does regularly;
    - The type and level of education and/or training required;
    - What the work environment is like (indoor/outdoor, individual or team, amount of travel, etc.);
    - What kind of work/life balance is required;
    - Options for growth, a typical trajectory, and related careers/positions.

According to Wood et al. [35], "determining a career direction is a central focus for adolescents who are entering adulthood and is an iterative process that may be revisited several times in their lifespan" (p. 629). Unfortunately, career counseling is not usually as accessible as it needs to be to help young people reach their full potential. In many cases, it is not until they reach young adulthood that career counseling is provided, and, even then, it is generalized, not based on interests, skills, and experiences.

At the expertise stage, activities that help adolescents and young adults determine likes and dislikes, strengthen their self-efficacy, and determine to what extent their interests are motivating choices include the following:

- Completing career interest and values inventories and reviewing results with professionals;
- Receiving exposure to occupations through career fairs, interviews with professionals, workshops, or self-study (books, web searches, etc.);

- Engaging in self-reflection exercises that examine past successes and challenges, prior work experiences, extracurricular activities for skills learned, likes and dislikes about the experiences, and hopes for future opportunities;
- Working with a counselor and peers with similar interests and abilities to envision future outcomes and develop goals consistent with their dreams and abilities;
- Practicing agency and advocacy in identifying and fulfilling goals;
- Exploring what future jobs will look like, especially in emerging fields such as artificial intelligence, green energy, engineering, and big data;
- Focusing on skills that will be critical in a wide range of career fields, including problem solving, critical thinking, communication, and collaboration.

7. Discussion and Future Directions

A key distinction between traditional gifted education and TDMM is the intended outcome or goal of gifted programming. In the gifted child approach, providing educational programs that are a better match to students' learning abilities is the immediate goal, and the long-term goal is often unspecified [23]. In the talent development framework, the immediate goal is to help children acquire both the cognitive and psychosocial skills needed to move to the next stage of talent development—for example, to move from potential to competency to expertise and to keep students on that path. The long-term goal is to enable more individuals to become creative producers in adulthood and to achieve at eminent levels [1,9]. However, given that the path from childhood to adulthood is long, filled with chance events, and affected by choices and opportunities, it is not expected that all or even many gifted children will produce transformational ideas or products.

The goal of talent development is to prepare children with the knowledge, psychosocial skills, and support they need to be able to function at the highest levels *they desire* in their chosen fields. Individuals may decide not to proceed on a path toward eminence, and professionals are obliged to honor those decisions without coercion; however, the choice should be based on personal values and preferences, rather than poorly developed psychosocial skills, inadequate preparation, or a lack of appropriate opportunities and insider knowledge [14]. By having the highest levels of achievement and creativity as the long-term goal of programming, more gifted children might pursue paths towards levels of excellence in their chosen areas of interest and talent. Some fields are less developed, competitive, and filled with tradition than others (e.g., software engineering vs. medicine), making transformational contributions [36] (McWilliams et al., 2109) more accessible and less subject to gatekeepers and other constraints. New fields will emerge over time. Finally, a specialized career guidance team could help individuals create academic and career plans, develop portfolios in preparation for job interviews or applications for university, and provide connections to businesses, government resources, and other networks.

7.1. Supporting Talent Development at Home

Families have a strong influence on children's beliefs, values, and opportunities, and, consequently, they have an important role in talent development. When it comes to developing talents fully—particularly in students with exceptional potential in a domain—the influence of the family can be the determining factor in whether that potential is actualized. Engaging parents in talent development starts with making the philosophy, framework, and related continuum of services available to families by posting it on website pages and through other social media, providing program materials to parents in their home language, and through parent meetings. Providing clear, comprehensive information helps ensure that all parents, teachers, and students in the community have access to and understand what to expect from the opportunities available to participants. Experts in gifted education, talent development, and career development can offer workshops and seminars for parents on topics that are relevant to the age and talent development stage (see Table 7). Parent workshops need to be tailored to the community. For example, a concern for some families is that talent development programs will result in their children leaving their communities or choosing careers that are not acceptable to family values.

Parents are their children's first teachers, and this frequently means that parents introduce children to talent domains with which they are most familiar—through their careers, their own hobbies, or family-based activities. In one study [37], researchers found that most of the talented individuals they interviewed were introduced to their eventual talent domains at a very young age by their parents. Though some children have interests and strengths that align with their parents, others do not. Additionally, new fields of study and careers emerge regularly, and talent pipelines need to be developed. If children are mainly introduced to potential areas of interest and study by parents, it makes sense, from a talent development perspective, to introduce parents to unique and rapidly evolving domains that may appeal to their children.

Table 7. Potential topics for parent education.

Emergent Talent Stage
- Talent Development Theory
- Talent Identification: Finding Children's Strengths and Interests
- Being Open to Areas of Interest Outside the Family's Experience
- Finding Talent Development Opportunities: The Role of Enrichment and Supplemental Programming in Talent Development
- Social-Emotional Needs in a Talent Development Approach
- Non-cognitive Skills that Support Achievement and Performance
- Advocating Effectively for Your Child
- Competency Stage
- Parenting for Achievement and High Performance: Finding Talent Development Opportunities
- The Role of Assessment and Monitoring Growth in Talent Development
- Enrichment and Accelerated Programming
- Developing Autonomous Learners
- Connecting with Peers and Creating Networks Inside and Outside of School
- Non-cognitive Skills that Support Achievement and High Performance
- Becoming Familiar with the Role of Mentors
- Working Collaboratively with Schools
- Planning for Higher Education and Career Exploration
- Expertise Stage
- The Essential Role of Mentorships and Internships
- Creative Productivity in Adulthood—Joys and Sacrifices
- High-Performance Psychosocial Skills
- Networking with Peers and Professionals
- Getting Ready for Higher Education and Careers

7.2. Supporting Talent Development in the Classroom

Young people need teachers and mentors with expertise and experience to help them fully develop their talents. One aspect of expertise is content and tacit knowledge of a domain, and another important aspect of expertise is pedagogical knowledge and familiarity with the talent development model and the content and skills of the subject beyond the grade level of instruction.

Teachers and program administrators will likely need professional learning opportunities from the fields of gifted education and talent development, including the tenets of the TDMM, knowledge about how talent can manifest in different domains of ability and their trajectories, and knowledge about the cognitive and psychosocial skills necessary at each stage of talent development. Teachers may also need to have higher levels of content knowledge in order to meet the demands for more advanced content earlier.

Talent development requires that educators regularly assess interests, strengths, and learning needs and adjust instruction and learning outcomes in response.

Therefore, knowledge and consistent use of tools and strategies for preassessment, formative assessment, and the identification of advanced learning needs are critical. Creating optimally matched learning environments that result in talent development requires that educators and program administrators be knowledgeable of approaches to accelerating instruction for students who have demonstrated a mastery of content or potential for advanced learning. There are many forms of acceleration, from early entrance to school or educational programming to compacting instruction to minimize the amount of time spent on material students have already mastered. Topics for professional learning could include (a) compacting instruction, (b) tiering lessons, and (c) increasing rigor and complexity through leveled questioning. Teachers and program coordinators should be able to adjust content and programming to address pace (rate of instruction), depth (deepening the knowledge of a domain), and complexity (using advanced thinking strategies), and schools need to have a policy and procedure in place to make decisions about how and when to allow students to enroll in programs early (which has typically been allowed based on age or previous course work).

8. Conclusions

Although school is the primary place for embarking on a talent development trajectory, it cannot be the sole place for an expansive view that includes the acquisition of expertise in any domain. Students will need support outside of school from programs, mentors, competitions and fairs, and higher education. This article focused specifically on talent development that can reasonably take place in school with the assistance of school personnel that are knowledgeable about out-of-school services and opportunities. In this article, we distinguish between programming that is based on developing domain talents from that of a traditional gifted education that assumes that a gifted child is globally gifted. We offer principles that feature a reliance on cognitive and psychosocial development, as well as suggestions based on best practices to support identifying potential, assessing growth, and incorporating a wide array of professionals and adults in supporting talented children and youth to achieve their goals and aspirations.

Author Contributions: Conceptualization, R.F.S., P.O.-K., S.C., E.C. and F.C.W.; data collection and analysis, R.F.S., P.O.-K., S.C., E.C. and F.C.W.; writing—original draft preparation, R.F.S., P.O.-K., S.C., E.C. and F.C.W.; writing—review and editing, R.F.S., P.O.-K., S.C., E.C. and F.C.W. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: No new data were created for this article.

Conflicts of Interest: The authors declare no conflict of interest.

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education sciences

Article

Teachers' Beliefs and Their Influence on Math Instructions for Gifted English Learners

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Abstract: The dynamic interplay between teachers' beliefs and practices significantly impact the quality of instruction and the trajectory of talent development in young students. This case study explores the beliefs and practices of two elementary teachers instructing gifted ELs in mathematics. The constant comparison method was used to analyze data collected from classroom observations, semi-structured interviews, and field notes. Three factors were found to affect the (in)consistency between teachers' expressed beliefs and observed practices: compatibility among core and peripheral beliefs, knowledge about evidence-based practices, and classroom management skills. Students exhibit higher levels of participation, communication, and engagement in critical thinking skills when their teacher embraces constructive perspectives in teaching mathematics, demonstrates pedagogical expertise, and employs a proactive classroom management approach. Conversely, students encounter restricted opportunities to independently construct their own understanding of mathematics when their teacher holds maladaptive beliefs about teaching mathematics, has limited knowledge of evidence-based practices, and has an authoritarian classroom management style. These findings underscore the need for a new approach to professional development (PD) that encourages teachers to critically examine the connection between their beliefs and instructional practices and their impact on the student's mathematical talent development.

Keywords: English learners; elementary math; giftedness; teaching practices; teachers' beliefs; perceptions

Citation: Yang, J.; Özbek, G.; Cho, S. Teachers' Beliefs and Their Influence on Math Instructions for Gifted English Learners. *Educ. Sci.* **2023**, *13*, 728. https://doi.org/10.3390/educsci13070728

Academic Editor: Jacobus G. Maree

Received: 1 June 2023
Revised: 12 July 2023
Accepted: 13 July 2023
Published: 17 July 2023

1. Introduction

The U.S. has seen disappointing results from policy initiatives aimed at the inclusion of English learners (ELs) in gifted education [1–5]. In contrast to the 60% growth in EL enrollment nationwide, reaching as high as 200% in some states [6], the number of ELs in gifted programs stagnated at a mere 2% [7]. So, how did a country that prides itself on being a "nation built by immigrants" fail to capitalize on the diverse talents of its youngest citizens? This study contends that the inadequate scrutiny of the interplay between teachers' beliefs and instructional practices, as related to gifted ELs, plays a central role in this shortcoming. To foster an environment of equity, one that empowers ELs to flourish in gifted education programs, it is imperative for us to gain a robust understanding of how teachers' instructional practices are shaped by their beliefs regarding gifted EL students, talent development, and the teaching of mathematics. So far, endeavors toward this objective have been hindered by the extremely low enrollment of ELs in gifted programs. We are unlikely to gain a comprehensive understanding of how to effectively teach ELs in gifted classes when these students are either absent entirely or grossly underrepresented in these programs. This dearth of research evidence was underscored by Mun and her colleagues [8] in their systematic review of literature on ELs in gifted education, in which only seven (7) empirical studies on effective instructions were identified.

This present case study stands out for its distinctiveness, as it delves into the beliefs and actions of two teachers who were tasked with instructing classes exclusively composed of gifted ELs in mathematics. The insights gained from this study concerning teachers' beliefs about gifted English learners (GELs) and the consequential impact on their instructional practices will significantly contribute to the advancement of teacher training. By illuminating the intricate relationship between teachers' beliefs, instructional approaches, and quality of teaching, this study will inform the development of targeted interventions aimed at enhancing the teacher's capacity to effectively teach diverse learners. Promising avenues for such interventions include professional development and peer mentorship programs, which offer valuable opportunities for teachers to engage in reflective practices. Through these initiatives, teachers are encouraged to critically evaluate their own beliefs and instructional practices and to identify areas where they might deviate from evidence-based recommendations. By actively participating in a continuous cycle of self-reflection and professional learning, teachers gain the power to serve as catalysts in fostering the talent development of every student.

This study is informed by a situated-sociocultural perspective on mathematics teaching and learning. We posit that learning is meaning-making, "a process by which people interpret situations, events, objects or discourses, in light of their previous knowledge and experience" [9] (p. 106). The critical role of meaning-making, with particular attention to the shift away from students' mastery of discrete elements of content towards the development of reasoning, communication, and problem-solving skills, is a central tenet of the effective teaching practices identified by the National Council of Teachers of Mathematics [10,11]. For GELs, learning is optimized in classrooms that offer them abundant and diverse opportunities to engage in cognitively demanding tasks that encourage risk-taking, sense-making, and reinterpretation of knowledge within compatible social contexts [12]. There is substantial evidence [13,14] that with appropriate curricular and instructional support, ELs can participate, contribute, and succeed in math in spite of and because of their language diversity. ELs have the capacity to develop their proficiency in both languages as they participate in communicative and meaningful tasks [15], and they can bring new perspectives and resources to the classroom that can benefit their peers [16]. This strength-based perspective of Els positions these students as strong candidates for gifted and talented services.

1.1. Teacher's Role in Gifted EL's Talent Development

The role of teachers in facilitating ELs' access to rigorous learning opportunities is crucial in these students' development of mathematical talent [17–19]. Effective mathematics instruction for ELs necessitates the teacher's deep understanding of the linguistic and cultural backgrounds of his/her students, as well as their unique learning needs [20,21]. Teachers who implement pedagogical approaches that promote inquiry-based learning, nurture critical and creative thinking skills, and provide support for language-rich mathematical discussions have been found to significantly enhance ELs' mathematical comprehension and proficiency [18,20]. Teachers who hold positive beliefs about EL's potential for academic growth are more likely to set challenging goals and provide the necessary support to help ELs reach their full potential [22]. Considering the substantial body of evidence indicating that ELs can achieve remarkable levels of academic success when supported by teachers who possess asset-based beliefs and a toolkit of culturally responsive teaching strategies [23–25], we must reject any notion that cast ELs as less-than-capable students. They should be viewed as multi-competent [26] learners who can draw from their cultural and linguistic knowledge as they discover and employ multiple ways of meaning-making.

1.2. Relationship between Teachers' Beliefs and Practices

The scholarship on the role of teachers' beliefs in teaching and learning spans decades and can trace its roots to the first edition of the Handbook of Research on Teaching [27]. It has grown considerably since then and has taken many directions. The complexity of teachers' beliefs manifests in both the range of beliefs and the intricate manner in which these beliefs are structured and applied. Beliefs are organized within a complex, interconnected, and multidimensional system [28] and are held with varying degrees of certitude [29] by the individual, subject to change with time and experience [30], and can coexist with conflicting beliefs [31,32]. The strong elements of subjectivity and fluidity that undergird the construct of teachers' beliefs affect how beliefs are used as contextual filters through which teachers interpret their experiences, shape their interactions with students, and enact classroom practices [33,34]. Hence, it is not surprising when discrepancies arise between what teachers think they should do (beliefs) and what they actually do (observed practices).

1.3. Relationship between Teachers' Beliefs and Instructional Practices

Teachers' beliefs play a crucial role in shaping instructional practices, particularly in the domain of mathematics and gifted education [35–37]. These beliefs influence the choices teachers make regarding curriculum, instructional strategies, and classroom interactions. Understanding teachers' beliefs about math and giftedness and their impact on instructional practices is essential for providing appropriate educational opportunities that foster the talent development of gifted students. While the connection between teachers' beliefs and their practice may seem self-evident, there are many times when a teacher's expressed beliefs are incongruent with his or her actual classroom practice [38,39].

Teachers' beliefs about gifted students can vary widely, influencing their perceptions of giftedness and the instructional strategies they employ in the classroom. Unfortunately, certain teachers may have a fixed mindset, believing that giftedness is innate and unchangeable. This mindset may lead to limited expectations for their gifted students' academic growth and a lack of differentiation in instruction. In contrast, teachers with a growth mindset view giftedness as a malleable trait that can be developed through effort and effective instruction. These teachers are more likely to provide challenging and engaging learning opportunities for gifted students [40]. However, there are times when teachers profess growth mindset beliefs but do not translate them into effective instructions in the classroom [41]. This disconnect is not exclusive to general education teachers who may not have received adequate professional training in research-based practices. It can even be found in teachers who were trained to teach gifted students. Tofel-Grehl and Callahan [36] found that while teachers in specialized STEM high schools ranked inquiry-based learning as a priority, the observed instruction consisted of lectures with a high proportion of work correction and homework practice. This incongruency between beliefs and practices can be so stark that even their students are acutely aware of it. In interviews with the researchers, students readily expressed their frustration about the dissociation between their teachers' words and actions, "they [the teachers] say we do inquiry, but all we do is what we are told. It's kinda lame sometimes" [36] (p. 48).

While many experts consider mathematics-related beliefs to be a significant, or perhaps the most influential [29] predictor of teacher behavior, the relationship between teachers' beliefs and practice is not unequivocal nor linear. Teachers' beliefs about the nature of mathematics can vary along a continuum from a procedural-oriented, deductive view to an inquiry-driven, constructive view [42]. The constructive perspective supports a learner-focused model of teaching that prioritizes individual sense-making and supports the establishment of a student-centered environment [43]. The deductive view aligns with a teacher-directed transmission approach that focuses on students following rules and replicating procedures rather than constructing knowledge [44]. However, there are many times in which teachers who endorse constructivist views about teaching and learning do not necessarily implement classroom practices that reflect those beliefs [45–47].

1.4. Factors That Affect the Relationship between Teachers' Beliefs and Practice

Why do teachers often fail to align their actions with their stated intentions? Although the question appears straightforward, the answer is a multifaceted issue with intricate layers. We will discuss four reasons for this misalignment and their implications in regard to student learning. First is the vital role that teacher preparation programs play in shaping teachers' beliefs and instructional practices. Research suggests that these programs may not adequately prepare teachers to bridge the gap between theory and practice [48]. Teachers may enter the classroom with strong beliefs about student-centered, inquiry-based instruction but lack the necessary pedagogical skills and strategies to implement them effectively. The absence of explicit training and support in translating beliefs into actionable instructional practices can contribute to the misalignment between what teachers believe is effective and what they actually teach in the classroom. The second factor is the various constraints and pressures under which teachers operate within our complex educational system. Time limits, standardized testing requirements, and curriculum mandates can limit teachers' ability to implement their preferred instructional approaches [49]. In such cases, teachers may feel compelled to prioritize coverage of content over student-centered, inquiry-based instruction. Additionally, external demands from non-teaching duties can negatively affect how much teachers spend in the classroom and teaching quality. For example, one (1) out of four (4) teachers loses at least 30% of his/her time through disruptions caused by disciplinary issues or administrative tasks [50]. The third factor is the lack of resources and support. Teachers require adequate resources and support to implement their instructional beliefs effectively. However, limited access to instructional materials, technology, professional development opportunities, and collaboration with colleagues can hinder the ability of teachers to align their practices with their beliefs [51]. Without the necessary resources and support, teachers may struggle to implement student-centered, differentiated instruction or lack the confidence to experiment with new strategies. As a result, their instructional practices may deviate from their beliefs. Lastly, the instructional practices of teachers are influenced by their own prior experiences as learners and habits. These ingrained habits and beliefs can be resistant to change, even when teachers hold progressive beliefs about effective instruction [48]. For example, a teacher who was primarily exposed to traditional, teacher-centered instruction during their own schooling may unconsciously default to similar practices despite recognizing the benefits of student-centered approaches. Overcoming deeply ingrained habits and beliefs requires deliberate reflection, ongoing professional development, and support from instructional leaders.

1.5. Need for Study

There is a plethora of research aimed at providing insight into the complexity of teachers' beliefs–practice relationship [52–60]. However, the beliefs–practice relationship within the context of teaching gifted English learners (ELs) remains unexplored. In Lucas, Villegas, and Martin's review on this topic [61], they were only able to locate five studies [62–66] that examined whether and in what ways teachers' beliefs about ELs relate to instructional practices. None of those studies investigated the direction and strength of the association between teachers' beliefs and practice as it pertains to gifted students or mathematics. This scarcity of research is in dissonance with the rapidly changing landscape of education in the United States and elsewhere in the world. As a result of migration and globalization, ELs are the fastest-growing student group, and two-thirds of these students are in grades K-5 [67]. Although teachers play an enormous role in the math talent development of young students, the connection between teachers' beliefs and practices remains underexamined, and even less is known about how beliefs inform the pedagogical choices of teachers in support of particular groups of underserved students, such as gifted ELs. This lack of understanding is part of the reason why ELs are continuously underrepresented in STEM fields in schools and in the workplace [68]. The purposes of the current study are to address limitations in previous research; examine teachers' beliefs and their teaching practices with gifted ELs; and explore how teacher and classroom characteristics affect the correlation between teachers' beliefs and teacher practices. The current study has the potential to provide insights into teacher preparation and professional development for teachers of culturally and linguistically diverse students. With more information about the interaction between teaching beliefs and practices, teacher educators will be able to develop strategies to support effective teacher behaviors and target and remediate undesirable ones.

1.6. Research Questions

The specific questions guiding this case study are: (a) What are elementary school teachers' beliefs about teaching math to gifted ELs? (b) How do elementary school teachers teach math to gifted ELs? (c) How consistent are teachers' beliefs and instructional practices? To answer these questions, we explore the experience of two second-grade teachers to probe the dynamics of the beliefs–practice relationship and its effect on the quality of teaching and learning in a math class of gifted English learners.

2. Materials and Methods

A qualitative case study [69] was used to examine teachers' beliefs about gifted English learners in mathematics and the way in which these beliefs are translated into classroom practices. Case studies offer an in-depth and holistic exploration of individual teachers within their unique classroom contexts [70], allowing researchers to capture the complexity and nuances of teachers' instructional decision-making. By conducting interviews and engaging in extensive observation, we, as researchers, deeply immersed ourselves in the natural setting of the classroom. This allowed us to directly witness, analyze, and evaluate teaching quality within the context of the instructional activity, teacher–student interaction, and learning objectives. This immersive approach enabled us to uncover the dynamics that underlie teachers' beliefs, the conditions under which beliefs are translated into practice, and the factors that either facilitate or hinder the relationship between teachers' expressed beliefs and their observed practices.

2.1. Context of the Study

This case study is part of a larger investigation of the teaching and learning behaviors in elementary math classes of GELs from underprivileged communities in a large urban school district located in the northeast of the United States [71,72]. Students were identified as mathematically gifted based on teacher observations of their mathematical skills and motivation to learn. This identification system is based on the position that access to gifted and talented programs should be expanded to include students with exceptional talent and/or who express a high level of interest in mathematics [73–75]. The students attended enrichment math programs 3 times a week after school for approximately 40 min per session for 6 months. At the beginning and end of the year, a 12-question math test was administered to assess students' knowledge in geometry, measurement, number sense, and algebraic reasoning. The test comprised a combination of single-answer questions and open-ended questions. Regularly scheduled classroom observations were carried out by the authors and graduate assistants in the eight participating schools. For the present study, Ms. A and Mr. B, two teachers from one of these schools, were selected for fine-grained analyses of the teaching and learning processes enacted in their classrooms.

2.2. Participants and Setting

We employed purposeful, criterion-based sampling for this study [76]. The selected school has a large, culturally, linguistically, and economically diverse student population and is located in a multicultural community. The school was chosen because its students and the community from which they come are representative of those who are often overlooked in scholarly discourses about talent development. By intentionally situating our study in this school, we take the position, as advocated by NCTM [75], that mathematical talent is evenly distributed across geographic, demographic, and economic boundaries. The selected elementary school serves 1702 students from preschool to fifth grade; 747 of these students are identified as ELs. The school's minority student enrollment is 100%, and 89% are economically disadvantaged students. In 2022, 38% of students scored at or above the proficient level for math, and 36% scored at or above that level for reading on the state assessment. The math proficiency rate for third-grade ELs was 15%, 8% for 4th, and 5% for 5th. There are 140 full-time teachers, 36 (26%) of whom are in their first or second year of the profession [77].

The two teachers selected for participation are representative of the two predominant types of teachers of ELs: (a) generalists trained as broad-field elementary school teachers and (b) specialists with a degree or certification in teaching English as a second language or bilingual education. Mr. B—a generalist—is the type of teacher that most ELs will encounter, as the number of teachers who are trained to work with language-minority students has not kept pace with the rapid growth of ELs in the school system. It is estimated that more than 60% of teachers have ELs in their classrooms, but only 10% of these teachers have completed sufficient coursework [78]—like Ms. A—to support these students. More information on the school and teachers can be found in Tables 1 and 2, respectively.

Table 1. School demographic information.

Students		Number	Percentage
Grade Level	Student K-5	1702	
	Grade 2	312	18%
Ethnicity	White	8	<1%
	Hispanic	1623	95%
	Black	1	<1%
	Asian/Pacific Islander	69	4.0%
	Other	1	<1%
Eligible for Free and Reduced Lunch		1521	89%
English Learners		970	57%
Gender	Female	852	50%
	Male	850	50%
Teachers with 3 or More Years of Experience		124	96%

Table 2. Teachers' demographic information.

	Ms. A	Mr. B
Teaching position	Dual language teacher	General and special education teacher
Age	Early 50s	Mid 40s
Gender	Female	Male
Education	BA: Political ScienceMaster: Education	BA: Business and MediaMaster: Education
Ethnicity	Hispanic	Caucasian
Number of years of teaching	17	5
Number of years of teaching in high-need schools	17	5
Number of years of teaching gifted students	3	2

2.3. Data Collection

The triangulation process [79] for these multiple cases relied on data collected from (1) classroom observations during the after-school math enrichment program, (2) a semi-structured interview about teachers' perceptions of and beliefs about mathematics and teaching math to gifted ELs, and (3) field notes from the interviews and observations.

***Teacher Interviews*:** Both teachers were interviewed twice in the six-month period during which they taught the gifted ELs in an after-school math enrichment program. The semi-structured interviews were approximately an hour long and conducted by the authors of this study. The questions focused on these teachers' perceptions of and beliefs about the characteristics of gifted ELs (How would you describe gifted English language learners (Els) in your class?), effective strategies in teaching mathematics (What are methods or strategies that you find to be effective and ineffective that you would change or remove?), and how to support gifted ELs in math (How would you describe a teacher's role is in supporting students? What can you do to help students to overcome challenges?). The interviews were audio-recorded and transcribed verbatim.

***Classroom Observations*:** Each teacher was observed for 24 after-school class sessions, about 40 min each, during a six-month period. The non-participant observations were conducted by the authors and graduate assistants. Teacher behaviors were observed across diverse settings and activities within the classroom (e.g., whole-class instruction, large-group activity, small-group work, free play, cleanup time, and transition). The aim of conducting observations across different settings is to comprehensively capture the variations in teacher practices that may be influenced by the specific characteristics of the immediate environments and activities. Extensive training was conducted prior to commencing observations to enhance reliability and validity among observers. The training was based on both videotaped classroom interactions and live observation in classrooms not in the sample. The verbal exchanges in the observation were captured by audio recording and were transcribed verbatim. The observer placed the recording device in a position that could best capture the discourse between the teachers and the students. The observer also positioned herself in the classroom where she could view and document the non-verbal interactions that were taking place between teachers and students and among students themselves. These observational notes were used in conjunction with the audio transcription to create a comprehensive observation document of the classroom.

***Field Notes*:** Field notes were immediately completed after each observation to enhance data and provide a rich context for analysis [80]. The field notes were used by the observers to create a condensed account of the class session, fill in details that were not able to be recorded on the spot, and provide reflections on the events that occurred. The field notes were used in conjunction with the data from the interviews and observations to help us make sense of the context in which the teacher–student interactions were taking place, gain insights into the observed teaching and learning processes, and generate questions about behaviors that are noteworthy for future investigation. The creation and analysis of field notes allowed the authors to engage in reflection about the study's framework and questions [81,82] and track our analytical thinking from the outset of the data-collection period and into an analysis period.

2.4. Data Analyses

The constant comparison method [83] was used to search for the meaning of every piece of information. First, the interviews, classroom observations, and field notes were thoroughly examined individually. This was followed by an initial round of open coding grounded in the framework of teaching behaviors [84]. After identifying the open codes from each case, we used cross-comparison [69] to coalesce and array the evidence across the two cases to identify the central themes relevant to teaching gifted ELs in mathematics. Looking between and within themes for each teacher, we developed an instructional profile for each teacher, characterized by their observed practices and explanations for specific actions. Finally, the data were categorized, restructured, and presented in narrative form [85–87].

Qualitative research acknowledges the role of the researcher as an instrument in shaping the results of the study [88,89]. As part of the process of identifying patterns in teachers' beliefs and instructional practice, the data analysis was deliberately interpretive. The interpretive framework is used to make assertions and comparisons regarding teachers' beliefs and practices based on the standards of practice established by the National Council of Teachers of Mathematics [10]. The expressed beliefs of the teachers and observed practices that align with the perspective of math as sense-making [10] were categorized as “constructive” or “student-centered.” Beliefs and practices that reflect the math-as-procedures [10] mindset were categorized as “deductive” or “teacher-directed.” Peer debriefing, triangulated sources, and thick descriptions of the data were used to add to the credibility and dependability of the findings [90]. The process of interpretive analysis involved extensive discussion between the authors of this study and members of the research team. Codes and themes were iteratively refined during periodic group meetings.

3. Results

The presentation of findings includes the comparison and contrast of the two teachers’ expressed beliefs, observed practice, and the (in)consistency between beliefs and practice, followed by a discussion of the factors that influence the beliefs–practice relationship. Students’ names are presented as pseudonyms.

3.1. Case Study: Ms. A

Ms. A believed that learning mathematics is a process of exploration. During interviews, Ms. A used the term “research” several times to describe mathematical learning: “I give them [students] the tools so that they can deepen their research. How to push it [learning] forward, how to question when they’re researching.” This perception of learning math as “doing” math is strongly correlated with Ms. A’s selection of instructional activities for her students. In a lesson about measurement, several stations with cups and containers in various sizes were set up around the classroom, with three (3) to four (4) students assigned to work cooperatively at each station (Figure A1).

In the following excerpt, Ms. A reviews the students’ results from the previous day’s activity, in which students compared how much water each type of cup (1 cup, $1/2$ cup, and $1/4$ cup) could hold.

> **Ms. A:** So, what did you learn from our experiment on Thursday? That was really interesting? Let us start with Leandro.
>
> **Student 1 (Leandro):** It was interesting that I found two half cups are one cup.
>
> **Ms. A:** So, there are two halves in one, in one whole cup . . . isn’t that interesting? Love your observations. How about you, Isabell?
>
> **Student 2 (Isabell):** Four (4) fourths made a whole cup.
>
> **Ms. A:** How many fourths make a whole cup? Four. It took four (4) of these (points to the $1/4$ cups) to make one full cup. Very interesting.

Ms. A purposefully elicited responses from multiple students, creating an environment where students were encouraged to share their observations, imbuing the activity with individual significance for each student. After students had developed an understanding that a “cup” is an ambiguous term that can be used to refer to several different types of measuring instruments, Ms. A challenged the students further with this question, “When you say this container holds four (4) cups of water, which cup? Which cup?” In the subsequent activity, Ms. A played an active role as a facilitator as students began to grapple with the idea that measurements can differ depending on the size of the measuring unit. Throughout this solution-finding process, Ms. A introduced tools to help students develop their problem-solving and reasoning skills. These tools extended beyond simple physical objects such as measuring cups, encompassing a wider array of elements, including graphic organizers. One such tool, the data chart (Figure A2), was distributed to students to help them accurately document their predictions and observations during the experiment. Tools such as these play a crucial role in fostering the development of essential critical thinking skills, such as data gathering, analysis, and presentation.

Ms. A believed that problem-solving extends beyond the task of finding the correct answer. When asked about how she judges the success of a student activity, Ms. A indicated that she looks for instances where "more conversation is happening between the students on [math] ideas". Ms. A was rarely observed asking students to produce a singular answer to a question. She was often found **to ask open-ended questions** such as "What was the most surprising discovery that you made while we were doing the water experiment"?, or "What did you discover that was interesting"? Ms. A was quite deliberate about the types of questions she asked. She explained the value of using open-ended questions to engage students in the activities: "open-ended questions make it [challenging problem] accessible . . . then usually you'll see these kids more involved, and more peers involved too." These statements showed that Ms. A was aware of the effect of purposeful questioning and deployed them accordingly to guide students through inquiry-based learning. These questions prompted students to reflect on their experience, evaluate possible solutions, and plan the next step of action. For Ms. A, the development of these critical thinking skills involved in the problem-solving process are more important than finding a pre-designated answer.

Ms. A believed that students learn through classroom talk. Ms. A asserted that talk is the pivotal element in mathematical learning. She stated, "The more they talk, the more they engage, the more English learners engage with content matter, the more they learn". Ms. A believes that student talk, either between peers or with the teacher, is a key indicator of effective learning taking place. And if a teacher hears "lots of mm-hmm", according to Ms. A, that is a sign that students are disengaged. Ms. A's high valuation of talk is reflected in her practice when she repeatedly prompted her students to openly share their ideas, defend the ones that they agree with, and critique the ones they do not. "Do you agree or disagree with [student's name] just said?" is a common question that Ms. A posed to her students during whole-class and group activities. Ms. A believed that students develop a deeper level of understanding of math through talk, as she explained the following: "If you can explain something . . . it is deeper, and it is also more internalized". Ms. A is also keenly aware of the obstacles that prevent students from participating in classroom discourse. She explained, "If children are afraid or they're shy and they don't want to engage, they're not going to learn. If you have the best math program, but your children are afraid because they don't know the language, and nobody makes them feel welcoming in their life".

Ms. A demonstrated a deep understanding of the significance of fostering a safe and inclusive environment for her students. She took deliberate measures to empower them to take initial steps towards open communication, often reminding them they were free to express their thoughts without reservation, "You can say anything you want". Moreover, she consistently emphasized the importance of mutual respect, asking students to "listen to everyone's ideas" when they are engaged in agree/disagree discourse. In a lesson on the measurement of area, Ms. A took further steps to demonstrate to her students that their voice mattered when she recorded every student's contribution to a whole-class discussion (Figure A3). She validated the students' ideas when she announced to the class, "Everybody makes different predictions . . . I am writing your ideas on the board".

3.2. Case Study: Mr. B

Mr. B believed that students should learn how to apply their knowledge to solve problems. When asked about expectations and learning objectives in mathematics, he said, "You need to get them to understand the steps of the problem and what is in the problem. So, they can . . . understand and how to apply it". Even though Mr. B used the term "problem" here, it had a very different connotation from the type of open-ended problems posed in Ms. A's class. Mr. B perceived math "problems" as an exercise in efficiency, to be solved quickly, and allocating time for students to explore their own sense-making could be a potential distraction. This attitude was reflected in Mr. B's implementation of an instructional activity in a lesson about measuring length. Students were each given a one-foot ruler and were asked to measure the length of their shoes. Most of the students were observed to be able to use the ruler appropriately. Mr. B asked students, "How many inches are your shoe?" and received an array of answers. Mr. B often repeated the students' responses, such as "OK, 9." or "Daniel is 6". He did not pose follow-up questions to ask students how they used the ruler, what they understood about the markings on the ruler, or more critical questions, such as why a one-foot ruler is an appropriate tool to measure the length of a shoe. Mr. B's behavior in this event indicated that he prioritized procedural application rather than conceptual knowledge acquisition in student learning.

Mr. B believed that the role of the teachers is to facilitate student learning. When asked about strategies to engage students in mathematics, Mr. B responded, "I am a facilitator ... [I] walk around the classroom ... make sure they [the students] have the right things". This emphasis on the right or correct answer portrayed Mr. B's perception of mathematics as a deductive process. Hence, Mr. B adopted a close-ended instructional approach that herds his students towards one singular solution rather than allowing students the time and space to make sense of the problem at hand. While Mr. B may use phrases such as "I am like a partner" or "I help guide them" to convey his intention of sharing space and fostering collaboration with his students, his actions exhibited a dictatorial approach. This became evident in the teacher–student interactions during the measurement activity. As each student reported his or her shoe length, Mr. B recorded the measurements and constructed a graph on the projector (Figure A4).

Then, Mr. B instructed the students to mimic his actions, stating, "I want you to do the same thing". As Mr. B walked around the classroom to monitor students' progress, he repeatedly pointed to the project to remind students, "Look at the numbers and put them on the line plot". The rest of the lesson proceeded without solicitation of any student contributions.

Mr. B believed that language is a useful teaching tool. In his interview, Mr. B emphasized the importance of language and communication skills as an integral aspect of teaching and learning math. Mr. B stated that he found classroom discussions are an effective way to teach problem-solving strategies, stating, "Discussions help because you can sort of get them to understand the steps of the problem and what is in the problem. So, they [students] can both understand the words and how to apply them". Mr. B also stated that "My goal is, of course, for them to understand what they are reading and understand the process of how to solve the problem". Although Mr. B's responses may have suggested a commitment to creating a language-rich environment, the actual classroom interactions between the teacher and students did not reflect the same discourse-focused approach. Below is an excerpt from an observation of a lesson on regrouping in subtraction. The lesson began with Mr. B instructing the students to open their workbooks to a specific word problem.

> **Mr. B:** Let's look at number three. Marcel jumped 39 cm high. Jamal jumped 48 cm high. How much higher did Jamal jump than Marcel? Okay. So, how much higher, what does that mean I have to do?
>
> **Students (multiple students answering in chorus):** Subtract.
>
> **Mr. B:** Minus, subtraction. Okay. Jamal is 48 minus 39, Okay?
>
> **Student 1:** I know the answer from minus.
>
> **Mr. B:** This is what you should do. Put them on top of each other.
>
> **Student 2:** A number up here?
>
> **Mr. B:** 48. Good.
>
> **Student 3:** 39, where?
>
> **Mr. B:** It says here in your book, 48 minus 39. Like this (writes on the board as $\begin{array}{r}48\\ -39\\ \hline ?\end{array}$).

In this short exchange, we identified two instances in which Mr. B failed to seize valuable moments to utilize language and communication to develop the students' math and literacy skills. Mr. B could have asked the students to read the question and used this opportunity to evaluate their language proficiency. Mr. B could have queried Student 1 on the potential answer when the student volunteered a response. Instead, the student was ignored, and Mr. B proceeded to provide overly simplistic instructions on setting up the subtraction problem in column form. The students, either as a whole class or as individuals, were excluded from the discourse space in the room.

Mr. B believed that students could benefit from scaffolding and differentiated instruction. When asked about how he helps students who may be struggling in mathematics, Mr. B responded, "I think scaffolding is pretty important because a lot of the times, some math problems, require many steps. So, when you scaffold, you can break a problem apart into easier things, and you can focus on the one thing, get your information first, understand that. Then move on to the next step". Although Mr. B's responses may have suggested an orientation towards differentiated instruction, the actual classroom interactions between the teacher and students did not reflect the same student-focused approach. When he noticed a student struggling with subtraction involving regrouping, he failed to provide the intended personalized assistance. Instead, Mr. B made a general announcement to the class, "Chris has trouble, so let's show her". He then proceeded to demonstrate the computation procedure on the board for all students. He explicitly instructed the class, "We regroup and borrow one from four, change that to three, either to an 18 minus nine . . . OK, write it". These actions contradicted Mr. B's professed belief in individualized instruction and revealed a reliance on teacher-directed, explicit teaching methods. This whole-class, teacher-directed instructional practice left very little, if any, room for students to demonstrate their own individual mastery of the content, even though Mr. B professed that he evaluates the success of his lessons by contemplating, "What could I have done to maybe support them [students] and for them to understand more or maybe to connect to it [math] more". This type of reflexive teaching was not documented in the observed practices. By not querying the student on the answer or where and how s/he made the mistake, Mr. B missed the opportunity to gain insight into the student's thinking process. Without taking any measures to establish a foundational knowledge of the students' capabilities, Mr. B was ill-equipped to differentiate his instruction and effectively support his students in overcoming challenges.

3.3. Consistency between Teachers' Beliefs and Practices

By comparing teachers' expressed beliefs and observed instructions related to critical thinking and problem-solving skills, we determined that there is a high level of consistency between Ms. A's beliefs and practices, as demonstrated by the following indicators:

- Allowing students to develop mathematical reasoning skills through experimentation.
- Utilizing critical thinking strategies to encourage students to evaluate their ideas on problem solving.
- Ask open-ended questions to prompt students to explore different ideas.

We also determined that Mr. B showed a high level of inconsistency in the following indicators:

- The role of the teacher as a facilitator in student-centered activities.
- Engage students in learning and applying language and communication skills in mathematical reasoning.
- Differentiate instructions to provide students with multiple methods to interact with the content.

4. Discussion

Teachers' beliefs about mathematics can range from viewing mathematics as a static, deductive application of facts and formulas to a dynamic domain of knowledge based on constructive sense-making and pattern-seeking. These beliefs are often seen as direct precursors to behavior [28]. However, empirical evidence with respect to the degree of alignment between the mathematical beliefs of teachers and their practices has been inconclusive. Like in prior studies [45,47,53], we found that teachers can espouse constructive beliefs about mathematics but do not exhibit evidence of them in their teaching, or the practices were implemented in an ineffective manner. The incongruency between beliefs and practice suggests that the construct of teachers' beliefs is not held in isolation but exists as a part of a multi-layered ecological model. Within this larger framework, the enactment of beliefs into practice can be influenced by various internal and external factors. We have identified three of these factors as possible explanations for the variation in the teachers' beliefs–practice relationship.

Factors That Affect Teachers' Beliefs–Practice Relationship

Compatibility between Beliefs. Although both Ms. A and Mr. B implemented similar measurement activities, the depth of mathematical reasoning and level of engagement by the students displayed in Ms. A's class far surpassed Mr. B's. Although Mr. B perceived himself as a facilitator and may have planned to conduct the shoe measurement activity as a student-centered learning experience, his actions portrayed his beliefs about mathematics as a deductive process. The conflicts between Mr. B's beliefs negatively affected the implementation of the measurement activity, which failed to promote the students' critical thinking skills. Instead, speed and replication were prized over the development of mathematical reasoning for the students. For Ms. A, her beliefs about learning math through exploration aligned with her goal for the water measurement activity, both of which emphasized the students' development of reflection, evaluation, and planning skills. The contrasting outcomes between Ms. A's and Mr. B's implementation of measurement activities underscored the critical impact of the compatibility or conflict between teachers' beliefs on their practice. When teachers possess a congruent belief system that supports student-centered and inquiry-based learning, the potential for enhancing the students' critical thinking and conceptual understanding becomes more pronounced. Conversely, when there is a misalignment, such as in the case of Mr. B, the quality of teaching and learning suffers, even if the teacher has good intentions.

Where did Mr. B's transmission-oriented belief about math come from? Additionally, how is he not conscious of it? The most likely genesis of Mr. B's beliefs is his personal schooling experiences. New teachers may be novices to the profession, but they already possess strong beliefs about teaching and learning [28], shaped by their decade-long experience as students [28]. Multiple studies [91–93] have found the persistence and transfer of teachers' beliefs about math, formed as students, into their current teaching practice. Mr. B, as a student, could have been heavily influenced by the traditional, teacher-directed approaches to mathematics that are prevalent in our schools. Mr. B, as a teacher, did not relinquish this deductive perspective on mathematics upon entering the profession. His transmission-oriented beliefs about mathematics became apparent in his description of a typical lesson structure: "Might be five, 10 min of me [teaching] . . . another 40 min, half hour [for students] to do work". This type of "I do, you watch" approach, followed by student replicating the algorithm modeled by the teacher, is emblematic of teacher-directed instruction. The research-informed, constructive belief about mathematics advocated by the teacher education program did not supplant but was superimposed on top of his pre-existing traditionalist one. Consequently, we observe a constant tug-of-war within Mr. B's beliefs, both in his words and actions, resulting in an overall less-than-satisfactory teaching quality.

The conflict within Mr. B's belief system highlights the inherent tension between his deeply rooted core belief in mathematics as procedure-driven and his less-firmly-held peripheral belief in students exercising autonomy in constructing meaning. While the tension between these conflicting beliefs may be readily apparent to an external observer, the beholder of these beliefs may not be aware of this juxtaposition [37,41]. Hence, uncovering conflicts within an individual's belief system is a crucial initial step for a teacher in modifying maladaptive beliefs [94]. In a case study of a second-grade teacher, Wood, Cobb, and Yackel [95] observed profound changes in both the teachers' beliefs and teaching methods after she engaged in intensive reflective teaching practices for a year. Her transition from traditional approaches to prioritization of the construction of mathematical meaning by students was precipitated by an iterative process of analysis and evaluation of daily video recordings of her lessons. This type of lengthy, transparent reflective teaching would be particularly crucial for teachers like Mr. B, as it enables them to pause and assess the impact of the interplay between their beliefs and instructional practices on their students. This introspective approach allows them to gain valuable insights from their experiences and break free from the entrenched teacher-directed mindset they experienced themselves as students.

Knowledge of Evidence-based Practices. An additional factor that contributed to the difference in teaching quality between Ms. A and Mr. B was their knowledge of evidence-based practices. Ms. A stated in the interview that she was familiar with the eight practice standards, eight Effective Teaching Practices identified in NCTM's *Principles to Actions: Ensuring Mathematical Success for All* [10]. Mr. B responded that he was not familiar with NCTM as an organization or their professional recommendations. This lack of knowledge of research-based guidelines points to a weakness in teacher education on math content and pedagogy [96–99]. This under-preparation is evident in Mr. B's interview response when he stated, "I can't remember if I have heard of NCTM, I don't know about them". While Mr. B expressed beliefs that align with the student-centered approach endorsed by NCTM [10], we struggled to find instances where students were afforded voice or choice over their learning, two defining characteristics of student-centered learning. Instead, Mr. B was observed to give explicit directions on every part of the measurement activity. Students were often instructed to "look at the board" and copy down the teacher's answer. This discrepancy between words and actions stems from Mr. B's interpretation of what qualifies as student-centered learning. During his interview, Mr. B frequently used the term "student-centered" when discussing situations that involved hands-on learning. This suggests that he may have misconstrued the meaning of student-centered teaching, mistakenly associating it with any activity involving concrete or visual materials in some way, regardless of the quality of the instructional delivery.

Without a foundational knowledge of evidence-based practices, Mr. B could not accurately assess whether his understanding and implementation of student-centered instruction aligned with the recommended practices and their true essence. So, while a few objectives of student-centered learning were partially fulfilled in Mr. B's class, the opportunities for students to exercise their own agency were severely constrained. Rather than encouraging students to take the initiative to record the data about shoe sizes and create their own graphs, Mr. B monopolized the task by providing a pre-made graph for students to copy. This discrepancy between Mr. B's beliefs and instructional practices highlighted the need for teachers to develop an authentic understanding of student-centered learning and the importance of empowering students in learning mathematics. We cannot assume that this enlightenment will naturally occur over time. Despite Mr. B being less experienced compared to Ms. A, his five years of teaching should not be considered short by any means. In the context of large urban schools, where the average number of years a teacher teaches is 14 and where 36% of teachers have between 3 and 9 years of experience [100], Mr. B's 5 years can be seen as a substantial duration. Yet, Mr. B did not report attending any math-specific professional development in recent years. Good teaching, or more specifically good math teaching, requires teachers to develop their own problem-solving, critical thinking, and reasoning skills. It is unrealistic to rely on time spent in the profession as a guarantor of effective teaching. Engaging in rigorous professional development focused on math content and pedagogy is vital for teachers to refine and enhance their teaching skills.

Classroom Management. The classroom management styles of Ms. A and Mr. B had a notable impact on the translation of their instructional beliefs into instructional practice. Ms. A nurtured a collective sense of responsibility among her students. She proactively communicated her expectations to the students in advance, ensuring clarity and understanding. For instance, when it was time for students to write and reflect on the water-measurement activity, Ms. A addressed the class by saying, "You may continue working quietly as you answer the questions. I will use this time to start the cleanup while you write in your journals". In this manner, she effectively conveyed to the students the expectation of independent and quiet work. At the same time, she demonstrated her willingness to share the responsibility of tidying up. Ms. A's classroom management style, which prioritizes student investment and participation in creating a conducive learning environment, aligned seamlessly with her student-centered approach to content instruction. This alignment can also be observed in Mr. B's classroom management style and instructional approach, albeit at the opposite end of the continuum. Mr. B adopted an authoritarian approach to maintain or at least attempt to have strict control over his classroom. During the shoe-measurement activity, when he noticed off-task behavior from a student, Mr. B expressed his displeasure, "Put the ruler away. You still haven't even copied. I have already provided you with the answers. I don't understand why we need to discuss it further". Then, Mr. B threatened to relocate the student to sit alone if he did not resume work. While such disciplinary actions often elicited immediate compliance, over time, the students in question would revert to their previous off-task behaviors, such as ceasing their work, engaging in chitchat, or displaying restlessness through fidgeting. The students' off-task behaviors are symptomatic of their limited sense of ownership in a classroom that frames mathematical learning within a limited, deductive perspective and where compliance becomes the easiest route to reach a predetermined solution.

Ms. A's proactive and Mr. B's reactive approaches to classroom management are representative of their distinct responses to curriculum implementation. Ms. A interpreted the curricular expectation for her gifted ELs as providing opportunities for them to "express their unique ideas ... as each of them think so differently". Ms. A placed great value on the exploration of ideas as it encourages students to "think outside the box". "All ideas must be tried", Ms. A stated in her interview, because each student's response can "come to you with a different meaning". Meaning-making takes time [101–104], and time is generously given in Ms. A's class as she and her students spend time talking, writing, and experimenting with different problem-solving strategies. Challenging instructions and meaningful learning opportunities require time to implement. When time is not given, as in Mr. B's classroom, the teaching quality suffers, and the learning opportunities shrink. Mr. B preferred to adhere strictly to the prescribed curriculum because "The standards are already embedded into the curriculum and the lessons themselves". He expressed reluctance to deviate from the curriculum as it contained detailed information about which standards should be addressed and how to teach them. This preference for a prescribed curriculum is common among new teachers who often feel more comfortable following established plans in the nascent stage of their career [105]. While it is normal and expected for novice teachers to accept curriculum guidance, excessive reliance on any particular curriculum, no matter how well-designed, hampers the development of expertise necessary to handle the uncertainties of teaching [106,107]. When teachers feel ill-equipped to respond effectively to classroom uncertainties, such as disruptions or student disengagement, they often resort to authoritarian approaches to regain control. This negative consequence is evident in Mr. B's observed practices. He allowed his instructions to be confined by the parameters set by the curriculum, implementing authoritarian measures to enforce strict adherence to the predetermined order and sequence of the lesson plans outlined in the curriculum.

5. Conclusions

The sweeping reforms in mathematics that gained momentum in the United States during the 1980s and have since resonated globally have firmly established constructivist principles as the bedrock of mathematics education. The reforms operate on the assumption that teachers who embrace inquiry-based, student-centered approaches are more adept at implementing such practices in the classroom, thereby enhancing the overall quality of teaching. However, this study presents compelling evidence that challenges this very premise. Both Ms. A and Mr. B expressed beliefs that are aligned with the constructivist perspective of mathematics that emphasizes meaning-making and problem solving. However, only Ms. A exhibited a strong and positive correlation in her beliefs–practice relationship. The incongruency between beliefs and practice, as seen in Mr. B, has been noted in other studies that have found similar inconsistencies [37,42,92,108,109]. This misalignment among individual teachers perpetuates the prevalence of a transmissive, teacher-directed approach to teaching mathematics on a global scale [110]. The teacher's dominant presence within math classes undermines the envisioned ideal of co-constructing knowledge advocated by proponents of math reforms.

When reviewing the findings of this study, it is tempting to attribute the disparity in the teaching quality between Ms. A and Mr. B to the relatively short duration of Mr. B's 5-year tenure in the teaching profession, especially when contrasted with the extensive 17 years of experience held by Ms. A. One could even argue that Ms. A was naturally endowed with the ability to create a more inclusive and engaging classroom environment, given that she shares the same ethnicity (Latinx) and home language (Spanish) as most of her students. While we acknowledge that cultural background and years of experience can positively impact teaching quality, it is unproductive to focus solely on immutable attributes such as race and time. These factors cannot be altered to help Mr. B or any other teacher to improve their practice. Let us turn our attention to actionable measures that we can undertake to support teachers to effectively nurture the mathematical talents of young gifted English learners.

6. Implications

6.1. The Need for a New Approach to Professional Development

In the cases of both Ms. A and Mr. B, their beliefs about teaching mathematics exerted a significant influence on their instructional practices. However, the power of teachers' beliefs is often overlooked in the design of most professional development (PD) programs. Instead, professional developers often make the assumption that teachers share the same beliefs as they do. Consequently, a typical PD tends to focus primarily on aspects such as lesson planning, instruction, and assessment, neglecting the critical role of teachers' beliefs in shaping effective teaching practices. According to Hill's [111] observations of local and regional math PD sessions, teachers assumed passive roles, listening or watching as professional developers explained concepts and practices. Although teachers engaged in math activities during most sessions, they were primarily applying the strategies illustrated by the professional developers. This direct transplantation of practices without providing teachers with the opportunity to critically examine their purpose or align them with their personal beliefs can lead to a cognitive disconnect. As a result, teachers may struggle to fully invest in and adopt the demonstrated strategies, regardless of their recommendations or research evidence, into their instructional repertoire. Consequently, it is not surprising that the evidence on the effectiveness of math professional development is mixed and, at times, disheartening. Research has indicated that many PD programs, even those incorporating elements associated with rigorous standards and high quality, did not enhance teacher knowledge or student achievement [112–115]. For those programs that did yield positive effects, the impact often diminished within months to a year [116], and in some instances, within days [117]. The criticism against the typical one-shot professional development model is fierce [111,118–120].

6.2. Tackling Conflicts between Beliefs and Practice

Building upon the insights gained from our study and recognizing the factors that had contributed to the limited success of the traditional PD model, an effective PD program for teachers of gifted ELs should incorporate several key elements. First, the program should be intensive, spanning several months to a year and allowing for sustained engagement and growth. Second, the focus should be on mathematics, emphasizing content-specific knowledge and strategies. Third, the program should address teacher planning and instruction, providing practical guidance and support in implementing evidence-based practices. Additionally, the program should be aligned with the mathematical practices outlined in the NCTM standards, ensuring that instructional approaches are grounded in research and best practices. PD program facilitators should create opportunities for teachers to observe and analyze the application of student-centered instruction in teaching advanced mathematics to gifted English learners. Teachers should be encouraged to identify aspects of the intended curriculum materials and instructions that may not align with their own beliefs or seem unfeasible within their classroom contexts. By engaging in this examination of "intended" and "implemented", teachers can develop a deeper understanding of the recommended practices, the underlying rationale of the curriculum objectives, and how their current understanding aligns or diverges from the intended goals. Explicitly recognizing the disparities between the desired instructional approach and their current teaching practices enables teachers to take the necessary steps to address maladaptive beliefs and ineffective strategies. This type of reflective analysis is instrumental in bridging the gap between what should be practiced and what is currently being practiced in the classroom, facilitating the growth and improvement of instructional practices.

6.3. Adapting the Beliefs–Practice Relationship in Response to Contextual Factors

Furthermore, it is essential to provide teachers with exposure to a diverse range of methods for implementing evidence-based practices in the classroom. By redesigning professional development in this manner, we can enhance teachers' pedagogical knowledge and strengthen their ability to create optimal and engaging learning experiences for their students. This new approach to professional development begins with the recognition that there is no one-size-fits-all recipe for translating constructive beliefs about teaching mathematics or enacting student-centered instruction. Instead, teachers should be encouraged and supported in utilizing their knowledge and expertise to tailor instruction based on the specific context of their schools and students while still ensuring alignment with evidence-based recommendations.

This approach acknowledges that teachers are the experts in their classrooms, with valuable insights into their students' strengths, challenges, and learning styles. It respects their autonomy and encourages them to take ownership of their professional growth. By exploring various methods of implementing student-centered instruction, teachers have the opportunity to select and adapt approaches that align with their personal beliefs and teaching style. This empowers teachers to create an instructional style that feels authentic and genuine to them rather than imposing a prescribed set of instructions that may not resonate with their personality or experience. When teachers have the freedom to choose and adapt instructional methods that align with their values and teaching philosophy, they are more likely to effectively implement student-centered practices. This flexible approach promotes a stronger connection between the teacher's intentions and the actual teaching practices in the classroom. By embracing flexibility and demonstrating respect for teachers' expertise and decision-making, this new approach to PD fosters a culture of ongoing growth and development, ultimately benefiting both teachers and students.

7. Contribution

This study makes a valuable contribution to the field of gifted education and talent development by examining not only the beliefs held by teachers regarding teaching mathematics to English learners but also how those beliefs are manifested in their instructional practices. Our findings highlighted several factors that either facilitate or hinder the translation of teachers' student-centered beliefs into practice. These facilitating factors include having compatible and constructive beliefs about teaching mathematics, possessing pedagogical knowledge, and utilizing effective classroom-management strategies. Conversely, hindering factors encompass holding conflicting beliefs (both constructive and transmissive), lacking knowledge about evidence-based practices, and adopting authoritarian classroom management approaches. Now that we have identified some of the obstacles that hinder the translation of teachers' constructive beliefs into student-centered instruction, the next step for future research is to evaluate the effectiveness of professional development programs designed to remove these obstacles or mitigate the adverse effects of maladaptive teachers' beliefs and practices in regard to students' math talent development.

8. Limitations

Despite the interviewer's efforts to remain neutral and objective, the nuanced nature of human communication may inadvertently reveal aspects of their beliefs or biases. Even without explicit expressions of beliefs, subtle indications or unintentional signals from the interviewer can potentially reveal their underlying stance. This interplay between the interviewer and the teacher can impact the overall tone and content of the interview, potentially influencing the teacher's responses. We also need to acknowledge that our assumptions about "teacher-directed" and "student-centered" behaviors may not always be valid. Simple categorization of teacher behavior may not be possible. For example, explicit direction-giving by teachers may sometimes precede collaborative group work, and close-ended questions may precede scaffolded support. In these cases, what may be interpreted as teacher-directed actions were used as part of student-centered instruction.

Author Contributions: All authors took part in data collection, data analysis, reporting of the study, determining the subject of the manuscript, methodology, research design, and reviewing and editing. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by Unites States Department of Education (US DOE), grant number S206A170028.

Institutional Review Board Statement: The research was approved by St. John's University (Protocol Number IRB-FY2020-271) and New York City Department of Education (Protocol Number 1906).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Data are unavailable due to privacy or ethical restrictions.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Figure A1. Water-measurement activity station.

4. How much water do you think it can hold? Write down your **Prediction**!
5. Use the cup and pour water into Container. How much water can it actually hold? Write down your **Measurement**!

Container	**Prediction**	**Measurement**
A		
B		
C		

Figure A2. Water measurement data chart.

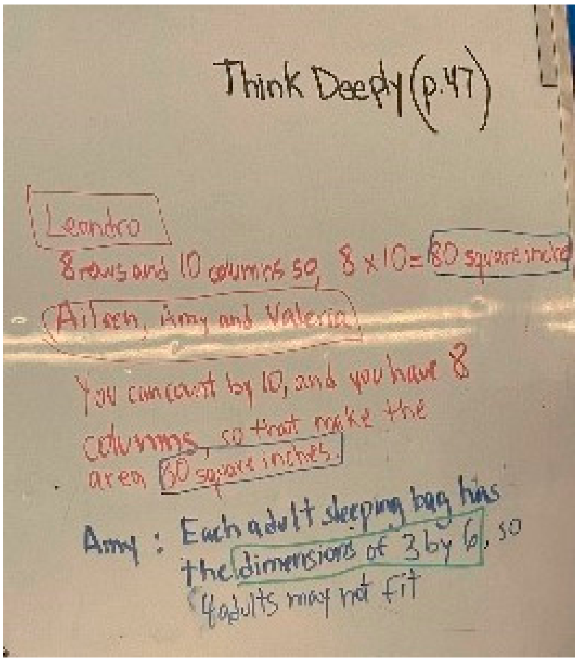

Figure A3. Students' ideas on how to measure area.

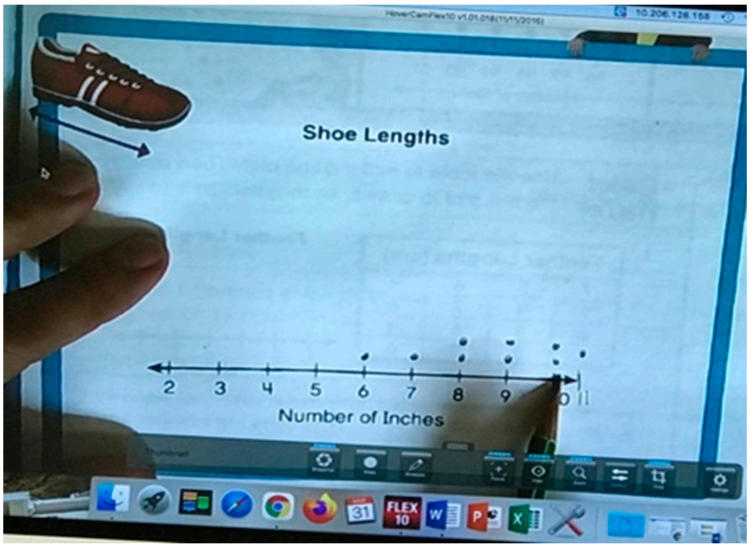

Figure A4. Mr. B's graph, as seen on the projector.

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Article

Motivational Profiles of High Achievers in Mathematics: Relations with Metacognitive Processes and Achievement Emotions

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Abstract: The current study aimed to explore alternative motivational profiles of high achievers in Mathematics, within the framework of the Situated Expectancy-Value Theory. Furthermore, it aimed to examine the profiles' potential differences in relation to self-reported metacognitive processes, such as metacognitive awareness and experiences, and achievement emotions related to Mathematics. A comprehensive evaluation in Mathematics was conducted on a total of 492 ninth-graders, including students from regular junior high schools, experimental junior high schools, and an academically advanced summer program. The assessment involved a battery of school-type mathematical tasks, resulting in the identification of 141 high achievers. Cluster analysis, based on students' expectancies for success, subjective value, and perceived cost in relation to Mathematics, revealed five motivational profiles labeled as follows: Cluster 1: Higher Motivation; Cluster 2: Higher Expectancies, Value, and Cost; Cluster 3: Lower Expectancies; Cluster 4: Lower Value; Cluster 5: Lower Motivation. Differences were found among the five profiles in terms of students' reported metacognitive awareness and their emotions of enjoyment, pride, anxiety, shame, and boredom toward Mathematics. Students with the Higher Motivation profile appeared to be the most adaptive across all of the examined variables, while students with the Lower Motivation profile reported less favorable levels of motivational and affective variables than most others. However, high achievers did not differ significantly regarding their metacognitive accuracy. Examination of the gender distribution within the clusters did not reveal any differences in gender representation.

Keywords: Mathematics; high achievers; achievement motivation; achievement emotions; metacognition; secondary education; cluster analysis

Citation: Moustakas, D.; Gonida, E.N. Motivational Profiles of High Achievers in Mathematics: Relations with Metacognitive Processes and Achievement Emotions. *Educ. Sci.* **2023**, *13*, 970. https://doi.org/10.3390/educsci13100970

Academic Editors: Kirsi Tirri and Valerie Margrain

Received: 31 July 2023
Revised: 16 September 2023
Accepted: 19 September 2023
Published: 23 September 2023

1. Introduction

The development of students' mathematical competence is among the core aims of school curriculums. Traditionally, enhanced cognitive skills had been considered as the underlying factor that ensured high Mathematics achievement [1,2]; however, it soon became clear that such skills were not sufficient [3]. Educational research has gradually revealed a wide range of factors relative to high achievement in Mathematics, highlighting, among others, the significant role of motivational beliefs, metacognitive processes, and, more recently, achievement emotions [4–8].

Moreover, during the last years, STEM education has become the focus area of many education systems worldwide [9], triggering an increasing interest in Mathematics as its foundational component. This has facilitated the advancement in Mathematics research, leading to several applications in educational contexts that would enhance students' achievement and STEM choices [10–13]. However, there is still a need for further investigation toward a better understanding of high achievement. For example, typical studies in the area usually examine independently the various factors relating to achievement in

Mathematics, while holistic approaches are limited. Also, continuous developments in educational research, especially in the fields of achievement motivation and emotions [14–16], require multiple research approaches and further enrichment of the relevant results.

At the same time, a significant part of research related to Mathematics achievement has focused on low achievers and ways to enhance their performance. However, studies on students who excel in Mathematics are less frequent; these students are often considered to require minimal support in academic settings due to the widespread notion that their abilities suffice for overcoming potential academic challenges [17]. Moreover, high achievers are usually treated in schools as a homogenous group [18], and their unique characteristics and needs are often overlooked [19]. Person-centered methodologies [20–22] could highlight the diversity of these students, but studies utilizing them for this purpose are still generally lacking.

Given these considerations, this study aimed to explore the motivational profiles of high achievers in Mathematics via a person-centered approach and investigate their potential differences in relation to metacognitive processes and achievement emotions.

1.1. High Achievers in Mathematics: Motivational Beliefs, Metacognitive Processes, and Achievement Emotions

1.1.1. Motivational Beliefs

Researchers have been for long investigating the factors that are associated with Mathematics performance, including motivational beliefs. These beliefs are closely related to performance on tasks with specific criteria of completion, such as mathematical exercises. Overall, research is constantly highlighting motivational beliefs as strong predictors of Mathematics performance [23–26].

Among the several theoretical frameworks describing achievement motivation, Expectancy-Value Theory (EVT) has evolved over the years to take into account both ability beliefs and perceived task value, examined within a specific context (thus being renamed as “Situated EVT”—SEVT—after 2020) [5,27]. According to the theory, students’ expectancies for success, defined as individuals’ beliefs regarding their anticipated performance on an upcoming task, are a decisive factor for engaging with this task. Expectancies for success, even if conceptually distinct, are empirically proximal to academic self-concept and to self-efficacy, which is defined as one’s beliefs in successfully carrying out the actions needed to complete a task [28,29]. Moreover, the theory describes a task’s subjective value in relation to the task’s qualitative characteristics and the ways these characteristics drive engagement with the task. More specifically, SEVT identifies four dimensions of value: (i) intrinsic value, referring to one’s enjoyment while engaging or planning to engage with a task, which is similar to the concept of interest [5,30], and intrinsic motivation of Self-Determination Theory [31,32], (ii) attainment value, describing the importance of dealing with a task in order to preserve one’s own identity, (iii) utility value, representing the usefulness of engaging with a task as a means for the fulfillment of other goals, and (iv) perceived cost, including the effort needed to engage with a task, the time to be invested (opportunity cost), and the emotional and psychological consequences of engaging with a task (e.g., disappointment after a possible failure). In contrast with the first three dimensions of value, perceived cost refers to the negative aspects of engaging with a task, and thus, it has a negative impact on the overall achievement motivation. For this reason, cost is often studied independently from the rest dimensions of value, providing more nuanced insights regarding students’ achievement motivation [21,33–36]. Finally, the theory takes into account a series of contextual factors, which also affect motivational beliefs, such as a family’s socio-economic status and socio-emotional climate, parent’s general beliefs, societal stereotypes, etc. [5].

Situated Expectancy-Value Theory is especially prevalent among studies on Mathematics achievement; students’ perceptions of competence in a subject of particular difficulty, such as Mathematics, as well as the varying value they could attribute to this subject, are catalyzing factors for students’ achievement. When examining the motivation of high achievers in Mathematics through the lens of SEVT, consistent findings show that these students tend to have higher levels of expectancy for success, and they generally assign greater value to Mathematics in comparison to their peers [24,37,38]. For example, in a study of German students from fifth to twelfth grade, Gaspard and colleagues [38] found that students' grades in Mathematics were positively predicting their expectancies for success. Moreover, the study found that high achievers attributed greater overall value to Mathematics than low achievers, but their lead was less eminent than the one found regarding their expectancies for success. The researchers also noticed that utility value had the weakest correlation with achievement in Mathematics compared to the other value facets.

SEVT also stresses the role of social stereotypes in the formation of students' expectancies for success and subjective task value [5,39]. Among others, it predicts that male students are expected to hold more adaptive motivational beliefs related to domains traditionally perceived as male-dominated, such as Mathematics. Indeed, the majority of empirical findings report expectancies for success and at least some dimensions of perceived task value to be lower for female students [40–44]. For example, Guo and colleagues [40] studied three cohorts of eighth-grade students from Hong Kong and found a predictive direct effect of gender on motivational beliefs. More specifically, male students had higher math self-concept and intrinsic value for Mathematics than female students, even if no significant differences were found for utility value. Brown and Putwain [45] reported similar results for English adolescents, both for expectancies for success and a combined measure of all three dimensions of subjective task value. This pattern favoring boys persisted even when considering only high achievers in Mathematics [46,47]. For example, Preckel and colleagues [46] compared academically gifted and average-ability German students, finding, in both cases, significantly higher expectancies for success and perceived value of Mathematics for boys than for girls, with the academically gifted sample showing the largest gender differences.

1.1.2. Metacognitive Processes

Metacognition refers to an individual's awareness of one's cognitive processes and the ways they can be regulated [48–50]. It takes various forms, the major of which are metacognitive knowledge, metacognitive skills, and metacognitive experiences [48,49,51,52]. Metacognitive knowledge is declarative knowledge about cognitive tasks, processes, and strategies stored in one's memory. It also comprises procedural knowledge on how to apply specific cognitive strategies, as well as conditional knowledge on when to apply such strategies. Metacognitive skills are abilities that facilitate monitoring, control, and evaluation of cognitive processes. Such skills play an important role in self-regulating learning, enabling individuals to acquire new knowledge and master new skills more strategically. Finally, metacognitive experiences refer to any kind of cognitive or affective experiences one might have (feelings, judgments, or estimates), which are also related to one's learning [50,53,54]. For example, depending on the level of feeling of certainty, a student might opt to revise the learning material once more before the exams.

Metacognition has been found to contribute significantly to Mathematics achievement, especially in the domain of problem-solving [8]. In their review of the relationship between metacognition and Mathematics education, Schneider and Artelt [55] presented previous research suggesting a 15–20% shared variance between metacognition and Mathematics performance. Moreover, they acknowledged a significant impact of declarative metacognitive knowledge in Mathematics performance, even when controlling for cognitive abilities. In a more recent review, Desoete and de Craene [56] highlighted that teaching metacognition is necessary to foster the development and improvement of mathematical skills. In addition to metacognitive knowledge and metacognitive skills, metacognitive experiences [57] have also been studied in relation to students' academic performance. For example, Tay and colleagues [52] examined 14-year-old students and found that their feeling of difficulty while solving mathematical tasks was a stronger predictor of their performance than their metacognitive knowledge or skills.

Research on mathematically talented children has identified advanced metacognitive skills already from the early years of primary school [58]. During adolescence, high achievers in Mathematics continue to show enhanced metacognitive skills compared to their peers; they make better use of cognitive strategies than relying on trial and error, or they transfer appropriate strategies more easily among similar problems [59,60]. Various studies have also addressed the metacognitive experiences of high-ability students [61]. For example, high academic achievers are often found to have weakened feelings of certainty for their performance in comparison to low achievers in general [62–64], with the exception of mathematical tasks, where overconfidence is usually the norm for all achievement levels [65–67]. However, high achievers in Mathematics seem to be better calibrated than low achievers, estimating their performance with greater accuracy (i.e., the extent of deviation of feeling of certainty from actual performance) [65–68].

1.1.3. Achievement Emotions

The relationship between affect and achievement in Mathematics has been traditionally studied mostly for Mathematics anxiety [69–73]. However, during the last years, the research focus has taken a shift toward a more detailed investigation of other discrete emotions arising in achievement settings, such as enjoyment, shame, hope, boredom, etc. [74–76]. This change has also been facilitated by theoretical advances in the field, with Pekrun's Control-Value Theory—CVT—[77,78] emerging as one of the most established theoretical frameworks describing emotions related to achievement activities or their results. According to CVT, students' beliefs regarding their control over an achievement activity (e.g., successfully passing the academic year final exams), combined with the value they pose on the activity per se, are decisive factors both for the type and the intensity of the arising emotion in relation to this activity. Apart from the typical distinction between positive and negative, CVT distinguishes emotions based on the degree of activation they elicit. Emotions such as pleasure, hope, gratitude, anger, anxiety, and shame are capable of driving a person to take action in relation to an activity. On the other hand, emotions like relief, satisfaction, disappointment, despair, and boredom reduce an individual's activation, for example, by inhibiting a student's engagement with a specific mathematical task.

Lots of studies have investigated the interaction between achievement emotions and academic achievement, including performance in school Mathematics. In their review, Goetz and Hall [79] reported statistically significant, even if moderate, negative correlations between anxiety and student academic achievement, ranging in average between -0.20 and -0.25. These outcomes were based on three meta-analyses, which included studies on Mathematics performance [70,80,81]. When other discrete emotions like enjoyment, pride, anxiety, anger, boredom, etc., were considered, their mean correlations to Mathematics performance were also found to be close to $|r| = 0.25$ [79]. Overall, the results are consistent regarding the emotion's valence and its relation to achievement: positive activating emotions (e.g., enjoyment, pride, and hope) are positively related to achievement, while negative deactivating emotions (e.g., disappointment and boredom) are negatively related [78].

Most studies indicate, on average, more positive and less negative emotions for high achievers. For example, Roos et al. [82] found lower levels of both state and trait anxiety in relation to Mathematics for ninth- and tenth-grade high achievers, compared to their low-achieving peers. In the study of van der Beek and colleagues [83], including ninth-grade Dutch students, the researchers found that high achievers had enhanced self-concept, higher levels of enjoyment, and lower levels of anxiety in comparison to their peers. Also, Goetz and colleagues [84] investigated the emotional experiences of German students in early adolescence before, during, and after taking a Mathematics test, considering their cognitive abilities. They found increased enjoyment for students at the upper quartile of abstract reasoning abilities, who also scored higher on the math test than the rest of the students. Moreover, high achievers reported lower levels of anxiety and anger than their low-achieving peers. However, when the emotion of boredom was considered, student reports were similar, regardless of achievement level.

Boredom usually stands out from the rest of the achievement emotions, with studies demonstrating contradictory results. Some findings show that high achievers exhibit lower levels of boredom compared to low achievers [85], while others find it similar [84,86] or even higher [87]. Trying to investigate this discrepancy, Preckel and colleagues [88] evaluated the reasons behind the manifestation of boredom by distinguishing between boredom arising in environments with low academic challenges and boredom arising in environments with excessively high academic challenges. For gifted students who transferred to a more academically demanding environment, the researchers found that boredom arising from low academic demands decreased during the transition, while boredom arising from higher academic demands actually increased. As a result, the overall reported level of boredom did not differ significantly from the boredom experienced by students in regular classes with typical achievement levels.

The relationship between achievement emotions and achievement motivation has also been investigated. Increased motivation is often accompanied by more positive activating and fewer negative deactivating emotions, as predicted by theory [77,78] and demonstrated in a series of empirical studies. In one of them, Peixoto and colleagues [89] examined a series of achievement emotions of Portuguese adolescents during class and during a test in Mathematics. In both cases, the correlations of achievement emotions with academic self-concept and perceived value of Mathematics were found to be positive for positive emotions and negative for the negative ones (except for the emotion of relief). In another study, Goetz and colleagues [90] investigated the academic self-concept of German adolescents and its relation to enjoyment, pride, anxiety, anger, and boredom. The researchers found significant correlations with all types of emotions, which were stronger for Mathematics than for the English or German Language, implying the importance of considering emotions when studying Mathematics achievement.

1.1.4. Studying High Achievers with Person-Centered Approaches

Person-centered approaches usually provide a more fine-grained depiction of student profiles, since they do not examine variables in isolation like traditional methods but seek to classify individuals into meaningful groups [20,22,91]. For example, Andersen and Cross [92] used latent class analysis to investigate the motivational profiles of a large representative sample of ninth-graders from the US, evaluating their academic self-concept, their interest in Mathematics, their perceived importance of the subject, as well as its utility value. Their analysis revealed four distinct motivational profiles, with 15% of the high achievers belonging to the low motivation cluster. In another study, Conley [91], using EVT theory, found seven motivational student profiles, two of which were characterized by high expectancies for success, high value of Mathematics, and also high cost, differing only in terms of their members' achievement goals. Similarly, Watt and colleagues [21] used the EVT framework to examine the motivational profiles of Australian adolescents. The researchers identified three motivational profiles, including a low motivation cluster comprising one out of five high achievers. Moreover, it was found that high perceived cost was associated with weakened psychological and emotional wellbeing, especially for students with high expectancies for success and high perceived value of Mathematics. Gonida and colleagues [20], using latent class analysis in the framework of achievement goal theory, found a similar percentage (17%) of high achievers with all goal orientations low (both performance and mastery goals, approach and avoidance), characterized also by maladaptive help-seeking beliefs and low intention to seek instrumental academic help.

These studies suggest that person-centered approaches may provide richer insights regarding high achievers' motivation, as they shift the focus from the average high achiever to alternative profiles. Moreover, being aware of the diverse student profiles could also inform instructional practice. In a recent review of studies on differentiated instruction [93], among the main conclusions was high achievers' positive perception of instruction that was tailored to their specific needs and interests. However, most teachers do not differentiate their instruction [93], also due to beliefs that "gifted children are already good, small in number and do not need a different education" [94]. Further research highlighting the heterogeneity of high achievers could facilitate raising awareness of their specific but usually overlooked educational needs (see also [20]).

1.2. The Present Study

The present study focused on Mathematics achievement during adolescence and adopted a person-centered approach to examine high achievers' motivational beliefs, using the framework of the Situated Expectancy-Value Theory. The identified profiles would be associated with metacognitive processes (metacognitive awareness, perceived task difficulty and certainty for the solution provided to each task, metacognitive accuracy) and achievement emotions. Moreover, as gender effects have been discussed in SEVT and supported by prior research in relation to Mathematics achievement and motivational beliefs, an additional aim of the present study was to examine the composition of the resulting motivational profiles in terms of gender. Thus, the main research aims of the study were: (i) the identification of different motivational profiles of high achievers in Mathematics based on their expectancies of success, the value they assigned to this school subject, and their perceived cost, (ii) the investigation of how the different motivational profiles are associated with experienced emotions and metacognitive processes, and (iii) the examination of gender distribution within the resulting profiles.

In accordance with these aims and based on prior empirical evidence, the hypotheses of the study were the following:

Hypothesis 1. *Students with adaptive motivational profiles (i.e., high motivational beliefs such as high expectancies of success, high assigned value on Mathematics, and low cost) would be more likely to report higher metacognitive awareness, have better metacognitive accuracy, and report more positive and less negative achievement emotions [77,89,90];*

Hypothesis 2. *Clusters of high achievers with a maladaptive motivational profile (i.e., poor motivational beliefs such as low expectancies of success, low assigned value on Mathematics, and high cost) were expected to emerge [20,21,92];*

Hypothesis 3. *Male students were expected to have more adaptive motivational profiles in relation to Mathematics [46,47,95].*

2. Materials and Methods

2.1. Participants

The initial study sample included 492 (56% female) 9th-graders from (i) 10 regular junior high schools (297 students), (ii) 3 experimental junior high schools for academically advanced students (138 students), and (iii) a summer program for academically talented adolescents (57 students). The final sample of the study consisted of 141 high achievers, who were identified from the initial sample via an ad hoc procedure, described in Section 3.

2.2. Measures

2.2.1. Achievement in Mathematics

Participants' Mathematics achievement was assessed with a battery of school-type mathematical tasks. These tasks were based on the 9th grade's curriculum and were carefully selected after an initial iterative evaluating procedure, including experienced professional teachers and students. The selected tasks were further tested in a pilot study with 114 ninth-graders, attending a public regular junior high school in an urban setting. The pilot results showed that the distribution of Mathematics performance was skewed to the right, indicating a floor effect. Thus, it was necessary to decrease the overall difficulty of the tasks to ensure better alignment to the students' academic level. The professional teachers agreed on the use of the shortlisted seven mathematical tasks, which were of gradual difficulty and included linear and quadratic equations, factorization of algebraic expressions, as well as root calculation.

2.2.2. Motivational Beliefs

Participants' motivational beliefs for school Mathematics were assessed via the Expectancy-Value-Cost scale of Kosovich and colleagues [34]. The scale consists of 10 items measuring 3 motivational variables: (i) students' expectancies for successfully fulfilling the requirements of their Mathematics class (3 items, e.g., "I am confident that I can understand the material in my math class"), (ii) the aggregated value that students attribute to the subject of Mathematics (intrinsic, attainment and utility value, 3 items, e.g., "I think my math class is useful"), and (iii) the perceived cost of working on school Mathematics (4 items, e.g., "My math classwork requires too much time"). Students provided each of their answers in a 5-point Likert scale, ranging from 1 (absolute disagreement) to 5 (absolute agreement).

2.2.3. Metacognitive Processes

The metacognitive processes examined were students' metacognitive awareness and metacognitive experiences. Specifically, participants were asked to complete the jr Metacognitive Awareness Inventory—jr MAI [96], which has two subscales: (i) knowledge of cognition (9 items, e.g., "I know when I understand something") and (ii) regulation of cognition (9 items, e.g., "I occasionally check to make sure I'll get my work done on time"). Students responded with a 5-point Likert scale, ranging from 1 (absolute disagreement) to 5 (absolute agreement). In the end, the two subscales were combined into a single measure of metacognitive awareness.

Perceived task difficulty and students' certainty for their provided solution were also measured with Likert scales. Participants assessed each mathematical task in a range from "not difficult at all" (1) to "very difficult" (5) and their level of certainty from "not certain at all" (1) to "very certain" (5). Students' reported certainty was also used to calculate their performance calibration as a measure of students' metacognitive accuracy on estimating their own performance, described in the Section 3.

2.2.4. Achievement Emotions

Five achievement emotions in relation to Mathematics were measured with the Achievement Emotions Questionnaire—AEQ [97], an instrument which was developed based on Pekrun's Control-Value Theory [77,78]. The classroom-related part of AEQ was designed to evaluate emotions experienced before, during, and after a typical school lesson. Specifically, 53 items were used to measure 2 positive and 3 negative emotions, namely enjoyment (10 items, e.g., "I enjoy being in class"), pride (9 items, e.g., "I am proud of the contributions I have made in class"), anxiety (12 items, e.g., "I worry the others will understand more than me"), shame (11 items, e.g., "I'd rather not tell anyone when I don't understand something in class"), and boredom (11 items, e.g., "I get so bored I have problems staying alert"). Students' responses were recorded in a 5-point Likert scale, with (1) indicating absolute disagreement and (5) absolute agreement.

2.3. Procedure

For the implementation of the study, special permission was requested and consequently granted from the National Institute of Educational Policy. Students participated voluntarily after being informed about the aims of the study and the right to withdraw at any part of the procedure, and they were also ensured for the anonymity of the data they would provide [98]. Parental consent was also obtained via signed forms with details of the study. Students were initially assessed in Mathematics during a typical school hour (45 min). During another school hour, they completed the Likert-type questionnaires for the evaluation of the motivational, metacognitive, and affective variables under examination.

3. Results

3.1. Psychometric Properties of the Scales

The validity of each scale was tested through Principal Component Analysis (PCA) with varimax rotation using SPSS version 23. The number of principal components for each scale was identified using Cattell's criterion (scree plot) [99]. The PCA revealed three components for the Expectancy-Value-Cost scale, with all items loading to the corresponding component, as expected. The analysis for the jr Metacognitive Awareness Inventory revealed two components, approximating the two subscales of knowledge and regulation of cognition. However, following the suggestion of the jr MAI authors [96], the two scales were combined into a single measure of metacognitive awareness, which would suffice for the aims of the study. The PCA for the Achievement Emotions Questionnaire was applied to each one of the five emotion subscales, and the scree plot indicated one component in each case. These results confirmed the theoretical structure of all used scales.

The reliability of each scale was assessed with Cronbach alpha, and the results were equally satisfying: (i) $a_{exp} = 0.86$, $a_{val} = 0.84$, $a_{cost} = 0.74$ for the EVC subscales, (ii) $a_{met} = 0.84$ for jr MAI, and (iii) $a_{enj} = 0.92$, $a_{pride} = 0.85$, $a_{bor} = 0.95$, $a_{shame} = 0.92$, $a_{anx} = 0.90$ for the AEQ subscales. Moreover, the examination of the correlations between each item and the total score of the corresponding sub-scale revealed only three items from the jr MAI scale with a correlation under the threshold of 0.30 [100]; however, their potential exemption from the subsequent analyses would not impact the overall reliability of the scale, since further analyses showed that the corresponding Cronbach alpha would remain at similar levels.

3.2. Identification of High Achievers

In order to enhance the accuracy of students' Mathematics performance assessment, their grading on the mathematical tasks was Rasch-analysed [101,102] with jMetrik software, version 4.1.1 [103], and thus their aggregated grades were transformed to better estimators of Mathematics performance. Based on these performance indicators, students were ranked accordingly in order to facilitate the identification of high achievers in the sample. The participants were classified into four distinct performance categories with the JASP software, version 0.14 [104]. The criterion used was one standard deviation above and below the mean performance of students attending regular junior high schools ($N = 297$), who better represented the general population among study participants (Figure 1). High achievement was defined as performance at least one standard deviation above the mean, resulting in approximately 10% of this sub-sample being considered as high achievers (Table 1). Subsequently, the high achievement threshold was used to identify high achievers in the total sample ($N = 497$), resulting in 141 high-achieving students. This sub-sample comprised 31 students from the regular junior high schools, 80 students from the experimental junior high schools, and 30 students from the academic summer program. The subsequent analyses were based on this sub-sample, representing high achievers in Mathematics.

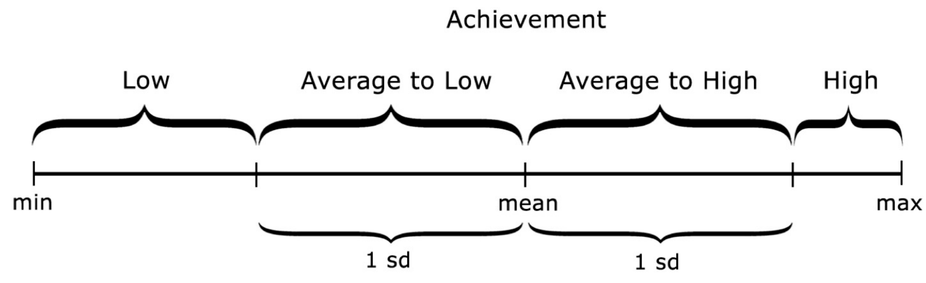

Figure 1. The four achievement categories on the continuum of Mathematics performance.

Table 1. Distribution of Students Attending Regular Junior High Schools in Achievement Categories.

Category	Achievement	*N*	%
1	High	31	10.4
2	Average to High	104	35.0
3	Average to Low	124	41.8
4	Low	38	12.8
Total		297	100.0

3.3. Performance Calibration

Preliminary analyses also included the calculation of participants' metacognitive accuracy, which was one of the metacognitive measures included in the study.

The accuracy of students' estimation of their Mathematics performance was assessed with the Absolute Accuracy Index [105]. Students' reported certainty for their provided solution in each task (c_i), along with students' actual performance at the task (p_i), were used for the calculation of the index according to the formula:

$$\frac{1}{N}\sum_{i=1}^{N}(c_i - p_i)^2,$$

where N is the number of Mathematics tasks ($N = 7$).

3.4. Motivational Profiles of High Achievers

The motivational profiles of the 141 high achievers in Mathematics were investigated via cluster analysis with k-means, using JASP 0.14 [104]. This method facilitated the classification of students according to their expectancies for success, the value they attributed to Mathematics, and their perceived cost of dealing with this subject. Since k-means algorithms require an a priori specification of the number of clusters to be formed, potential models with different numbers of clusters were compared with each other using the Bayesian Information Criterion (BIC). This index was minimized for the classification of students in five clusters (Figure 2). The selected model explained 66% of the variance (R^2) of the motivational variables, above the 50% indicative threshold [106]. The five clusters are depicted in Figure 3, and the centroids of each one are shown in Table 2. Their corresponding z-scores represent the deviation of each cluster's mean from the total mean (z-score = 0) of the 141 high achievers, for each one of the three motivational variables. The difference, measured in standard deviations, could be interpreted as the effect size of a student's participation in the cluster [107]. Thus, a value close to 0.2 indicates a small effect, a value around 0.5 indicates a moderate effect, whereas a value of 0.8 or above implies a large effect, according to the definition of Cohen's d effect size [108]. The majority of these differences for each motivational variable, presented in Table 2, indicate a moderate to large deviation from the total mean value of each variable in the high-achieving sample. Moreover, the five clusters seem to differ significantly from each other at least in one of the three variables (z-score differences at least 0.8), which further supports the internal validity of the resulting classification.

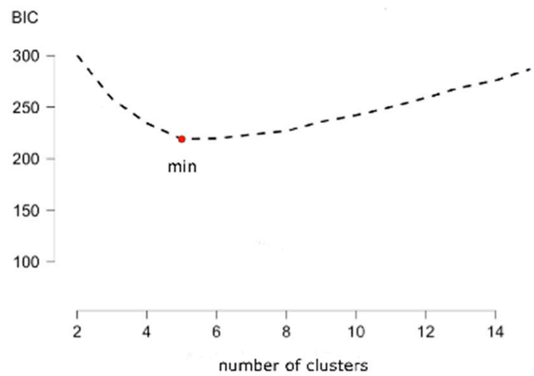

Figure 2. BIC minimization.

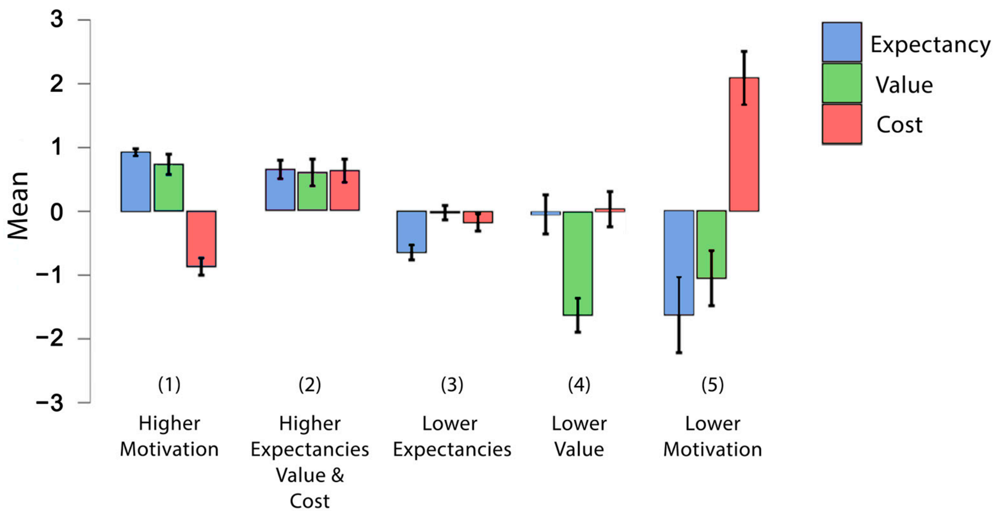

Figure 3. Means of expectancy, value, and cost per cluster (z-scores), with 95% confidence intervals.

Table 2. Cluster Sizes and Respective Means of the Three Motivational Variables.

Cluster	1	2	3	4	5
Relative Size	27%	17.7%	34%	12.8%	8.5%
Expectancy	4.95 (0.93)	4.75 (0.64)	3.85 (−0.64)	4.28 (−0.04)	3.17 (−1.63)
Value	4.52 (0.73)	4.41 (0.59)	3.97 (−0.02)	2.78 (−1.62)	3.19 (−1.05)
Cost	1.54 (−0.87)	2.62 (0.62)	2.05 (−0.17)	2.19 (0.03)	3.69 (2.08)

Note. z-scores are indicated in parentheses.

Students belonging to Cluster 1 represented 27% of high achievers. They were characterized by significantly higher expectancies for success, attributed higher value to Mathematics and perceived lower cost compared to the rest of high achievers. Students in Cluster 2, which represented 17.7% of the sample, did not differ significantly from the students in Cluster 1 in terms of expectancies for success and value attributed to Mathematics, since they also reported quite high values for both of these variables. Cluster 3 was the most populated, representing 34% of high achievers. Its members stood out due to their lower expectancies for success; however, the value and cost they reported did not deviate significantly from the corresponding mean values of the high achieving sample. Students who belonged to Cluster 4, representing 12.8% of the sample, differed from the rest only regarding their beliefs on the value of Mathematics, considering it much lower than the average high achiever. Finally, Cluster 5 included students who held significantly lower expectancies for success and value of Mathematics, and at the same time, they perceived significantly higher cost in comparison to the corresponding means of the sample, making them the least motivated group among high achievers.

With the emphasis given to the most prominent characteristics of each cluster's members, the five clusters were labeled as follows: Cluster 1—Higher Motivation; Cluster 2—Higher Expectancies, Value, and Cost; Cluster 3—Lower Expectancies; Cluster 4—Lower Value; Cluster 5—Lower Motivation (Figure 3). It is noted that these labels are not absolute but relative to the corresponding mean of the total high-achieving sample for each one of the three motivational variables.

Next, MANOVA with JASP [104] was applied in order to test whether the five clusters significantly differed in terms of the metacognitive processes (metacognitive awareness, perceived task difficulty, perceived certainty and accuracy) and the achievement emotions of their members. Significant differences were found in relation to metacognitive processes, $V_{pilai's} = 0.345$, F (16, 540) = 3.187, $p < 0.001$, *partial* $\eta^2 = 0.086$. After univariate analyses with Bonferroni correction, these differences were traced to students' self-reported metacognitive awareness, F (4, 135)= 9.102, $p < 0.001$, *partial* $\eta^2 = 0.212$, and their perceived certainty for the solution provided, F (4, 135)= 4.332, $p = 0.003$, *partial* $\eta^2 = 0.114$, but not to their perceived task difficulty or to their metacognitive accuracy. Post hoc tests revealed similar levels of metacognitive awareness for students belonging to the *Higher Motivation* and the *Higher Expectancies, Value, and Cost* clusters (Cluster 1 and Cluster 2). The rest of the clusters (Clusters 3, 4, and 5) were found to have lower metacognitive awareness compared to the *Higher Motivation* cluster, but nonsignificant differences were found among them. Students in the *Higher Motivation* cluster also reported being more certain about their provided solutions compared to the students in the *Lower Expectancies* and *Lower Motivation* clusters. Cluster means are summarized in Table 3.

Significant differences were also found among the five clusters regarding the emotions under examination of high achievers, $V_{pilai's} = 0.735$, F (20, 540) = 6.076, $p < 0.001$, *partial* $\eta^2 = 0.184$. Univariate analyses with Bonferroni correction indicated stronger differences for Enjoyment, F (4, 136) = 15.545, $p < 0.001$, *partial* $\eta^2 = 0.314$, Pride, F (4, 136) = 15.834, $p < 0.001$, *partial* $\eta^2 = 0.318$, and Anxiety, F (4, 136) = 15.770, $p < 0.001$, *partial* $\eta^2 = 0.317$. Smaller differences, but still with large effect sizes, were found for Boredom, F (4, 136) = 11.161, $p < 0.001$, *partial* $\eta^2 = 0.247$ and Shame, F (4, 136) = 9.228, $p < 0.001$, *partial* $\eta^2 = 0.213$. Post hoc comparisons showed that students in the Higher Motivation cluster (Cluster 1) reported significantly more positive emotions (enjoyment and pride) and less negative (boredom, anxiety, and shame) than the students of the Lower Motivation cluster (Cluster 5). Students in the Higher Expectancies, Value, and Cost cluster (Cluster 2) and Lower Expectancies cluster (Cluster 3) did not differ in terms of their achievement emotions, while some differences were found in the other combinations of cluster emotions comparison, as can be seen in Table 3.

Finally, the examination of gender distribution in each cluster did not reveal any significant deviation from the gender ratio in the total sample of high achievers, X^2 (4) = 1.461, $p = 0.833$.

Table 3. Comparison of the Means of Metacognitive and Emotional Variables for each cluster.

Cluster	(1)	Higher Motivation	(2)	Higher Expectancies, Value & Cost	(3)	Lower Expectancies	(4)	LowerValue	(5)	Lower Motivation		
	Mean (z)	**sd**	**Mean (z)**	**sd**	**Mean (z)**	**sd**	**Mean (z)**	**sd**	**Mean (z)**	**sd**	F	η_p^2
Metacognitive Awareness	3.93 (0.59) ^{a}	0.37	3.84 (0.39) ^{a,b}	0.44	3.49 (−0.40) ^{c}	0.30	3.48 (−0.43) ^{c}	0.58	3.49 (−0.43) ^{b,c}	0.42	9.102 ***	0.212
Perceived Difficulty	1.38 (−0.44)	0.36	1.63 (0.16)	0.41	1.66 (0.23)	0.45	1.57 (0.02)	0.32	1.64 (0.18)	0.48	2.852 *	0.078
Perceived Certainty	4.83 (0.54) ^{a}	0.28	4.55 (−0.06) ^{a,b}	0.43	4.48 (−0.21) ^{b}	0.57	4.51 (−0.15) ^{a,b}	0.37	4.37 (−0.45) ^{b}	0.47	4.332 **	0.114
Metacognitive Accuracy	0.34 (−0.31)	0.53	0.66 (0.09)	0.75	0.70 (0.14)	1.06	0.66 (0.08)	0.74	0.70 (0.13)	0.66	1.263	0.036
Enjoyment	4.06 (0.77) ^{a}	0.54	3.40 (−0.10) ^{c,b}	0.78	3.45 (−0.04) ^{b}	0.51	2.88 (−0.79) ^{c}	0.66	2.81 (−0.89) ^{c}	0.93	15.545 ***	0.314
Pride	4.09 (0.76) ^{a}	0.53	3.69 (0.23) ^{a,b}	0.62	3.34 (−0.23) ^{c,b}	0.46	2.98 (−0.71) ^{c}	1.01	2.85 (−0.88) ^{c}	0.83	15.834 ***	0.318
Boredom	1.73 (−0.47) ^{c}	0.89	2.27 (0.11) ^{b,c}	1.07	1.95 (−0.23) ^{c}	0.59	2.88 (0.76) ^{a,b}	0.80	3.15 (1.04) ^{a}	0.91	11.161 ***	0.247
Anxiety	1.42 (−0.73) ^{c}	0.36	2.04 (0.14) ^{b}	0.77	2.11 (0.24) ^{b}	0.59	1.80 (−0.19) ^{b,c}	0.54	2.85 (1.29) ^{a}	0.82	15.770 ***	0.317
Shame	1.51 (−0.52) ^{c}	0.56	1.96 (0.05) ^{b,c}	0.84	2.06 (0.17) ^{b}	0.71	1.74 (−0.23) ^{b,c}	0.58	2.89 (1.21) ^{a}	1.04	9.228 ***	0.213

Note. Means in the same raw with different exponent differ significantly at $p < 0.05$ level. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

4. Discussion

Based on the Situated Expectancy-Value Theory, the present study aimed to investigate alternative motivational profiles of high achievers in Mathematics. Also, it intended to explore potential differences among them in relation to metacognitive variables and a series of positive and negative achievement emotions. Using cluster analysis, five distinct motivational profiles of the identified high achievers emerged, labeled according to their deviation from the average high achiever: (1) *Higher Motivation,* (2) *Higher Expectancies, Value, and Cost*, (3) *Lower Expectancies*, (4) *Lower Value*, and (5) *Lower Motivation*.

The results showed that almost one out of four high achievers had the most adaptive profile of *Higher Motivation* (Cluster 1). Students with this profile reported higher expectancies for success, attributed greater value to Mathematics, and perceived less cost when dealing with this school subject compared to the average high achiever of the sample. Students in this cluster also showed increased metacognitive awareness and felt more certain about their solutions in the given mathematical tasks. Moreover, they were experiencing, on average, greater enjoyment and pride for their performance in Mathematics compared to their high-achieving peers while feeling less anxiety, shame, and boredom. These results confirmed *Hypothesis 1* and are in line with the predictions of the Control-Value Theory, which poses that increased motivation is accompanied by more positive activating and fewer negative deactivating emotions [77,78]. The results are also in accordance with numerous empirical studies, which indicate strong correlations between motivational variables, such as achievement goals and perceived task value, and achievement emotions, especially in classroom settings [89,109,110].

Students with the *Higher Expectancies, Value, and Cost* profile (Cluster 2) represented almost one-fifth of the sample. They shared a lot in common with students with the *Higher Motivation* profile (Cluster 1) despite the increased perceived cost of dealing with Mathematics. Specifically, students of Cluster 2 reported similar levels of metacognitive processes and most achievement emotions with students from Cluster 1, with the exception of significantly lower enjoyment and increased anxiety. Probably, high performance in Mathematics for many students in this cluster was the outcome of excess effort and time invested, and thus, it came at a high cost. This finding highlights the importance of evaluating cost separately rather than combining it with the positive dimensions of value into an aggregated score. Combining the positive and the negative dimensions of this cluster's value would cancel each other out, resulting in an overall value typical for the high-achieving students in the sample (Figure 3). Such aggregation would make it difficult to trace the reasons behind the increased anxiety that was observed in students belonging to this cluster, an emotion often associated with high perceived cost [111]. Conley [91] also found clusters of students with differences in reported affective variables when the perceived cost of Mathematics was considered independently, while they shared similar levels of overall value attributed to Mathematics. The elevated cost experienced by students in Cluster 2 might also explain their moderate enjoyment of math class; their enjoyment did not differ significantly from the enjoyment levels of students in the *Lower Motivation* cluster (Cluster 5), despite Cluster 2 students' increased interest in the subject (Table 3).

The *Lower Expectancies* cluster (Cluster 3) was the largest one, representing one-third of high achievers. With the exception of their expectancies for success, the other two motivational variables (value and cost) were close to the corresponding means of high achievers. Their reported metacognitive processes and achievement emotions were also around the means of the high-achieving sample, making this profile the most typical for high achievers.

The remaining two clusters were the least populated but of particular interest. Students within the *Lower Value* cluster (Cluster 4), while not differing from the average high achiever in terms of expectancies for success and perceived cost, attributed moderate value to Mathematics on average. This finding might explain the moderate levels of enjoyment and pride of students with this specific profile. Students belonging to this cluster might have had more interest in other school subjects, and their high achievement could be merely the result of their quest for a high-grade point average in school. More importantly, this finding suggests that the value of Mathematics could be questioned also by students who excel in this school subject, a counterintuitive result given the consistently reported positive correlation between achievement in Mathematics and its perceived value [24,38,112]. However, this finding highlights the importance of using person-centered approaches when more refined insights into individual variation are sought.

Moderate value was attributed to Mathematics also by students in the *Lower Motivation* cluster (Cluster 5), who were additionally characterized by moderate expectancies for success and increased cost. High achievement for students with this profile seems to come along with significant effort and low to moderate overall motivation. Metacognitive awareness and perceived certainty were also below the average levels of high achievers, while their positive emotions were below, and their negative emotions were above the average high achiever's respective levels. These results make this profile the least adaptive among the five emerged profiles of high achievers and confirmed *Hypothesis 2* for a cluster of high achievers with overall low achievement motivation.

Studies which have examined the psychological profiles of high achievers have primarily focused on their academic self-concept [113–115] and their achievement goals [20]. However, there are studies that investigated the psychological profiles of typical adolescents, regardless of their achievement level in Mathematics, which considered a range of motivational and affective variables, and resulted in outcomes similar to this study's. Among these common outcomes were the increased levels of positive emotions and decreased levels of negative emotions characterizing students with high motivational profiles [21,91,116]. Moreover, at least two studies [21,91] identified clusters similar to the *Higher Expectancies, Value, and Cost* cluster of the current study. These results highlight that high cost could co-exist with high expectancies and value for Mathematics.

The results of the study also confirmed that high-achieving students are well- calibrated regarding the estimations of their performance, a finding that has been consistently documented in a series of studies [65–68]. Moreover, no significant differences in terms of metacognitive accuracy were found among students with different motivational profiles, suggesting that accurate performance estimation is a well-developed skill of high achievers, independent of their motivational beliefs, such as the ones examined in the present study.

Moreover, it is worth noting the balanced gender ratio in each one of the five clusters, which followed the gender distribution in the initial high achieving sample. This was also the case for the cluster of *Lower Expectancies,* despite the anticipation of overrepresentation of female students (*Hypothesis 3*), grounded on the predictions of the Situated Expectancy-Value Theory [5,27]. SEVT emphasizes the influence of social stereotypes on students' motivational beliefs, suggesting that, theoretically, more girls would be expected to show reduced expectancies for success in a domain often perceived as male-dominated. This result is also contradictory to the majority of empirical findings, indicating low expectancies for success among female students [40–44], even for the ones scoring high in Mathematics [46,47]. While this phenomenon is not common, it is in accordance with some studies that have noted the gradual closing of the gender gap in expectancies for success throughout school grades, which, during adolescence, might even become negligible [95,117,118].

5. Limitations and Future Research

The present study provided further insights into the diversity of high achievers' motivational profiles, but it also had certain limitations which should be acknowledged. Among them is the evaluation of performance in Mathematics that was conducted using ad hoc mathematical tasks, since the focus was on high achievement within a school setting rather than using standardized procedures. Moreover, despite the carefully designed process of shortlisting these tasks to guarantee their representativeness for the grade's academic level, the final selection did not cover the whole curriculum of the ninth grade, evaluating Mathematics performance mostly in algebra. However, the resulting performance distribution of the students attending regular junior high schools resembled a Gaussian distribution.

Another limitation concerned the use of self-report instruments to measure the psychological variables of the study. Such methods lack the accuracy levels of more direct ways of measuring, for example, an emotion the moment it arises [119]. Also, despite the thorough validation of the AEQ tool used in the study [78,120,121], it is important to consider that the emotions identified and reported by students often depend on their willingness to disclose these emotions, which could be affected by students' social stereotypical beliefs [122]. Similarly, students do not always provide an entirely accurate depiction of their utilization of metacognitive strategies when they use self-reporting questionnaires [123]. This discussion highlights the benefits of the combined use of qualitative and quantitative approaches.

Future studies could also investigate whether the profiles found among high achievers would remain consistent throughout the whole period of secondary education or if they would vary according to students' school grades and the classroom environment, which is likely to be different among the school years. It would be of particular interest to examine a possible fluctuation of motivational profiles, especially during the critical stage of transition from primary to secondary school, when significant changes to students' ability beliefs are taking place [124–126]. Moreover, when investigating students' motivational profiles, it is worth considering contextual variables affecting student engagement with Mathematics. Such variables could include teachers' expectations for their students' success, as well as teachers' own motivational beliefs, emotions, or instructional style [5,127]. Families' SES could also be considered, given its impact on student motivation [5,40,128]. Finally, future studies could investigate further the nature of perceived cost when dealing with Mathematics, given its significant role in the present study as well. For example, it could be interesting to know more about students' specific conceptualization of cost, i.e., whether it is related mostly to increased effort, missing opportunities, or it is predominantly rooted in psychological factors [14]. Such approaches could provide further insights while evaluating the motivational profiles of high-achieving students in Mathematics.

6. Conclusions and Implications for Educational Practice

The present study contributes to the existing literature on high-achieving students in Mathematics by highlighting their alternative motivational profiles, which, in turn, are related to different metacognitive and affective characteristics. Contrary to the commonly held belief that high achievers comprise a homogenous group without significant challenges or needs for special support within academic settings [17,19], this study provided a more nuanced psychological depiction using a person-centered approach. The results showed that a considerable percentage of high achievers, despite their strong school track record, held counterintuitive motivational beliefs regarding Mathematics. Such beliefs included moderate expectancies of success, attributions of low value to Mathematics, increased perceived cost, or a combination of them. These outcomes were in line with previous research, which raised similar concerns for sub-groups of high achievers with non-adaptive motivational beliefs [20,113–115].

Moreover, the motivational profiles of high achievers were found to be closely aligned with their math-related achievement emotions. Students with the most adaptive motivational profile reported increased levels of enjoyment and pride and decreased levels of anxiety, shame, and boredom compared to the average high achiever of the sample. The opposite was observed for students with the least adaptive profile, thus replicating previous findings that indicated similar associations between motivational beliefs and achievement emotions [83,89,90,129]. Participants with higher motivational beliefs also reported enhanced metacognitive awareness and higher certainty for their Mathematics performance; however, all high achievers showed similarly high levels of metacognitive accuracy, regardless of their level of motivation.

These findings could have particular implications for educational practice. For example, they suggest that motivational interventions would be beneficial not only for low achievers in Mathematics but for high achievers as well. This might be applicable to the low value attributed to Mathematics by a considerable proportion of study participants, which could be successfully addressed even with short interventions that promote the utility component of the value of Mathematics. This has been shown in a series of studies targeting students [10,130,131] or engaging their parents as well [11,132]. Such interventions focusing precisely on utility value are the most common, as it is considered the most easily manipulable value dimension [133]. However, other interventions targeting attainment value, perceived cost, or a combination of value dimensions could also deliver favorable results [134]. These interventions are not yet commonly used in the context of Mathematics, but they have been already applied to other STEM subjects. For example, Johnson and Sinatra [135] found that the participants who adopted the perspective of a fictional student in a narrative, who believed in the importance of doing well in a biology course (attainment value), performed better on a post-test than those in the study's control group. Also, Rosenzweig et al. [136] tried successfully to reduce students' perceived costs related to college physics coursework by altering their attributions about challenges they faced in the course. The results of our study also underscore the importance of identifying high achievers who perceive a high cost when engage with Mathematics. This could help to timely address its causes before the increased cost potentially affects the overall total motivation and disengage students from their academic pursuits, as indicated in the longitudinal study of Tuominen-Soini and Salmela-Aro [111].

Another finding that could inform educational practice is the association between adaptive motivational profiles and adaptive emotions. Overall, higher expectancies for success in Mathematics are associated with enhanced perceived control when engaging with a mathematical task, and according to Control-Value Theory [78], this situation could potentially trigger positive emotions. Such associations were also found to be strong in previous research [90,137] and indicate a way for teachers to promote positive learning experiences through enhancing their students' academic self-beliefs.

In conclusion, a better understanding of high achievers' diverse motivational profiles and of the associated metacognitive and emotional differences could significantly contribute to the development of a more inclusive and supportive learning environment for high achievers, who are frequently overlooked in a regular class.

Author Contributions: Conceptualization, E.N.G.; methodology, E.N.G.; software, D.M.; validation, E.N.G. and D.M.; formal analysis, D.M. and E.N.G.; investigation, D.M. and E.N.G.; resources, D.M. and E.N.G.; data curation, D.M.; writing—original draft preparation, D.M.; writing—revision and editing, E.N.G.; supervision, E.N.G.; project administration, E.N.G. and D.M. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki and approved by the Institute of Educational Policy–Greek Ministry of Education (date of approval: 4 April 2017, No 57967).

Informed Consent Statement: Informed consent was obtained from all participants and one of their parents, and anonymity was assured.

Data Availability Statement: The data collected and used for this study can be downloaded in .sav format here: https://data.world/dimitris-math/profiling-high-achievers-in-math (accessed on 22 September 2023).

Acknowledgments: We would like to thank Emeritus Andreas Demetriou and Dimitrios Stamovlasis for their valuable insights and feedback regarding the statistical methods used for the data analysis.

Conflicts of Interest: The authors declare no conflict of interest.

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How Does an Inquiry-Based Instructional Approach Predict the STEM Creative Productivity of Specialized Science High School Students?

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Abstract: Creative productivity has not been studied much as an outcome of specialized science high schools. Rather, STEM career choices, acquisition of a STEM degree, and taking advanced STEM courses were taken as outcomes. This study examined whether the inquiry-based instructional approaches experienced by students predict their creative productivity and whether its effects are mediated through co-cognitive factors, school engagement, and school GPA. This study is part of a national longitudinal study about students from Science Academies, a type of specialized science high school in South Korea. A total of 599 students at Science Academies were surveyed on experiences of inquiry-based instructional approaches, co-cognitive factors, school engagement, and school GPA in math and science in their second year, and on creative productivity in their last year at Science Academies. Creative productivity was measured by the number of awards received from STEM competitions for research, problem solving, or projects. Confirmatory factor analyses confirmed the convergent validity of the measurement model. Structural equation modeling analysis and bootstrapping analysis revealed the direct, indirect, and total effects of inquiry-based instructional approaches on creative productivity. Inquiry-based instructional approaches experienced by students at Science Academies had a sequentially positive impact on co-cognitive factors, school engagement, and school GPA, ultimately contributing to creative productivity.

Keywords: creative productivity; specialized science high schools; co-cognitive factors; STEM; school engagement; school GPA

Citation: Kim, J.; Im, H.; Ahn, D.; Cho, S. How Does an Inquiry-Based Instructional Approach Predict the STEM Creative Productivity of Specialized Science High School Students? *Educ. Sci.* **2023**, *13*, 773. https://doi.org/10.3390/educsci13080773

Academic Editor: Valerie Margrain

Received: 1 June 2023
Revised: 22 July 2023
Accepted: 24 July 2023
Published: 28 July 2023

1. Introduction

To develop talents in science, technology, engineering, and mathematics (STEM), specialized science high schools (SSHSs) that provide intense and advanced STEM learning experiences through acceleration, enrichment, mentoring, and internships have been established [1–3] in many countries. It was found that high doses of acceleration and enrichment at SSHSs have contributed positively to students' career choices in STEM [1,4–7]. Wai et al. [7] followed students who scored in the top 0.5% in the Scholastic Aptitude Test (SAT) for math at age 13 and found that they had high achievements in STEM (STEM Ph.D., STEM publications, STEM tenure, STEM patents, and STEM occupations). Those who demonstrated high achievement were found to have had a higher STEM grade point average (GPA) during their high school career.

Subotnik, Kubilius-Olszewski, and Worrell [8] suggested the highest possible levels of creative performance or productivity should be the goal of gifted education. However, creative productivity has not been studied as a desired outcome of SSHSs, even though creative productivity is an essential property of eminent individuals who have changed and improved human welfare [9,10]. Instead, various outcomes such as admission to Ivy League Universities, STEM career choices, taking Advanced Placement (AP) course, high SAT scores, and/or high GPA in rigorous math- and science-related courses at the pre-college level and beyond were used to evaluate the effectiveness of education in SSHSs [5,6,11]. For example, Almarode, Subotnik, and Maie [4] studied long-term outcomes of education at SSHSs, such as the number of scientists, mathematicians, and engineers produced and their relationships with instructional practices, with SSHS graduates 4–5 years after their graduation from an SSHS. Logistic regression analyses on the relationship among classroom practices, strategies, and getting degrees in STEM revealed that 11–25% more of the students acquired bachelor's degree in STEM when they experienced teachers asking questions with predetermined answers, teachers making connections with other content areas, teachers focusing on a deep understanding of complex content, and participating in an internship or mentorship.

Since 1961, South Korea has experienced rapid economic development, and its well-educated populace has been the driving force behind the nation's impressive growth [12]. As South Korea continues to cultivate its industrial economy, the demand for human resources with creativity in STEM fields has grown increasingly imperative. Responding to the demand, the first specialized science high school (SSHS) in a province in 1983 marked a significant milestone in the education landscape. However, as SSHSs were established competitively by various provinces each year, the number of such schools increased to 15 in 1998. Consequently, a discernible decline in the average proficiency of students became evident and the education system underwent a paradigm shift, placing greater emphasis on the acquisition of knowledge and skills, thereby compromising creative productivity.

To address these concerns, the Gifted Education Promotion Act was promulgated in 1999, establishing the framework for the creation of eight Science Academies, which are specialized science high schools, across the country. These schools adopted an inquiry-based curriculum and instruction approach incorporating highly accelerated STEM content. The primary objective of Science Academies is to foster students' creative productivity [13,14]. It is worth noting that the eight Science Academies selectively admit approximately a total of 830 top-performing students nationwide each year, as reported by the National Science Gifted Information [15].

According to the Mega Model of Talent Development [8], students at the Science Academies are still in the stage of developing STEM talent. Their creativity is being transformed from general creativity to the STEM creativity that STEM professionals generally demonstrate. There have been studies which found that specialized education at an SSHS serves as a catalyst for the advancement of students' knowledge and skills in the STEM domain. However, it is not clear whether the inquiry-based instructional approach employed by Science Academies will contribute to enhanced creative productivity. Theoretically, the integration of inquiry-based instruction and heightened student engagement holds the promise of nurturing creative productivity in STEM fields. However, its actual contribution to creative productivity needs to be investigated.

In the section below, an examination of the theoretical underpinnings of the inquiry-based instructional approach, along with an exploration of definitions, developmental models, and the multifaceted nature of creativity, is undertaken. Furthermore, a review of the literature on variables associated with creativity is conducted, with a specific focus on exploring the development of creative productivity of students at Science Academies.

2. Theoretical Background and Review of Related Literature

2.1. Theoretical Background

2.1.1. Inquiry-Based Instruction and Nurturing STEM Creativity

Informed by constructivist and student-centered principles, inquiry-based learning has been recognized as a pedagogical approach that places emphasis on authentic and relevant study experiences [16–18]. Grounded in this approach, the inquiry-based instructional approach capitalizes on student motivation and engagement [19,20]. Incorporating a range of key components, inquiry-based learning (IBL) is characterized by elements such as a driving question, engagement in authentic and situated inquiry, learner ownership of the problem, teacher support rather than teacher direction, and creation of artifacts [16,21–23].

Establishing a safe learning environment is crucial for inquiry-based instruction, which necessitates student-centered and open-ended instructional approaches. In a safe learning environment, students actively participate in investigating real-life problems and applying critical and creative thinking skills [24]. Collaborative work with peers and mentors should be encouraged, emphasizing frequent communication among individuals with diverse ideas and backgrounds. Reflection and meta-cognition are promoted to enable students to think deeply about their learning. Additionally, connecting classroom activities to authentic, real-world experiences is prioritized, with teachers serving as facilitators in this process [25].

Given the attributes of an educational environment that fosters creativity, it is possible that inquiry-based instruction is a potent approach for cultivating and enhancing creative productivity.

2.1.2. Definition of Creativity

Creativity has long been equated with divergent thinking due to the domain-general assessment of creativity for children, such as the Torrance Tests of Creative Thinking (TTCT), which incorporate fluency and flexibility as key criteria. However, it is important to note that creativity is not synonymous with divergent thinking. Even Torrance [26], who developed a test to assess creative thinking, defined creativity as a psychological process involving the identification of difficulties, problems, missing information, or anomalies, followed by the generation and evaluation of hypotheses to address these deficiencies. The process may involve revision, retesting, and, ultimately, the communication of results.

Another school defines creativity by the nature of products. Stein [27] defined creative work as a novel creation that is accepted by a group as tenable, useful, or satisfying within a specific time frame. Stein emphasized that creativity emerges from the reintegration of existing materials or knowledge, while also incorporating new elements. Similarly, Runco [28] asserted that creative works should be original and appropriate. This definition aligns with Stein's perspective, as a work can only be accepted as satisfying if it is perceived by a group as useful and appropriate. The creative productivity of STEM talented students in Science Academies may be better defined by their products' originality and appropriateness than by creative thinking processes.

2.1.3. Development of Creativity

Kaufman and Beghetto [29] proposed that creativity develops from mini-c, little-c, Pro-c, to Big-C. Mini-c creativity refers to the novel and personally meaningful interpretations of experiences, actions, and events, often observed in children who discover new things. Little-c creativity manifests in everyday life, such as cooking, writing poetry, or landscaping. Pro-c represents a developmental progression beyond little-c, but has not yet reached the level of Big-C. It might be observed in the works of individuals who have achieved professional-level expertise in a specific domain. Big-C creativity is found in eminent individuals who are recognized for their significant contributions to human well-being. Engaging in extended formal or informal apprenticeships within academic institutions for over ten years can lead to the development of creativity at different levels. While some individuals may only reach the little-c level of creativity, others can attain the Pro-c level [29]. Assessments of these different levels of creativity vary, with self-assessments and microgenetic methods used for mini-c; psychometric tests (e.g., TTCT) and teacher ratings for little-c; citations, peer opinions, and prizes for Pro-c; and major prizes, honors, and historiometric measures for Big-C. While mini-c and little-c are domain-general, Pro-c and Big-C are domain-specific. Science Academy students might enter the developmental stage for demonstrating Pro-c while they are engaged in conducting projects or solving real-life problems utilizing their STEM knowledge and skills. Their Pro-c creativity might be assessed based on their citations, peer opinions, prizes based on their STEM artifacts produced through projects, or creative problem solving.

2.1.4. Multi-Faceted Nature of Creativity

Creativity is a complex construct comprising multiple components, as identified by various scholars [30–34]. Guilford [33] listed several psychological components necessary for creativity, including sensitivity to problems, fluency, novelty, flexibility, synthesizing ability, analyzing ability, reorganization or redefinition, complexity, and evaluation. Amabile [30,31] expanded on Guilford's components by adding domain-relevant skills and task motivation. Domain-relevant skills encompass the factual knowledge, required techniques, and talent specific to a particular domain. Task motivation includes both the motivation to engage in a task and the perception of motivation towards that task. Motivation, especially intrinsic motivation, plays a crucial role in creative performance [31]. These cognitive, personality, and social factors interact with one another in the context of creative performance.

Sternberg [34] emphasized the intellectual facet of creativity, highlighting aspects that can be explained by intelligence theory, intellectual styles, and personality traits such as tolerance of ambiguity, willingness to overcome obstacles, willingness to grow, intrinsic motivation, and moderate risk-taking. Cho [32] proposed the Dynamic System Model of Creative Problem Solving Ability to explain the development of STEM creativity among scientifically talented students. This model incorporates divergent and convergent thinking as tools of creativity, motivation, domain-general and domain-specific knowledge and skills, and a nurturing environment as the foundation of creativity. These components interact with and influence one another, and their manifestation can be affected by age and the nature of the problems to be solved [35–37]. Cho [32] also stressed that although divergent thinking is significantly correlated with creativity, it is not synonymous with creativity itself.

2.2. Review of Related Literature

As creativity refers to ideas, products, or performances which are valuable and new [38], productivity should refer not only to the quantity of products, but also to products' quality in terms of value and novelty. Professionals' Pro-c creative productivity in STEM might be operationally defined as the number of renowned products, such as published scholarly articles or registered patents in the STEM field [39]. However, it may be impractical to expect high school students to generate scholarly articles or patents. Alternative indicators of creative performance or achievement can be sought, such as accolades obtained from research competitions or creative problem-solving events such as the Intel Talent Search, Siemens Competition, or Math or Science Olympiads [29]. Awards and accolades from these competitions would be reasonable evidence of Pro-c creativity in addition to published scholarly articles and patents.

Depending on the psychosocial factors in the transformational process of educational experiences to students' outcomes, the influence of inquiry-based instructional experiences will be different as catalysts for talent development [40–46]. The creative productivity of professionals in academic (degrees obtained) and scientific (patents) areas are predicted by differences in abilities [7]. Students' creativity in STEM is predicted by psychosocial factors [8,40–44] and knowledge and skills in specific domains [8,35].

Co-cognitive factors are likely to contribute to creative productivity [44,45] and be interdependent with cognitive development [44], especially for the production of social capital. Renzulli emphasized that it is necessary to develop co-cognitive factors in order for talent to benefit society. Co-cognitive factors include optimism, courage, romance with a topic/discipline, sensitivity to human concerns, mental/physical energy, and a vision/sense of destiny. Previous research has indicated that engagement in volunteer work contributes to the augmentation of co-cognitive factors [45]. In light of this finding, it becomes intriguing to investigate whether the adoption of an inquiry-based instructional approach with which students can choose and attempt to solve a driving problem of real life can similarly enhance co-cognitive factors. Furthermore, a pertinent question would be whether these co-cognitive factors significantly contribute to the development of creative productivity.

Engaged students demonstrate effort, experience positive emotions, and pay attention to the activities and learning processes in the classroom [46]. Engagement is also associated with positive learning outcomes [47]. Teachers' use of certain instructional approaches may influence students' engagement. Engagement is behavioral, emotional, and cognitive involvement in academic activities [48]. Students' engagement is essential for high motivation, which influences creative productivity [49,50].

A comprehensive literature review conducted by Saunders-Stewart et al. [20] encompassed a 23-item criterion-referenced inventory that examined theoretically and empirically based student outcomes arising from inquiry-based learning experiences. The findings highlighted benefits, including: the development of knowledge and skills, increased intrinsic motivation, the cultivation of expertise, enhanced self-efficacy, task commitment, positive attitudes towards learning, perceived competence or expertise, and heightened creativity. Additionally, upon reviewing the literature, Barron and Darling-Hammond [16], Bell [51], and Condliffe et al. [17] found that students who participated in inquiry-based instruction experiences exhibited higher academic achievement overall, reflected in improved grades and test scores.

Previous studies on the outcomes of SSHSs are mostly focused on the linear relationship between educational experiences and the intended outcome, such as a STEM degree, STEM doctorate, STEM publications, STEM patents, or a STEM career [5,7]. Few studies have examined in-depth how such instructional approaches were mediated through students' academic achievement or psychological characteristics to predict creative productivity. Not all SSHS graduates who experienced the same inquiry-based instructional approaches may demonstrate high creative productivity after graduation. Therefore, it is necessary to find out how inquiry-based instructional approaches or strategies impacted their creative productivity, and their structural relationship with school GPA, and co-cognitive factors for predicting their creative productivity.

This study aims to examine whether students' perception of the practice of inquiry-based instructional approaches at Science Academies predicts creative productivity, and how co-cognitive factors and the school GPAs of STEM talented students work in the relationship between the practice of inquiry-based instructional approaches and creative productivity.

3. Materials and Methods

This study is part of a national longitudinal study of graduates from a kind of specialized science high school (SSHS), named Science Academies in South Korea, to be conducted for 25 years from 2017 to 2041. There are two different categories of SSHS in South Korea: one is Science Academies, which includes 8 schools, and the other includes 20 science high schools. Science Academies can recruit students from any province across the country with a more intense inquiry-based instructional approach. Science high schools can only recruit students from the respective provinces or cities where the school is located. Participants in this study were students from 8 Science Academies, but not from 20 science high schools. The first Science Academy was opened in 2003, whereas science high schools have been established since 1983. One of the goals of Science Academies is to enhance creative productivity of STEM talented students through inquiry-based instructional approaches including authentic intellectual work [52], discipline-based inquiry [53], project-based learning [54], and problem-based learning [55]. Park, K. and Seo [13] and Park, S. [14] found teachers and students felt positive about the instructional approaches at the Science Academies and the most frequently observed activities in the classrooms were students' presentations, discussions, seminars, and projects, and students were positive to unstructured open tasks. Park, K. and Ryu [56] examined instructional approaches at the Science Academies with a survey and found that students are encouraged to choose the problems or topics they wish to study within an instructional unit designed by the teacher; undertake projects on real problems, issues, and questions; get consultations from experts and authoritative sources; and work collaboratively to improve ideas and products. All students were required to conduct long-term research projects mentored by university professors or professional researchers at research institutes in addition to acceleration at least twice throughout the 3-year high school period. Total number of research projects each individual student conducted varied depending on their priorities [56].

3.1. Participants

Five hundred and fifty-nine (559) students from eight (8) Science Academies in Korea participated in this study. Out of 830 students in Class 2019, 813 (97.5%) consented to participate in the study and only 559 continued participating in the study for three consecutive years, from 2017 to 2019. Four hundred and seventy-three (473), 84.6%, of the students were boys, whereas 86 (15.4%) were girls. The population in the eight (8) Science Academies is 85% for boys and 15% for girls. Therefore, the sample reflects the population. According to the age in 2017, the largest group was 437 (78%) 16-year-old students, followed by 117 (21%) 15-year-old students. There were 3 (0.5%) 17-year-old students and 2 (0.4%) 14-year-old students. Since the data of students who participated for three consecutive years were analyzed, the attrition rate was 30%, which is not rare for longitudinal studies.

3.2. Measures

Questionnaire items were developed through review of related studies, reviews by educational psychologists, and teachers at SSHSs. Then, pilot study was conducted with 176 students from one SSHS. Validity was evaluated via conducting factor analysis based on the internal structure of the test and using the Kaiser normalization method with an equamax rotation technique applied through maximum likelihood estimation. Items meeting the following conditions were deleted: items that showed an increase in reliability of 0.05 or higher when excluding the item; items that displayed values with a difference of 1.5 standard deviations or more from the mean; items with item discrimination (correlation between the item and the total score) of 0.2 or lower; items with factor loading less than 0.3 in the factor analysis for a specific construct; items with high factor loadings for two or more unrelated constructs simultaneously; and items that did not load on any of the identified constructs but had high factor loadings on irrelevant constructs. Reliability was examined with internal consistency reliability, excluding certain items, and examining item-level descriptive statistics and item-total correlations. Cronbach's alpha levels, reliability coefficients, are reported for each variable.

3.2.1. Practice of Inquiry-Based Instructional Approach (IA)

The Science Academies' Instructional Practices and Learning Experiences Questionnaire [57] was used. This 5-point Likert Scale had seven items on curriculum and instructional practices including project-based learning; Socratic questioning; and student-centered approaches, with "1: never experienced" to "5: frequently experienced". Examples of items included: "classroom discussions between teacher and students"; "Student-initiated problem solving"; "Student-centered presentation and discussions"; "Conducting diverse projects"; "Hands-on activities"; "Experiments without answers known"; and "Investigation through observation". The Cronbach's Alpha Coefficient was determined to be high (α = 0.886).

3.2.2. School Engagement (SE)

Ten items from the Student Engagement in Schools Questionnaire [58] were used to measure school engagement. School engagement comprised: affective engagement; behavior engagement; and cognitive engagement. Examples of items included: "I like what I am learning in school." (affective engagement); "In class, I work as hard as I can."

(behavioral engagement); and "If I run into a difficult homework problem, I keep working on it until I think I've solved it." (cognitive engagement). The Cronbach's Alpha Coefficient was determined to be high (α = 0.937).

3.2.3. Co-Cognitive Factors (CC)

To measure co-cognitive factors, three sub-factors, including romance with a topic or discipline, physical/mental energy, and vision/sense of destiny, which were more creativity-related factors from the Operation Houndstooth: The Co-Cognitive Factors Scale [59], were used. For each factor, more items were added to increase the internal consistency reliability. Based on structural validity analyses with new items, 18 items were selected to measure the three factors. Example of items are: "I am involved in some activities being lost track of time"; "I cannot imagine my life working on something of no interest"; "I make my decisions"; "I am more energetic than other people"; "I imagine always who I want to be"; and "I know exactly what I like to do"; using a 5-point Likert scale where "1" is never and "5" is very much likely. The Cronbach's Alpha Coefficient (α = 0.943) was determined to be high based on a factor analysis.

3.2.4. School GPA (GPA)

Students self-reported their GPAs in math and science in their first and second academic years and the third year's first semester in five (5) points with '1' equaling GPA below 2.5; '2' equaling GPA from 2.5 to below 3.0; '3' from 3.0 to below 3.5; '4' from 3.5 to below 4.0; and '5' from 4.0 and above. Science Academies require three academic years for completion.

3.2.5. Creative Productivity (CP)

To determine creative productivity (CP), a total score of awards from various STEM research or creative problem-solving competitions was calculated. Examples of international competitions included, but were not limited to: International Mathematical, Physics, Chemistry, or Information Olympiads; Romanian Master in Mathematics; Singapore International Mathematics Challenge; and Intel International Science and Engineering Fair. Examples of Korean national competitions included, but were not limited to: Samsung Human-Tech Thesis Award; Korea Association for Gifted Education's Research & Education Competition; National Science Exhibition; and the Hanhwa Science Challenge. Different scores were given based on ranks, i.e., participation award = 1 point, distinguished award = 3 points, and top award = 5 points; based on group or individual, i.e., team award = 1 point, individual award = 2 points; and based on the degree of competitiveness, 1 point for domestic regional awards, 1.5 points for domestic national awards, and 2 points for international awards.

3.3. Procedure

A 5-point Likert scale questionnaire on students' perception of instructional practices and psychosocial factors was administered to students in their second year (2018) at the eight Science Academies. Data on creative productivity were collected through students' self-reporting in their third and last year (2019) at the Science Academies. Data on creative productivity were verified by checking with the data registered in the Korean National Human Resources Data System to secure external validity.

3.4. Analyses

Pearson's Product moment correlation coefficients were calculated, and Cronbach's Alpha was calculated to verify reliability. Before analyses of structural relations among instructional approaches, co-cognitive factors, school engagement, school GPA, and creative productivity, convergent validity of the measurement model was verified, and the significance of factor loading, average variance extracted (AVE), and construct reliability needed to be verified.

It was determined to be acceptable if factor loadings and average variance extracted (AVE) were above 0.500 and construct reliability was considered acceptable if it was above 0.700 [60]. The maximum likelihood method was employed for coefficient estimation in the structural model analysis. Various fit indices were examined to assess model fit, including χ^2/df CFI (Comparative Fit Index), TLI (Tucker–Lewis Index), RMSEA (Root Mean Square Error of Approximation), and NFI (Normed Fit Index). A CFI, TLI, or NFI value above 0.90 indicated excellent fit, while an RMSEA value below 0.08 indicated a good fit [61]. Furthermore, to determine the significance of direct, indirect, and total effects on creative productivity, the bias-corrected percentile method using bootstrapping was employed.

Descriptive statistics and correlation analyses were conducted. The mediating paths were evaluated using the structural equation modeling (SEM) technique. In order to control inflated measurement errors due to multiple items for the latent variables, item parcels were created for instructional approaches, co-cognitive factors, and school engagement. Using factor item parceling method, the fit indices of an SEM model were examined.

4. Results

4.1. Preliminary Analyses

Means, standard deviations, Pearson's product moment correlations between variables, skewness, and kurtosis are shown in Table 1. The inquiry-based instructional approach was significantly positively correlated with co-cognitive factors and school engagement (r = 0.300~0.605, p < 0.001). Creative productivity was also statistically positively correlated with school GPA, passion, goals (i.e., subscales of co-cognitive factors), and behavioral school engagement (r = 0.104~0.158, p < 0.001~0.05).

Table 1. Descriptive Statistics, Correlations statistics, correlations between variables.

		Inquiry-Based Instructional Approach			Co-Cognitive Factors			School Engagement			School GPA		Creative Productivity
		Class1	Class2	Class3	Mental Energy	Passion	Goals	Affective	Behavioral1	Behavioral2	Mathematics	Science	
Inquiry-based Instructional Approach	Class1												
	Class2	0.728 ***											
	Class3	0.711 ***	0.675 ***										
Co-Cognitive Factors	Mental Energy	0.400 ***	0.375 ***	0.371 ***									
	Passion	0.433 ***	0.376 ***	0.300 ***	0.705 ***								
	Goals	0.406 ***	0.353 ***	0.374 ***	0.781 ***	0.739 ***							
School Engagement	Affective	0.605 ***	0.547 ***	0.494 ***	0.508 ***	0.521 ***	0.523 ***						
	Behavioral1	0.482 ***	0.392 ***	0.397 ***	0.496 ***	0.487 ***	0.530 ***	0.696 ***					
	Behavioral2	0.475 ***	0.418 ***	0.415 ***	0.560 ***	0.590 ***	0.620 ***	0.697 ***	0.740 ***				
School GPA	Mathematics	0.114 **	0.011	0.018	0.056	0.072	0.065	0.130 **	0.174 ***	0.118 **			
	Science	0.125 **	0.049	−0.018	0.043	0.124 **	0.054	0.122 **	0.163 ***	0.117 **	0.640 ***		
Creative Productivity		0.056	0.049	0.019	0.061	0.142 **	0.104 *	0.048	0.060	0.111 **	0.129 **	0.158 ***	
M		4.195	4.176	3.835	3.944	4.174	3.942	4.135	4.274	4.209	4.007	4.329	13.260
SD		0.671	0.723	0.905	0.714	0.611	0.694	0.721	0.640	0.639	0.902	0.801	19.237
Skewness		−0.939	−0.841	−0.634	−0.384	−0.738	−0.410	−0.967	−0.878	−0.633	−0.849	−1.351	3.067
Kurtosis		1.497	1.022	0.186	0.374	1.638	0.371	1.746	1.321	0.929	0.346	1.718	13.945

N = 559, *** p < 0.001, ** p < 0.01, * p < 0.05.

4.2. Measurement Model

Before analyzing the structural relationships among inquiry-based instructional approaches, co-cognitive factors, school engagement, school GPA, and creative productivity, the convergent validity of the measurement model was examined. To do so, the significance of factor loadings, average variance extracted (AVE), and construct reliability were verified. A factor loading above 0.500 and an AVE above 0.700 were considered acceptable criteria for construct reliability [60].

In order to assess the extent to which the selected measurement variables explained their respective latent variables, confirmatory factor analysis was conducted to check factor loadings. The results revealed that the measurement model demonstrated a good fit with χ^2 = 158.320, df = 45, p < 0.001, CFI = 0.970, TLI = 0.956, NFI = 0.959, and RMSEA = 0.067 (see Table 2). As shown Table 3, the factor loadings for all measurement variables ranged from 0.774 to 0.902, indicating values above 0.500. Moreover, the AVE values ranged from

0.708 to 0.867, demonstrating values above the acceptable threshold of 0.500. Similarly, the construct reliability values ranged from 0.833 to 0.951, surpassing the acceptable threshold of 0.700 (see Table 3). Therefore, based on these comprehensive results, it can be concluded that the convergent validity of the measurement model has been established.

Table 2. The goodness of fit of the measurement model.

	χ^2	*df*	*p*-Value	CFI	TLI	NFI	RMSEA
Model	158.320	45	0.000	0.970	0.956	0.959	0.067
Acceptable Range				≥0.900	≥0.900	≥0.900	≤0.080

Table 3. Factor loadings, AVE, and construct reliability.

Measures and Variables	Unstandardized Factor Loading	*SE*	C.R.	Standardized Factor Loading	AVE	Construct Reliability
Inquiry-based Instructional Approaches						
Class1	0.820 ***	0.036	22.576	0.889		
Class2	0.818 ***	0.039	21.121	0.823	0.793	0.920
Class3	1.000	-	-	0.804		
Co-Cognitive Factors						
Mental Energy	1.000	-	-	0.859		
Passion	0.822 ***	0.034	23.923	0.825	0.867	0.951
Goals	1.021 ***	0.038	26.991	0.902		
School Engagement						
Affective	1.089 ***	0.046	23.819	0.833		
Behavioral 1	0.970 ***	0.041	23.896	0.835	0.847	0.943
Behavioral 2	1.000	-	--	0.863		
School GPA						
Mathematics	1.000	-	-	0.778	0.708	0.833
Science	0.939 ***	0.164	5.732	0.823		
Acceptable Range			≥1.965	≥0.500	≥0.500	≥0.700

$N = 559$, *** $p < 0.001$.

To verify discriminant validity, the correlation between variables and their respective average variance extracted (AVE) values were compared, following the criteria established by Fornell and Larcker [62]. If the AVE value was larger, it was considered to meet the requirements for discriminant validity. In fact, it was anticipated that as the correlations between variables increased, the likelihood of a lower discriminant validity would also increase. Hence, the correlation coefficient ($r = 0.740$, $p < 0.001$) between the variables school engagement and co-cognitive factors, which exhibited the highest correlation coefficient, and the AVE values for school engagement (0.847) and co-cognitive factors (0.867) were compared (see Table 4). The results revealed that the AVE values for school engagement and co-cognitive factors were both significantly larger than their correlation coefficient, indicating the presence of discriminant validity.

Table 4. Correlations among latent variables and creative productivity of the measurement model.

	Inquiry-Based Instructional Approaches	Co-Cognitive Factors	School Engagement	School GPA	AVE	Construct Reliability
Inquiry-Based Instructional Approaches	-				0.793	0.920
Co-Cognitive Factors	0.520 ***	-			0.867	0.951
School Engagement	0.665 ***	0.740 ***	-		0.847	0.943
School GPA	0.095	0.094	0.200 ***	-	0.708	0.833
Creative Productivity	0.053	0.114 *	0.090 *	0.181 ***	-	-

* $p < 0.05$, *** $p < 0.001$.

4.3. Structural Modeling Analysis

In this study, the structural relationships between inquiry-based instructional approaches (IA), co-cognitive factors (CC), school engagement (SE), school GPA, and creative productivity (CA) among students at SSHSs were verified based on the research model established in this study (see Figure 1). The results showed that the research model was well-fit, with χ^2 = 165.752, *df* = 50, $p < 0.001$, CFI = 0.969, TLI = 0.960, NFI = 0.957, and RMSEA = 0.064.

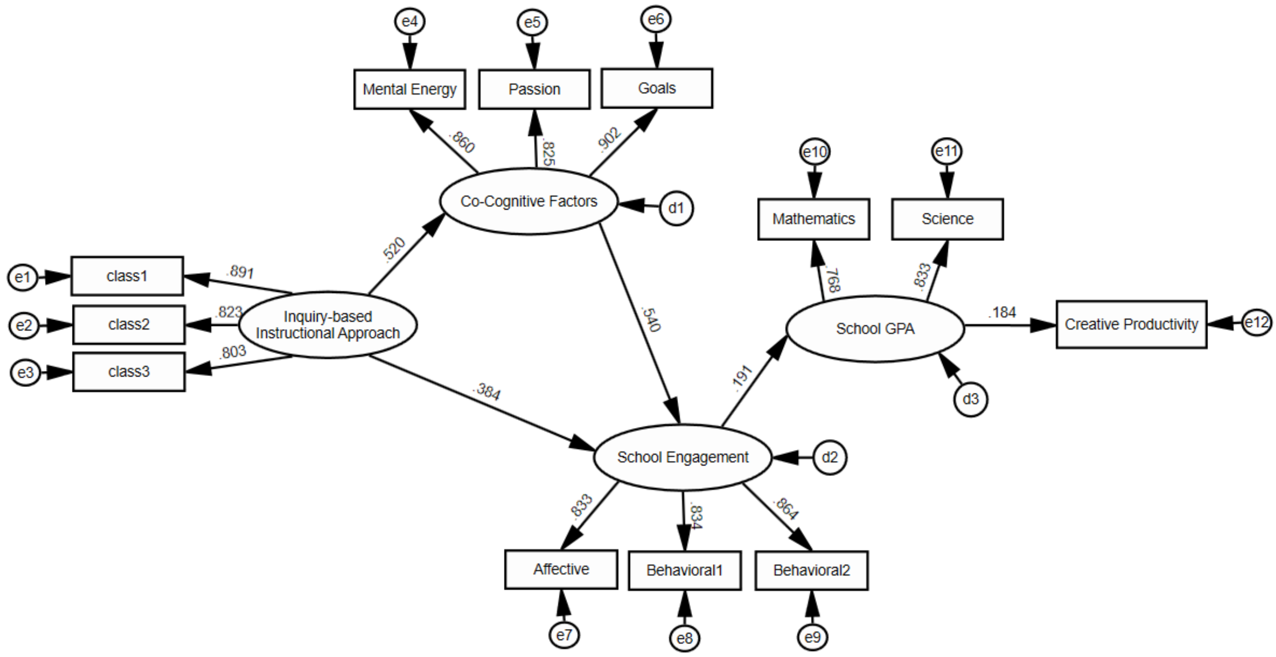

Figure 1. Structural equation model with the standardized regression weights.

Additionally, the path coefficients for the measurement variables for all latent variables were significantly high at 0.768 or greater. These findings suggest that the research model is a good fit for the data and that the structural relationships between the variables are supported.

The results of the structural equation modeling (SEM) analysis showed that inquiry-based instructional approaches (IA) had a positive impact on co-cognitive factors (CC) (β = 0.520, $p < 0.001$) and school engagement (SE) (β = 0.384, $p < 0.001$), and CC had a positive impact on SE (β = 0.540, $p < 0.001$). SE had a positive impact on school GPA (β = 0.191, $p < 0.001$), and school GPA had a positive impact on creative productivity (CP) (β = 0.184, $p < 0.001$). The path coefficients for the structural relationships between the variables were significant at $p < 0.001$ (see Figure 1 and Table 5).

Table 5. Path coefficients for the structural model.

Outcomes		Predictors	*B*	β	*SE*	*C.R.*
Creative Productivity	←	School GPA	5.125	0.184 ***	1.362	3.762
School GPA	←	School Engagement	0.239	0.191 ***	0.068	3.541
School Engagement	←	Co-Cognitive Factors	0.485	0.540 ***	0.039	12.519
School Engagement	←	Inquiry-Based Instructional Approaches	0.291	0.384 ***	0.032	9.063
Co-Cognitive Factors	←	Inquiry-Based Instructional Approaches	0.439	0.520 ***	0.039	11.148

N = 559, *** $p < 0.001$.

These findings suggest that the inquiry-based instructional approaches practiced in Science Academies can play an important role in enhancing the academic achievement and creative productivity of STEM talented students. It also suggests the importance of students' active engagement in school life in enhancing their academic achievement and creative productivity.

4.4. Direct, Indirect, and Total Effects on Creative Productivity

Based on the bootstrapping analysis, the direct, indirect, and total effects on creative productivity were examined. The total effect on creative productivity was found to be highest for academic achievement (total effect = 0.184, $p < 0.05$), followed by school engagement (total effect = 0.035, $p < 0.05$), inquiry-based instructional approaches (total effect = 0.023, $p < 0.05$), and co-cognitive factors (total effect = 0.019, $p < 0.05$). The indirect effects on creative productivity were found to be the highest for school engagement (0.035, $p < 0.05$), followed by inquiry-based instructional approaches (0.023, $p < 0.05$) and co-cognitive factors (0.019, $p < 0.05$). The significance of the indirect effects was confirmed using the bias-corrected percentile (BC) method. The results showed that instructional approaches, co-cognitive factors, and school engagement all had statistically significant indirect effects on creative productivity ($p < 0.05$). Specifically, inquiry-based instructional approaches had a statistically significant indirect effect on creative productivity, mediated through two paths: one through co-cognitive factors, school engagement, and school GPA and the other through school engagement and school GPA (indirect effect = 0.023, $p < 0.05$). Moreover, co-cognitive factors, school engagement, and school GPA were all found to have statistically significant indirect effects on creative productivity (indirect effect = 0.019, $p < 0.05$). School engagement also had a statistically significant indirect effect on creative productivity through school GPA (indirect effect = 0.035, $p < 0.05$). Therefore, based on these findings, it can be concluded that co-cognitive factors, school engagement, and school GPA significantly mediate the relationship between instructional approaches and creative productivity (see Table 6).

Table 6. Direct, indirect, and total effects of instructional approaches, co-cognitive factors, school engagement, and school GPA on creative productivity.

Outcomes	Predictors	Standardized Direct Effects	Standardized Indirect Effects	Standardized Total Effects
Creative Productivity	Inquiry-Based Instructional Approaches	-	0.023 *	0.023 *
	Co-Cognitive Factors	-	0.019 *	0.019 *
	School Engagement	-	0.035 *	0.035 *
	School GPA	0.184 *	-	0.184 *

* $p < 0.05$.

5. Discussion

This study examined the direct and indirect effects of the inquiry-based instructional approaches that students perceived during their study at Science Academies, co-cognitive factors, school engagement, and school GPA on creative productivity. In Korean Science Academies, inquiry-based instructional approaches are practiced, including project-based learning, student-centered teaching, and Socratic questioning approaches, and students expressed high satisfaction with these approaches [13,14,56].

The findings of this study revealed that inquiry-based instructional approaches, co-cognitive factors, school engagement, and school GPA all positively contribute to creative productivity. The inquiry-based instructional approaches perceived by students as practiced at Science Academies had a sequentially positive impact on the co-cognitive factors, school engagement, and school GPA of students, ultimately contributing to enhance creative productivity.

Furthermore, inquiry-based instructional approaches at the Science Academies also have a direct positive contribution to school engagement and co-cognitive factors. Therefore, based on these findings, it can be inferred that various inquiry-based instructional approaches perceived by students as practiced at the Science Academies, such as project-based, Socratic reasoning, and student-centered approaches, contributed to the cultivation of students' school engagement and co-cognitive factors in students. School engagement contributed to students' math and science achievement, which contributed to students' creative productivity.

These findings support several relevant previous studies [4,10] suggesting that high doses of STEM learning through acceleration and enrichment at an SSHS become important predictors of subsequent STEM achievement. It also supports the findings of various studies which found a positive relationship between inquiry-based instructional approach and students' achievement [16,17,51]. Furthermore, the findings of this study show that students' high achievement in math and science contributes to their creative productivity.

Previous research examining the impact of education at specialized science high schools (SSHSs) primarily concentrated on assessing the attainment of STEM expertise. In contrast, the outcomes of this study illustrate that inquiry-based instruction with a certain level of expertise in STEM has the potential to augment students' creative productivity within the STEM domain, aligning with the assertions made by Baer [63], Cho [32], and Lin and Cho [35]. Furthermore, the investigation revealed that the implementation of an inquiry-based instructional approach fostered the development of students' co-cognitive factors and school engagement, ultimately leading to improvements in their school grade point average (GPA) in mathematics and science.

Co-cognitive factors play a vital role in fostering a sense of commitment among talented individuals to contribute to the generation of social capital [44]. The findings of this study provide evidence that co-cognitive factors can be cultivated not only through participation in volunteer work [45], but also through the implementation of inquiry-based instructional approaches. This may be attributed to the fact that the problems students select for their projects or problem-solving activities can instill a sense of purpose/destiny, sensitivity to human concerns, courage, and motivation to address real-world challenges, thereby serving as a catalyst for the creation of social capital. This discovery represents a novel contribution to the existing body of knowledge on this topic.

Most of the talent-development models have emphasized the importance of educational opportunities and practices for the talent development of gifted individuals [40,64,65]. However, few empirical research projects were conducted on their relationships with psychosocial factors and their impact on creative productivity. Consequently, there has been limited empirical research performed on this relationship based on the data of SSHS students. Therefore, this study holds academic significance and distinguishes itself from previous related research by empirically validating the positive impact of inquiry-based instructional approaches at SSHSs on creative productivity through co-cognitive factors, school engagement, and school GPA.

5.1. Implications for Educational Practices

The findings of this study demonstrated that inquiry-based instructional approaches perceived by the students at SSHSs enhance students' school engagement, then co-cognitive factors, and then ultimately result in enhanced creative productivity. Other studies on the characteristics of the curriculum and instructional strategies at SSHSs also revealed that these schools utilize challenging and inquiry-based learning, as well as instructional strategies that connect real-world problems to the students' research or independent study, tailored to the characteristics of STEM talented students [1,3,66].

Furthermore, the research results indicate that STEM academic achievement has a direct impact on STEM creative productivity. These results align with a retrospective study conducted on graduates of Korean science high schools [67], further supporting the findings that STEM talented students who excel in academic achievement also demonstrate creative productivity, with the instructional methods and the school environment in gifted schools playing a positive role in fostering these outcomes. Therefore, when considering these findings collectively, this study provides educational implications regarding how to create a desirable school environment to enhance the creative productivity of gifted students. It can be concluded that inquiry-based instructional approaches, which enhanced students' achievement in mathematics and science, contribute to STEM creative productivity.

The comprehensive review of the literature on inquiry-based instruction informs us that the effectiveness of inquiry-based instruction lies in motivating students through critical elements like interest, choice, and autonomy [68]. Educational institutions must prioritize consistent efforts to enhance students' engagement in school activities by implementing inquiry-based instructional strategies. This approach is particularly vital for achieving exceptional success in mathematics and science, especially among gifted students in the STEM field. For STEM talented students, it is essential for teachers to actively grant them the freedom to make choices throughout the learning process. This student-centered approach fosters their intrinsic motivation, decision-making, self-reflection, self-assessment, and an appreciation for diverse perspectives and solutions. Teachers and mentors should act as facilitators, emphasizing active listening and reducing interventions. Encouraging students to explore, experiment, and providing non-judgmental feedback [69] and appropriate encouragement fosters a positive learning environment, leading to improved academic performance, deeper comprehension, and enhanced retention of knowledge [70].

Teachers can benefit from familiarizing themselves with various inquiry-based instruction models, such as project-based learning [71], problem-based learning [72], Genius Hour or 20% Time [73], Passion-Based Learning [74], Personalized Learning [75], and Open Inquiry [76]. These diverse approaches can further enrich the educational experience for students.

5.2. Implications for Future Research

This study aims to explore the factors influencing the creative productivity of students at SSHSs, focusing on their school engagement, cognitive and affective characteristics, and academic achievements during their high school period. Zabelina et al. [77] found that individuals' creative productivity peaks in their 20s, and vocational interest is a strong predictor for creative productivity in a specific domain. Considering these findings, it would be necessary to track participants of this study to find out whether the highly productive participants persist in their high creative productivity in their 20s. In addition, it needs to be investigated whether anyone immersed in school engagement, with cognitive and affective characteristics and high academic achievements demonstrate a peak in their creative productivity in their 20s.

5.3. Limitations

In this study, data were analyzed on factors related to the creative productivity of students who attended Science Academies during the years 2017–2019. Therefore, it may not be generalized to students from different time periods and different schools in different countries or cultures. Furthermore, the creative productivity of the participating high school students was primarily manifested in mathematics and science. It would be unreasonable to expect to find the same outcome consistently occurring in other domains.

Author Contributions: All authors took part in data collection, data analysis, reporting of the study, determining the subject of the manuscript, methodology, research design, reviewing and editing. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the Korean Ministry of Education.

Institutional Review Board Statement: Ethical review was exempted based on No. 16 (Cases for Exemption of Review and Approval) of Korean Educational Development Institute's IRB Operational Guidelines.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Data is unavailable due to privacy or ethical restrictions.

Conflicts of Interest: The authors declare no conflict of interest.

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education sciences

Article

Feelings about School in Gifted and Non-Gifted Children: What Are the Effects of a Fine Art Program in Primary School?

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Abstract: There is a consensus about the benefits of an artistic activity on health and well-being. In France, a gifted child is considered a special needs student for whom enrichment is advocated. Therefore, this study examines the extent to which a whole-class art enrichment program delivered to both gifted and non-gifted children benefits both student populations with respect to their school well-being. The art program was implemented in classrooms over the course of an entire school year (during the COVID-19 pandemic). The self-report French version of the Feelings About School scale (i.e., FAS) was completed in three steps (i.e., before, mid-program, and after) by a sample of gifted and non-gifted children benefiting from the program. The FAS scores of those students were also compared at the end of the school year with those of students who did not participate in the art program. Despite the pandemic context that requires caution in drawing definite conclusions, this study supports that (i) the fine arts practice is a lever of development, (ii) the sanitary situation was detrimental for elementary school students, and (iii) better adaptive capacities were exhibited by gifted children in this context.

Keywords: feelings about school; giftedness; artistic practice; fine arts; enrichment; inclusive school

Citation: Sanchez, C.; Blanc, N. Feelings about School in Gifted and Non-Gifted Children: What Are the Effects of a Fine Art Program in Primary School? *Educ. Sci.* **2023**, *13*, 512. https://doi.org/10.3390/educsci13050512

Academic Editors: Kirsi Tirri and Valerie Margrain

Received: 30 March 2023
Revised: 6 May 2023
Accepted: 15 May 2023
Published: 18 May 2023

1. Introduction

Supported by 3000 scientific studies that explore the relationship between art and health, the WHO (World Health Organization) has published a report rich in perspectives on the beneficial effects of the practice of art on individual and collective development [1]. In the light of this promising synthesis, the objective of our research is to measure the effects of regular participation in fine arts activities at school on the Feelings about School [2] of gifted and non-gifted students enrolled in elementary school (i.e., students from first to fifth grade, aged 6 to 11 years).

1.1. The Gifted Children: Elements of Consensus about What Characterizes Them

Since there is still no consensus on the scientific definition of giftedness and how to detect it [3,4], we will focus on the common denominators that distinguish gifted children in order to define this phenomenon. As a reminder, the gifted child presents an unperturbed yet atypical development. The developmental construction of the gifted children's intellectual abilities, both precocious and exceptional [5–8], allows their detection. Instead of relying solely on IQ scores of 120 [9–11], 125 [12–14], or 130 [15–20], which vary depending on the studies, it is more crucial to consider the child's entire developmental history when discussing the topic of giftedness. Current knowledge relating to the neural substrate of intelligence, using fMRI, has made it possible to objectify this exceptional functioning on the cerebral level, both via the observation of a better integrity of the white matter of the gifted [21] and by the discovery of a correlation between highly fluid intelligence and better structural connectivity (i.e., neuronal; [22]). Taking into account the child's developmental construction, the a posteriori study of really early developmental signs has also been established by science, at the level of motor as well as verbal acquisitions of the gifted infant and baby (i.e., advanced in the acquisition of babbling and then language [9,10]). In early childhood, gifted children would still be distinguished by extraordinary memory capacities [23,24]. Other cognitive or functional characteristics, for example, early humor [25], a curiosity trait [5,7,8,26,27], or a different sleep [28–30], also appear to distinguish these children, although they deserve further study. Scientific literature supports the concept of asynchronous development in gifted children, where their cognitive development is very advanced compared to their socio-emotional development which is either normalized or similar to that of their peers [6,7,31,32]. This disparity is thought to contribute to the difficulties some of these children encounter in understanding complex concepts at a young age without being emotionally prepared to handle them [6,33].

1.2. The Gifted Student: A Student with Special Educational Needs

Most gifted students, far from experiencing academic difficulties, appear to succeed in school [34]. Nonetheless, a developmental discrepancy is apparent when considering gifted students' diverse potentialities, including creativity, feelings about school, and involvement in the school environment [33]. Coupled with an erroneous social representation of the gifted children in France [35], this gap could be one of the factors that explain the paradox of gifted students who struggle with academic or adaptive difficulties [36]. Indeed, having significant cognitive abilities may not protect these children from the possibility of being insufficiently stimulated [37], underachieving, or even struggling academically [38]. Moreover, the level of well-being in gifted children appears to be related to both their academic achievement in school and the expression of their creativity [39]. However, reliable quantitative data on the prevalence of gifted children experiencing difficulty at school are lacking. The CNAHP (National Center for Assistance to children and adolescents with giftedness), however, conducted a study of 611 gifted children which revealed that 76.6% of them sought counseling for problems related to their schooling [40]. Gifted children are in fact considered by the French education system as a category of "special needs students", for whom recommendations have recently been advanced in order to promote both their academic success and their socio-emotional development in the school environment. The importance of differentiated pedagogy is emphasized, so that the student is offered tutoring, decompartmentalization, grouping, acceleration [41], or enrichment [42–44] on a case-by-case basis.

1.3. Theoretical Frameworks for Understanding the Gifted: From the Three-Ring Intelligence Model to the Self-System Theory

As we considered the creation of an enrichment program for gifted children (to approach giftedness with the greatest possible inclusiveness), we drew both from the three-ring intelligence model [45–47] and the enrichment suggestions that resulted from it [48]. Among the theories of intelligence, Renzulli's [46,47,49,50] theory has the main advantage of being holistic and open-ended in terms of how gifted individuals are identified, which is particularly relevant to the education of gifted children. Indeed, the aim is not so much to isolate a small percentage of children with a total IQ of 130 or more but to support the development, in an educational setting, of a wider range of children who do not always have homogeneous cognitive profiles but have very good abilities that should be encouraged. It is also an approach that contributes to the understanding of giftedness, considering the optimization of the gifted child's potentialities as being located at the meeting point between intellectual abilities, creativity, and engagement in the task. Here, we consider creativity as a lever to satisfy the development of the child's well-being in the school environment, by trying to encourage it in the child through the implementation of a fine arts program designed according to the multivariate approach to creativity [51]. Creativity is a dynamic process that allows an individual to juggle, through the flexibility of their thinking, between exploratory divergent thinking (i.e., generating a multiplicity of ideas) and integrative convergent thinking (i.e., achieving a finalized "object" following an effort of synthesis; [52]). Beyond its intrinsic relevance for the intellect of the gifted, this three-ring theory—coupled with the theories of engagement and the theory of multivariate creativity (see Figure 1)—seems to represent a favorable context to consider an artistic enrichment program for all (not only intended for gifted students) which is likely to induce children to practice the flexibility of their graphic creative thinking. On the one hand, creativity seems essential to prevent the social or behavioral maladjustment of children and adolescents [53,54]. On the other hand, finding ways to meet the needs of all students while meeting those of the gifted could make it possible to overcome the inclusion and differentiation issues that arise in schools, considering the particular needs of non-gifted students [55]. In this study, which is in line with research conducted on the functioning of gifted students compared to their non-gifted peers [33], engagement is understood beyond the task, as conditioning the child's self-determination in relation to learning [56,57]. The French version of the FAS (Feelings About School; [2,58]), selected to measure engagement in this research, is based on the self-determination theory [57,59,60]) and on its mostly adapted derivative in the field of education, the theory of auto-systemic processes [61]. This theory states that students' development (and involvement) is conditioned by the satisfaction of their basic psychological needs, namely to feel competent, autonomous, and in relation with others [2,58,61].

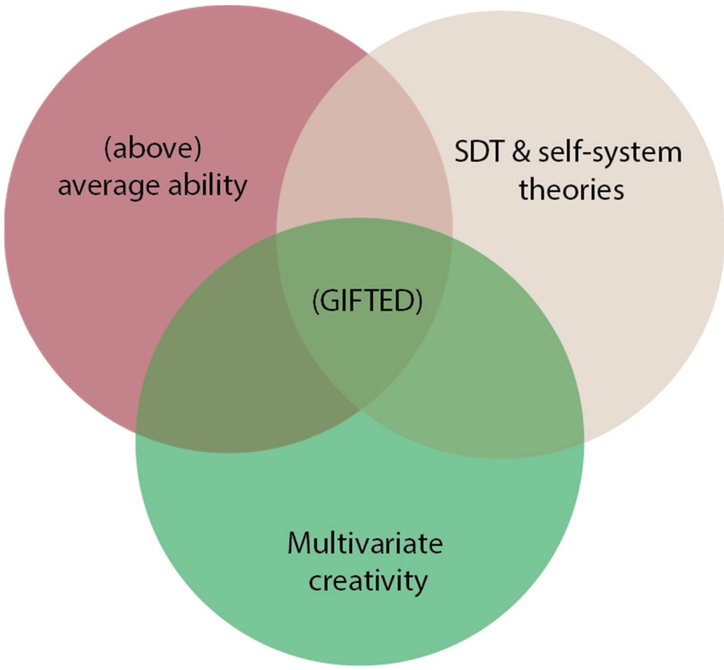

Figure 1. Graphical representation of Renzulli's three-ring theory [46,47,49,50] with integration of commitment theories and the multivariate approach to creativity [52], adapted from Sanchez and Blanc [33].

This issue of meeting the students' psychological needs is also of particular interest in this study, given the possible impact of an art enrichment program on students' engagement. Indeed, with respect to the schoolwide enrichment model (SEM) [62,63], the objective is to develop enrichment programs linked to the interests of gifted children which is similar to the implementation of Renzulli's theory urging to propose programs that engage (or re-engage) gifted children in learning through an activity that stimulates their creativity. While enrichments can be of three types, this study focuses on Type II enrichment, which is the most inclusive and consists of whole-class activities (exercises) that enable learners to acquire specific skills in a particular domain (in this case, fine arts).

1.4. Fine Arts as a Promising Enrichment Activity

After searching for enrichment activities that would be relevant for gifted children as well as for their peers, according to the SEM model mentioned above [62,63], we selected one that was centered around the fine arts. As a reminder, the recent WHO report on the effects of art on health and well-being [1] shows that it is possible to rely on the arts, at all ages, to promote harmonious development and good physical and mental health. While this report reveals a positive effect of participation in an artistic activity on many facets of individual development, this engagement in the arts appears especially relevant for children whose development is "under construction". One study indicated that the child's engagement in art would indeed be favorable to their own psychosocial functioning, as well as also having a beneficial impact on that of their parents [64]. Some studies tended to show respectively that it could help the child to strengthen their emotional skills [65] and express their emotions [66] while positively impacting their mood. Indeed, the simple act of drawing could have a positive effect on the mood of children aged 6 to 12 who are enrolled in elementary school [67]. At least two studies documented that the practice of art would also be a more predictive factor of school performance the earlier children are exposed to it [68,69]. Early exposure to music, for example, would have a lasting positive influence on the development of language and reading [70–74] and the ability to pay attention [75]. Participation in an artistic activity would be linked favorably to maintaining individual motivation and tenacity in the face of the task [76]. With the practice of fine arts, this positive effect of engagement in art on students' cognitive development seems to be added to a positive impact on their socio-emotional development at school, by promoting prosocial behaviors and social cohesion [77–80]. Despite limited literature on the effects of gifted students' engagement in an artistic practice, it seems to be beneficial for this population. In particular, gifted children who draw would develop more harmoniously than non-artists, and art therapy would be effective in this population [81,82]. Benefits appeared to be also found in the educational environment, with artistic enrichment which may allow underperforming gifted students to improve their academic results by transfer effects from competence to competence [83].

Taking into account the expected benefits of artistic activity on non-gifted as well as gifted students, we created the visual arts educational program Experiencing Art at School to facilitate the uniform deployment of visual arts sessions in a large number of schools, simultaneously and by a variety of teachers, in the most homogeneous way possible.

1.5. COVID-19 Context: Effects on Students

With the onset of COVID-19, which notably led to the temporary closure of schools, a distance learning program was put in place with the aim of allowing students, confined to their homes at the time, to follow their lessons remotely. A report by the French DEPP (Directorate of Evaluation, Foresight and Performance) based on seven surveys conducted in May 2020 shows that the system that was implemented allowed students to continue to benefit from learning; it was judged from fairly satisfactory to completely satisfactory (i.e., according to 77% of teachers) between the months of March and May 2020 [83]. However, this report does not take into account the effect of this situation on the functioning and psychological state of students, which it would nevertheless be interesting to consider in view of other studies that report less optimistic results [84,85], such as an increase in mood and sleep disorders [86]. Since the health crisis, the data also show an increase in consultations and hospitalizations in child psychiatry for adolescents aged 12 to 17 years [87], with a significant global upsurge in the development of mental illnesses in this population [85]. Another report by the French DEPP released later in November 2020 and based on the collection of data during the national evaluations of first, second, and sixth grades also showed a decrease in the academic performance of first- and second-grade students who experienced lockdown in Spring 2020.

1.6. Reminder of this Study's Objectives

In this study, we focused on examining whether a beneficial effect of exposure to the "Experiencing Art at School" program could be observed in gifted as well as in non-gifted children, despite the drawback of its being launched during the health crisis. Indeed, the benefits of the program were expected and evaluated with regard to the French Feelings About School [2], both among gifted and non-gifted schoolchildren, over the 2019–2020 school year. We expected to observe an increase in FAS scores after exposure to the program, for both gifted and non-gifted children, with a higher FAS after program follow-up compared to the FAS of children not exposed to the program.

2. Methods

2.1. Participants

Fifty-two elementary school teachers were recruited as part of this study, which was carried out according to a both cross-sectional and longitudinal approach. A total of 1100 students from the Montpellier metropolitan area took part in the Experiencing Art at School program. Among them, 350 students participated in our study, including 45 gifted children. The typical children were randomly selected from each class, after making sure that no neurodevelopmental or learning disorders had been reported concerning them. With regard to the gifted students, their inclusion was based either on the results of psychometric tests already carried out (the results of which were communicated to us beforehand) or via the taking and calculation of their short-form WISC-IV IQ score [88] carried out at the time of the implementation of the project in schools. The children we tested were selected either because their parents or teachers identified them as potentially gifted (using the Eduscol pre-screening grids published by the French Ministry of Education) or because we were able to identify them ourselves during interventions and interactions in the classrooms. Despite the aforementioned health context, we managed to form a control group in June 2020, with children from different public schools of the Montpellier district who had not been exposed to the program.

Our experimental group for which we were able to carry out the three programmed measurements of the FAS (i.e., at the initial state t0, mid-program t1, and at the end of the school year t2) included 105 non-gifted participants (including 56 1st- and 2nd-grade students and 49 3rd-, 4th-, and 5th-grade students; 48 girls and 57 boys) and 30 gifted participants (including 13 1st- and 2nd-grade students and 17 3rd-, 4th-, and 5th-grade students; 13 boys and 17 girls). Indeed, among the 350 children initially included in the study, only 135 children (105 non-gifted children and 30 gifted children) completed the FAS questionnaire three times. The other 215 children were excluded until one FAS measurement was missing, this high attrition rate in our sample being largely explained by the pandemic context. The control group (n = 33), which was sought out and constituted due to the context in June 2020, included 16 gifted and 17 non-gifted children from ordinary schooling backgrounds who did not benefit from the Art School program. As for the experimental group, the short version of the WISC-IV was administered to children suspected of being gifted by their teachers or parents to ensure that they were indeed gifted. However, it has to be mentioned that for most of the gifted children included in the control group, complete assessments were provided by the parents.

2.2. Material

2.2.1. Design of a Fine Arts Program

"Experiencing Art at School" is a fine arts teaching program consisting of short animated videos, along with guide booklets for teachers and step-by-step instructions intended to promote children's autonomy. Each session takes a major work of art as a starting point, allowing the children to copy it when they need reassurance or to move away from it to create their own work of art by appropriating it, by asserting themselves through different choices than those of the original artist. The idea was to allow the children, from sequence to sequence and from session to session, to acquire a variety of techniques (drawing, painting, collage, overlays, etc.), by manipulating different materials (pencil, charcoal, Indian ink, dry pastels, watercolor pencils, pastels, paint, etc.) to achieve their production. The program includes a total of 58 videos, which were designed according to the same format for the different levels considered. The program is available in three versions to suit three distinct levels (i.e., 1st/2nd grade, 2nd/3rd grade, and 4th/5th grade), the objective of which is to present a realistic program that follows the expected progression of the children's skills in terms of graphics, mastery of tools, and visual-spatial abilities.

The videos (each about five minutes in length) are all structured the same way and according to the following synopsis: opening credits of the program, statement of the title of the target artwork introduction providing knowledge about the work and the artist, presentation of the objective of the session and the steps to achieving it, disclosure of a technical "secret" to guide the children in carrying it out, presentation of a "Freedom space" allowing them to make their own choices to appropriate their creation, brief musical interlude during which the children are invited to pick up their equipment for the session, ending credits.

The Freedom space, which was present in all the sessions, allowed the child who claimed it to not copy the original work and opened the possibility of reinterpreting it while complying with a realization methodology (for example, completion of a preliminary drawing in the first session, inking or cutting and gluing in the second session, and coloring and painting in the third session). At the end of each video, step-by-step instructions summarizing the production steps for the session were projected on the whiteboard in order to allow the children to complete their art project with the greatest possible autonomy. The Freedom space was also made salient in the step-by-step instructions to encourage the children to seize it to bring their own ideas to their artwork.

During the lockdown due to COVID-19, we participated in the continuing education plan by allowing children to carry out the sessions at home, thanks to the creation of a YouTube channel and the distribution of temporary private links to view the videos (for example, here is a link to view the video of the first session of the last art sequence for 4th- and 5th-grade students: https://youtu.be/UqkczPHzir0 (accessed on 2 May 2020).

To conclude, the art program was supposed to have ended with an exhibit designed to fit into a class project. Although the pandemic context did not allow the children to exhibit a work of their choice in a physical room as was initially planned, they were nevertheless able to do so via the online museum Experiencing Art at School (https://www.musee-art-ecole.fr/ (accessed on 1 July 2020)) that we created for this purpose.

2.2.2. The French FAS Scale

The self-evaluative scale of the French FAS [2] measures feelings about school. The original FAS scale [58] has been translated into French and adapted for elementary school students from 6 to 11 years old, with the added measure of the Perception of Art Skills (PAS). The French version was validated by Sanchez et al. [2] through exploratory factor analysis, confirmatory factor analysis, composite reliability analysis, and ANOVA to ensure external validation. The FAS scale consists of 15 items distributed over five sub-dimensions: the PAS factor relates to the children's perception of their art skills, the PLS factor relates to perception of literacy skills, the PMS factor relates to perception of math skills, the FRT factor (Feelings about Relationship with Teacher) relates to the children's perception of their relationship with their teacher and the GAS factor (General Attitudes toward School) relates to the children's general feelings toward school. Easy to administer, the scale is both short (therefore adapted to the school setting) and simple for children to understand, because the items are clear and they can visualize their responses on a visual stick scale (see Figure 2).

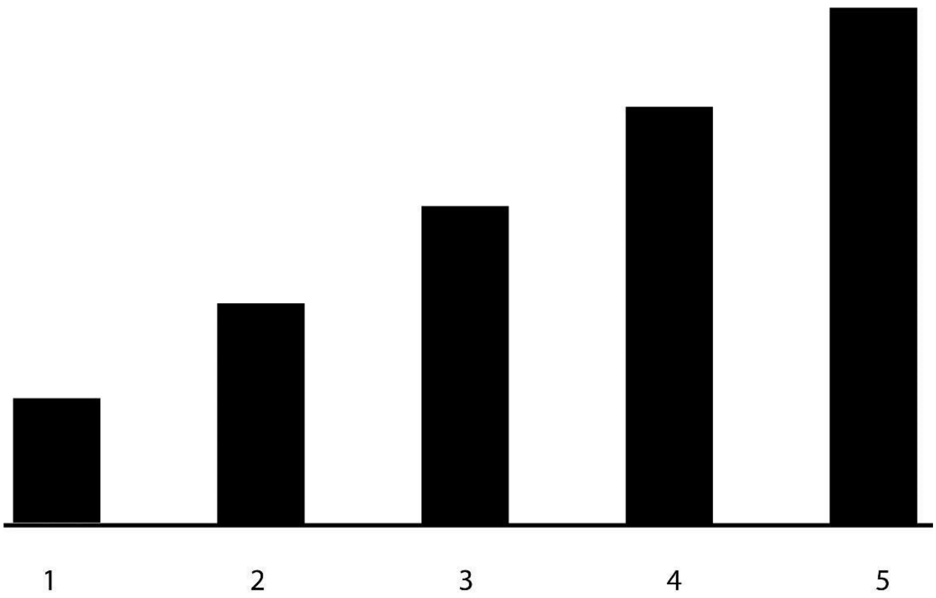

Figure 2. Bar's scale adapted from FAS [58] for the French FAS [2].

2.2.3. Short IQ

This is an abbreviated form of the WISC-IV [89], developed by Grégoire [88]. Very ecological, this short version of the WISC-IV makes it possible to obtain an approximate value of a child's IQ in four subtests: Similarities (i.e., to estimate the Verbal Comprehension Index), Matrix (i.e., to estimate the Perceptual Reasoning Index), Sequence-Letters-Numbers (i.e., to estimate the Working Memory Index), and Symbols (i.e., to estimate the Processing Speed Index). As with IQ, the distribution of short IQ values is normalized, following a Gaussian curve with a mean of 100.02 and a standard deviation of 14.98. In addition, the values of the QIT and the short IQ are correlated with 0.92 ($p < 0.001$). The test was exclusively administered to children who had been identified as potentially gifted through pre-screening and had not undergone a complete psychometric evaluation to confirm their giftedness. The children in the non-gifted group were not submitted to this test.

2.3. Procedure

The experiment was conducted from September 2019 through early July 2020. The Experiencing Art at School program was delivered in the classrooms every week by the teachers involved in the study, which allowed the participating students to take part in 26 fine arts sessions over the school year, including during lockdown.

All of the individual screenings (i.e., for the calculation of the Short QI [88] and the FAS [2]) took place in the schools, in a separate room where the experimenter received the children individually. The WISC-IV Short Form was administered in a single session to the students for whom it was scheduled. As a reminder, this short version of the WISC-IV was administered only to children who had been previously identified as potentially gifted (by their teachers, parents, or during classroom observations). The French FAS [2] was completed several times by all of the children benefiting from the program, at t0 (i.e., initially, before the launch of the Experiencing Art at School program), t1 (i.e., mid-program), and t2 (i.e., at the end of the school year). To evaluate the FAS of the children benefiting from the artistic program compared to children who did not benefit from it, a control group completed the same scale, under the same conditions, at the end of the 2019–2020 school year (i.e., at t2).

For each interview, the experimenter comfortably installed the student at a table on which a file was arranged representing the visual stick scale. After reminding the child that all his/her answers would remain confidential, the experimenter explained to him/her how he/she could use the stick scale in order to answer according to the example of the first item. Then, for each item read by the experimenter, the child was reminded of the meaning of the first and fifth sticks before positioning themselves on the scale, verbally or by pointing at the stick that reflected his/her feelings.

3. Results

In order to examine the effects of the artistic program implemented on the FAS of the gifted and non-gifted children who benefited from it, we conducted intra-individual analyses in two stages (i.e., on non-gifted children, then on a homogeneous sample of gifted and non-gifted children), before proceeding to a comparative analysis at t2 with a control group that did not benefit from the program.

To facilitate the reading of the results that follow, we would like to clarify that the scores of the French FAS scale are established from a rating ranging from 0 (at the bottom of the scale) to 5 points (at the top of the scale) for each item (according to the stick designated by the child). Since each sub-dimension is composed of three items, the maximum score obtained by each child is 15 points per factor. Finally, the total possible points obtained on the FAS is 75 (15 five-point items).

3.1. Effects of the Art Program on the French FAS of Non-Gifted Schoolchildren

To account for the effect of the fine art program Experiencing Art at School, via the effect of time, on the FAS scores of the typical individuals from the experimental sample ($n = 105$; see Table 1), two repeated-measurement ANOVAs were performed using the software Jamovi. The FAS scores and its five sub-dimensions are the dependent variables at the different measurement times (t0, t1, t2). We expected to observe an improvement in children's feelings about school over the school year, but given the pandemic context that occurred between t1 and t2, the positive effect of the program expected at t1 may disappear at t2.

Table 1. Descriptive statistics of the sample composed of an art program beneficiary group and a control group.

	Student Types		**School Grades**		**Gender**	
	Non-Gifted	**Gifted**	**Grades 1 and 2**	**Grades 3, 4, and 5**	**Girls**	**Boys**
Art group ($n = 135$)	105	30	69	66	65	70
Control group ($n = 33$)	17	16	7	26	9	24

From the initial state to the intermediate state (i.e., from t0 to t1, see Table 2), first of all, the first ANOVA made it possible to establish a main effect of the program on the average FAS score ($F(1, 104) = 4.65$; $p = 0.033$; $\eta2 = 0.007$), with scores increasing at t1. Specifically, the student's perception of his/her relationship with his/her teacher (FRT; $F(1, 104) = 4.58$; $p = 0.035$; $\eta2 = 0.009$) and his/her literacy skills (PCL; $F(1, 104) = 15.4$; $p < 0.001$; $\eta2 = 0.036$) improves from t0 to t1.

From the intermediate state to the final state (i.e., from t1 to t2, see Table 2), a decline in the GAS sub-score (i.e., general feelings toward school) is observed ($F(1, 104) = 13.4$; $p < 0.001$; $\eta2 = 0.037$).

Table 2. Average French FAS scores from t_0 to t_1 and from t_1 to t_2 for the non-gifted children of the art group.

Measures	t_0 *M (SD)*	t_1 *M (SD)*	t_2 *M (SD)*	De $t_{0\ à}$ t_1 (*p*-Value)	De $t_{1\ à}$ t_2 (*p*-Value)
FAS (Overall Score)	58.6 (7.3)	59.94 (7.47)	58.58 (10.03)	**0.033**	0.112
PCA (Perceived Competence in Art)	11.55 (2.69)	11.53 (2.66)	11.54 (2.74)	0.944	0.972
PCL (Perceived Competence in Literacy)	11.09 (2.71)	12.06 (2.36)	11.76 (2.35)	**<0.001**	0.211
PCM (Perceived Competence in Math)	12.35 (2.51)	12.41 (2.38)	12.24 (2.56)	0.728	0.399
FRT (Feelings about Relationship with Teacher)	10.93 (2.94)	11.46 (2.51)	11.35 (2.89)	**0.035**	0.637
GAS (General Attitude toward School)	12.74 (2.23)	12.47 (2.44)	11.46 (2.79)	0.206	**<0.001**

3.2. Effects of the Fine Arts Program on the FAS of Gifted Compared to Non-Gifted Schoolchildren

Among the 105 non-gifted students of the experimental group, we randomly composed a subsample of 30 non-gifted students in order to establish a comparison with the gifted students ($n = 30$) with two groups of the same size. The effect of the program, via the effect of time, on the FAS scores (see Table 3) of the non-gifted compared to the gifted individuals of this experimental sample was measured by performing one-factor ANOVAs (i.e., the type of student: gifted vs. non-gifted) and repeated measurements. Our goal was to examine whether the program could have a different effect on the feelings of gifted and non-gifted students. Between t1 and t2 with the occurrence of the pandemic context, we explored how the relationship to school of this population of children with special needs, compared to a population of non-gifted children, has been impacted by the pandemic situation.

Table 3. Program effects (via the effect of time) from t_0 to t_1 and from t_1 to t_2 on the average French FAS scores of the 60 students in the art group sample.

Measures	FAS (Overall Score)	PCA (Perceived Competence in Art)	PCL (Perceived Competence in Literacy)	PCM (Perceived Competence in Math)	FRT (Feelings about Relationship with Teacher)	GAS (General Attitude toward School)
$t_{0\ to}$ t_1 (*p*-value)	**0.010**	0.128	**0.004**	0.579	0.268	0.736
$t_{1\ to}$ t_2 (*p*-value)	**0.081**	0.674	0.290	**0.071**	0.156	**<0.001**

There is a main effect of time on the FAS ($F(1, 58) = 7.11$; $p = 0.010$; $\eta 2 = 0.022$), with an increase in scores from t0 to t1. In addition, a trend interaction effect of the type of student on the progression of the FAS scores from t0 to t1 is reported ($F(1, 58)= 3.02$; $p = 0.08$; $\eta 2 = 0.039$). This positive progression tends to be more marked among non-gifted (*M*t0 = 56.13; *SD*t0 = 6.71; *M*t1 = 58.8; *SD*t1 = 6.66) compared to gifted students (*M*t0 = 59.47; *SD*t0 = 6.62; *M*t1 = 60.13; *SD*t1 = 5.5).

The significant effect of t0 to t1 is found for the child's perception of his/her literacy skills (PCL; $F(1, 58) = 9.18$; $p = 0.004$; $\eta 2 = 0.029$), with scores that signal an increase. An interaction effect between the type of student and time is also observed on the average scores of the PCL sub-dimension ($F(1, 58) = 3.76$; $p = 0.057$; $\eta 2 = 0.012$); this positive progression is more marked in the non-gifted compared to the gifted students.

From t1 to t2, a trend effect of time is observed on the FAS scores ($F(1, 58) = 3.16$; $p = .081$; $\eta 2 = 0.017$), signaling a slight decline. This effect of time is accompanied by a trend interaction effect with the type of student on the FAS scores ($F(1, 58) = 3.15$; $p = 0.081$; $\eta 2 = 0.035$). The scores of the gifted (*M*t1 = 60.13; *SD*t1 = 5.5; *M*t2 = 59.8; *SD*t2 = 7.64) decline less than those of their non-gifted peers (*M*t1 = 58.8; *SD*t1 = 6.66; *M*t2 = 55.13; *SD*t2 = 12.82). Considering the sub-dimensions of the FAS, a significant decline in general feelings toward school (GAS) emerges from t1 to t2 ($F(1, 58) = 13.53$; $p = <.001$; $\eta 2 = 0.054$), while a significant interaction effect with the type of student is also observed ($F(1, 58) = 6.60$; $p = 0.013$; $\eta 2 = 0.026$). The decline in general feelings about school is stronger in the non-gifted children (*M*t1 = 12.3; *SD*t1 = 2.55; *M*t2 = 10.23; *SD*t2 = 3.21) than in the gifted children (*M*t1 = 12.23; *SD*t1 = 1.91; *M*t2 = 11.86; *SD*t2 = 2.25). Finally, the score relative to students' perception of their skills in mathematics also reveals a slight decline for all the students considered ($F(1, 58) = 3.37$; $p = 0.071$; $\eta 2 = 0.014$).

3.3. Comparison with a Control Group at t2

To assess whether the participation in the fine arts program influenced children's feelings about school, the FAS scores of gifted and non-gifted children who benefited from the fine arts program were compared with the scores of those who did not benefit from it (control group) at the end of the school year. Thus, two-factor ANOVAs were carried out here by considering the control sample (see Table 1) and the experimental sample composed of the same number of gifted students ($n = 30$) as non-gifted students ($n = 30$).

A main effect of the condition (control vs. experimental) was found for the PCA sub-score ($F(1, 89) = 18.624$; $p = < 0.001$; $\eta 2 = 0.169$): children exposed to the "Experiencing Art at School" program (*M*PCA = 11.52; *SD*PCA = 2.79) had a better perception of their art skills than those who did not benefit from the program (*M*PCA = 8.79; *SD*PCA = 3.11). On the other hand, no effect of the program was observed on the overall FAS score and its other sub-dimensions. However, there was a simple effect of the type of student, with increased scores for gifted compared to non-gifted students, in terms of Feelings About School ($F(1, 89) = 4.4$; $p = 0.039$; $\eta 2 = 0.047$), of connection with the teacher ($F(1, 89) = 4.051$; $p = 0.047$; $\eta 2 = 0.043$), and of perception of their literacy skills ($F(1, 89) = 3.19$; $p = 0.077$; $\eta 2 = 0.034$).

4. Discussion

The objective of this study was to examine whether exposure to a fine arts program, designed according to Renzulli's model, could have a beneficial effect on the well-being at school of gifted and non-gifted children. Starting from the self-evaluative measurement of the Feelings About School [2] of the students taken at different times, we followed the progression of the FAS of these two populations of children over an unusual school year since it was disrupted by the pandemic. Our results seem to indicate a positive effect of the fine arts program implemented among gifted as well as non-gifted students; the main contributions of this study will be discussed and conclusions will be formulated with caution due to the context in which our study was conducted.

4.1. Effects of the Program Experiencing Art at School on Students' Feelings about School

The program seems to have had a positive effect on the Feelings About School of both non-gifted and gifted children, according to the observed intra-individual progression from the initial state (i.e., before the launch of the program) to mid-program, or the middle of the 2019–2020 school year (before lockdown). In detail, the program seems notably to have promoted a better perception by the children of their literacy skills and of the student–teacher relationship. First, this echoes previous findings on the beneficial effects of numerous educational programs inspired by the SEM and Renzulli's three-ring theory [43,62], with several decades of hindsight. Second, this also echoes studies that have shown how participation in an artistic activity can be beneficial, both to the well-being of the student [1] and, by extension, to the strengthening and/or acquisition of new skills [68,79,82], in this case in the domain of literacy. This last result could find an explanation in the fact that the mental processes that allow one to apprehend a work of art are potentially similar to those that allow one to understand a text [90].

In the end, after the children's schooling was impacted by the occurrence of the pandemic (i.e., school closures, lockdowns, implementation of online learning, etc.), we no longer observed a positive intra-individual progression of Feelings About School of gifted and non-gifted children between the measures carried out mid-program and those that were recorded at the very end of the school year. The comparison of the results obtained at the end of the school year between our experimental group who benefited from the art program and the control group of children who did not benefit from it does not show any difference in terms of children's Feelings About School, except with regard to the students' perception of their artistic skills. Indeed, the children who benefited from the art program had a better perception of their artistic skills than the children who did not benefit from it. However, even if this result deserves to be replicated, the absence of an increase in the perception of art skills by the students in the experimental group between the different times may seem surprising. If the students who benefited from the art program, having learned and progressed, did not overestimate themselves in the subject, it is perhaps because they developed a finer, more adjusted vision of their art skills. Moreover, the comparison of the experimental group with the control group seems to support the hypothesis of a direct benefit of the practice of fine arts on the student's feeling of competence in the discipline itself, resulting in a more adjusted vision by the student of his/her real skills.

4.2. The Detrimental Impact of COVID-19 on Feelings about School

While the fact that this research was conducted in schools during the 2019–2020 school year, marked by the health crisis, constitutes an important limit to the measuring of the effects of the art program on Feelings About School, this context paradoxically sheds light on how this unprecedented situation may have impacted the feelings about school of the students considered [2].

Fortuitously, it was this context that made it possible to question the impact of this first lockdown in France associated with COVID-19 on the FAS of students. This research study seems to signal a detrimental effect of this unprecedented situation on students' development through the measurement of their Feelings About School (FAS). Indeed, by comparing the scores obtained mid-program (i.e., late January/early February) with the scores obtained at the end of the year, our study highlights a decline in children's FAS. In detail, this decline manifests itself in particular with respect to the general feelings that the children hold about school and regarding the perception that they have of their skills in mathematics. To not overinterpret these results, which were not the initial scope of this study, we could only draw cautious links with a study conducted at the national level, which reports a decrease in performance in French as well as in mathematics for first- and second-grade students, observed via national evaluations carried out during the start of the 2020/21 school year (DEPP, 2020). Our results seem to echo the national survey [86], which pointed to a negative effect of the first lockdown on both the daily life and the psychological functioning of 8- and 9-year-old children in France (i.e., increased levels of screen usage, as well as of mood and sleep disorders). They also tend to indicate an alteration in the psychological functioning of children, with a prevalence of clinical signs of anxiety and depression among those under 18 years of age that has more than doubled since the onset of the pandemic [84,85]. Overall, it seems reasonable to think that if children experience a decline in their well-being, their feelings about school would also be negatively affected, as suggested by the findings of this study.

4.3. Findings about the Intellect of the Gifted

In this study, gifted children's FAS are reaffirmed as being more positive than those of non-gifted children [33], especially with regard to the perception that children have of their literacy skills and their appreciation of the bond they share with their teacher. This result is consistent with the idea that most of them are successful at school and as such benefit from the status of "good students" which likely promotes the establishment of a good relationship with their teacher [38]. It is further consistent with the fact that they can correctly perceive themselves as more comfortable in literacy given their particularly developed intellectual abilities [5–8].

Moreover, it is interesting to note that a program designed around the intellect of the gifted, the SEM, and the theories on intelligence and enrichment of Renzulli [30,31,33,34] also contributed positively to the increase in Feelings About School of non-gifted children. While reaffirming the relevance of this theoretical framework for a pedagogical approach to the gifted (resulting in a stronger engagement among gifted children) [91], this indeed tends to show that an inclusive and non-elitist approach to the gifted, through the implementation of an enrichment program in the entire classroom, is quite conceivable to promote the development of all students.

Regarding the effect of the pandemic situation on the FAS of elementary school students (in particular the decline in general feelings toward school and the perception of math skills), it seems necessary to note a difference in the observed decline from t1 to t2 between the two populations studied. Since the Feelings About School of gifted children decreased less markedly than those of their non-gifted peers, this raises the question of the existence of a greater adaptation capacity of gifted students to this unprecedented situation. In fact, this suggests a latent capacity for engagement in gifted children, which is more resistant to environmental factors than that of their peers. It also suggests a possible increased resilience (i.e., ability to adapt to a negative situation) on the part of gifted children [92], which opens up new perspectives both for research and for the support of these students. Indeed, if greater resilience capacities were to be identified for this population, it might be appropriate to find a way to help these children tap into this resilience, which could constitute a lever to promote their harmonious development. However, it is also possible that gifted children suffer less from the school closures because they are bored at school and are not stimulated to the level of their skills [38,93], compared to the way they are stimulated or self-stimulated at home. A study by Leddo and collaborators [94] showed that gifted adolescents would have progressed equally with or without the guidance of a teacher in learning programs that allowed them to create websites. Their non-gifted peers, on the other hand, would have achieved similar results to gifted children only with the support of a teacher. It therefore also seems possible that the gifted children from the experimental group suffered less than their non-gifted peers from the absence or distance of their teacher during the pandemic. In view of the difficulty of deciding in favor of one of these proposed interpretations, it seems necessary to be able to dig in those different directions in future research, with the goal of a greater understanding of the adaptive capacities of these children in order to better support their development in the school environment.

5. Conclusions

While our results are at least partly in favor of a beneficial effect of the Experiencing Art at School program on scores of the FAS scale, we need to be cautious given the loss of the positive progression of FAS at t2 post-COVID-19 and the existence of a control group only at t2. Because other studies support the observation of the beneficial effects of participation in an artistic activity on the child [65,67,77–80], we are inclined to consider our results as promising regarding the presence of the beneficial effect of the Experiencing Art at School program on a positive progression of gifted and non-gifted children's Feelings About School. This study encourages further research aimed at determining the precise effects of artistic activity on the well-being of the child so that, in the interest of students, schools may have educational policies in favor of the arts, especially in France, where the teaching of plastic arts in primary schools still needs to be consolidated and better supported [95].

Interesting interindividual differences emerged between gifted and other students in this research, pointing to gifted children having better Feelings About School. In addition, the finding of an increased benefit from the Experiencing Art at School program for non-gifted children allows us to point out that inclusive approaches that support the development of gifted children can benefit everyone. Finally, there is the question of increased resilience among gifted students and/or these students' greater ease in adapting to a situation that leaves more room for self-directed learning. Overall, this research contributes to the understanding of the effect of the health crisis of Spring 2020 on students by showing that the health situation led to a deterioration in their FAS, although the effect is less marked among gifted students.

6. Limits and Perspectives

Within the context of the pandemic, this study yielded encouraging results, which, however, it is necessary to replicate by bringing together more substantial numbers of students. Specifically, the control group would benefit from being constituted up front and analyzed at the different measurement times. This study has another limitation: due to ethical and practical reasons, it was not possible to administer the short version of the WISC-IV to all of the children who participated. This means that we cannot rule out the possibility that gifted children were included in the group of non-gifted ones. Although this risk seems to have been reduced since the implementation of the art program allowed for repeated observations of children in the classroom, it should not be overlooked, and results should be treated with caution before being generalized. The context also prevented the full implementation of the art program, which initially also included a three-week sequence for the children to explore three-dimensionality through the creation of a sculpture. Obviously, this sequence would have been important to allow the children to benefit from a complete art education program.

Our work nevertheless paves the way for other research examining (i) art as a lever for student development, (ii) the gifted as a relevant gateway for optimizing the development of all learners, and (iii) resilience or self-directed learning as resources to support the development of gifted students. A future study should also shed even more light on the benefits of the Experiencing Art at School program, using a qualitative method in addition to a quantitative method. Indeed, in a more favorable context, all of the children's productions would benefit from being collected and studied so that the benefits of the art program can be determined more accurately with respect to creativity and diversified graphic expression through the different techniques taught. The proposed art program could also influence gifted and non-gifted children to varying degrees, but our study does not allow us to know exactly how: In the perception of an art object? In its description, its interpretation? In a certain "afterglow effect" by creating one's own work under the impression of the art object just studied? All these questions provide promising research lines for future studies.

Author Contributions: All authors contributed equally to the design and execution of the study conducted, as well as to the writing of the article. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: All data are available upon request by contacting the corresponding author.

Acknowledgments: We would like to thank all the participants in this study, and in particular the staff of the schools involved, for their confidence and interest in this project.

Conflicts of Interest: The authors declare no conflict of interest.

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education sciences

Article

Climate Competencies of Finnish Gifted and Average-Ability High School Students

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Abstract: In the face of global issues such as climate change, the world needs action competent, transformationally gifted citizens, who are willing to step up and take responsibility for a better future. However, empirical evidence on what supports the development of transformational giftedness is limited. Furthermore, the relationship between academic giftedness and transformational giftedness has not been clearly pronounced. The purpose of this study is to address this research gap by examining students' climate competencies. A total of 1703 students from five Finnish high schools (grades 10–12) participated in this study. Using a questionnaire, students' climate change knowledge, values, willingness to take action, sense of responsibility, environmental concern, and perceptions on how climate change issues are dealt with in school were examined. Four of the schools were general education high schools, while one was for students formally identified as gifted students. The findings indicate that academically gifted students in both general education schools and the gifted school show more climate competencies than average-ability students. Furthermore, gifted students that attended the school for gifted students show more climate competencies than the gifted students from general education schools. Based on the findings, the paper discusses how the development of transformational giftedness can be better supported in education.

Keywords: climate change education; academic giftedness; transformational giftedness; transformational education; action competence

Citation: Tolppanen, S.; Kang, J.; Tirri, K. Climate Competencies of Finnish Gifted and Average-Ability High School Students. *Educ. Sci.* **2023**, *13*, 840. https://doi.org/10.3390/educsci13080840

Academic Editors: Eleanor Dommett and James Albright

Received: 30 May 2023
Revised: 25 July 2023
Accepted: 10 August 2023
Published: 17 August 2023

1. Introduction

Climate change is one of the most pressing global issues of our time, with potentially catastrophic consequences for societies and ecosystems. In order to mitigate and adapt to climate change, the UN has acknowledged that everyone needs to do their part: governments, businesses and individuals [1]. In this transition, education has much to contribute. In recent years there has been a realization that climate education requires increased emphasis on supporting the development of students' competencies, values, attitudes and helping them gain more rigorous knowledge about the complex relationships between humans and their habitats, as well as the rebalancing of priorities and commitments that are involved in striving for sustainability. For instance, UNESCO ([2], p. 36) has stated that schools should encourage students to "re-evaluate [their] worldview and everyday behaviours", in light of what is necessary for climate change mitigation. In practice, such a transition requires students to develop green competencies, meaning that they are capable of systems thinking and future thinking, show awareness towards sustainability challenges, including ethical and social justice dimensions, are capable of examining their underlying values and show agency to participate in impactful action, both collectively and individually, now and in the future [3]. In essence, education needs to be transformative, meaning that education develops students to become autonomous, critical thinkers, and supports them in examining their conceptual foundations, helping them make changes to their frame of reference, if necessary [4].

The ideal, is that through the process of transformational education, students become action competent, meaning that they become active citizens in a democratic society, taking both direct action and indirect action. More recently, Sternberg [5] has coined the term transformational giftedness to describe a similar thing as action competence but bringing the focus to exceptional individuals. Namely, transformational giftedness means that students have exceptional ability or talent that enables them to make one or more extraordinary and meaningful contribution that helps make the world a better place [5]. According to Sternberg et al. [6], such transformation can happen on two levels. First, it can be Self-transformational, where a "positive, meaningful and possibly enduring difference" happens within oneself. This is often the preliminary to the second type of transformational giftedness, called other-transformational, where one aims to make a positive enduring difference to the world. Though action competence and transformational giftedness resemble each other in many regards, in this study we use the term transformational giftedness, as it better describes the focus of this study, which is to examine the climate competencies of academically gifted students.

While helping students develop transformational giftedness is something to strive for, this poses enormous challenges for formal education. First, climate change education is not yet strongly present in the formal curricula of many countries, the curricula often continue to focus on the causes of climate change rather than needed actions and behavioral changes, and there continues to be limited room for discussions on values and ethics [7]. That said, some countries have more possibilities to implement climate change education than others. In Finland, where this study takes place, sustainability issues have been included as one of the four core values of the curriculum in secondary school since 2016 (see [7,8]). This means that sustainability issues and climate issues can and should be implemented into all school subjects. However, as teachers in Finland are given a lot of autonomy, the subject-specific curriculum does not give clear guidelines on how sustainability and climate issues should be implemented into education. In practice, this means that climate change education tends to focus on knowledge creation, and it is very much up to an individual teacher how they implement climate change education in practice [9]. Despite the variance in CC-Ed implementation, the curriculum provides ample opportunities for teachers in Finland to help develop students' general competencies (see [10]). Authors [11] have argued that the concept of transformational giftedness adheres very well to the educational philosophy, the German Bildung tradition, on which education in Finland and in the Nordic countries is based. This philosophy aims at educating individuals to become competent citizens who actualize their individual talents and benefit society with their competences. In Finland academic achievement is not seen as the only aim of schooling but development of the whole person including moral reasoning and behavior are also emphasized [8,11]. Therefore, the Finnish curriculum may not present as many barriers to provide transformative education as the curriculum of some other countries.

Second, we don't yet fully understand what results in action competence or transformative education (see [12]). A relatively recent literature review does give some guidelines, as it highlights that impactful climate change education should be personally relevant, engage students, foster deliberative discussion, provide interactions with scientists, address misconceptions and implement community projects [13]. However, most of the studies in the review focus on the educational impact of climate knowledge, so further studies are needed to examine what type of education is transformational from a more holistic perspective, meaning it has long-lasting impacts on students' attitudes, values and willingness to take personal and societal action.

Third, education that is transformative for one student, may not be so for all. For instance, a recent study found that a university course on holistic climate change education was more transformational for non-STEM and female students than for others [14]. Therefore, further research is needed on how to make education transformational for all, or at least for most students.

What makes transformational education especially hard, is that it is not only about gaining more knowledge [15]. In fact, studies have shown that individuals may be reluctant to change their views even when presented with compelling evidence which is not in line with their views (see, [16,17]). Therefore, many other factors, such as attitudes (see, e.g., [18]), worldview [19], ease of taking action [20] and values [21,22] are at play. Individuals are also affected by their biases, such as self-bias and intragroup bias. This translates to individuals preferring to perform low-impact actions themselves, while expecting others to do high-impact actions (e.g., [5]). Additionally, responsibility is often deflected onto governments and businesses, as individuals see their own role in mitigating climate change as limited [23,24]. In addition, psychological and social factors, including perceived behavioral control, moral obligations, societal expectations and norms effect individuals' willingness to take action (see, e.g., [18,25,26]). In practice, this also means that for a student to become transformationally gifted in climate change issues, they need not only good cognitive skills, but also an interest in moral and ethical issues, the willingness to take moral responsibility, social support and the discipline and willpower to overcome both psychological and social barriers. As this requires a lot from an individual, this study seeks to increase our understanding on what factors help develop transformational giftedness in students. More specifically, we seek to understand how academic giftedness and the school environment may enhance transformational giftedness by helping them develop competencies. Despite the extensive literature on factors effecting climate action, there is a research gap in examining the effect of academic achievement on students' climate competencies. This study aims to address that research gap.

Academically Gifted Students

Gagné's [27] differentiated model of giftedness and talent 2.0 (DMGT 2.0) is a comprehensive framework to understand the development of gifts into talents in different domains. According to the model, the gifts can be developed into talents in the areas of science and technology, arts, sports, and athletics. Talent development is a process that involves systematic effort from an individual with a significant amount of time and other resources and a structured educational program. Gagné sees giftedness as potential that can be developed further with appropriate levels of intrapersonal and environmental factors. He also defines a gifted individual as one among the top 10% of age peers in at least one ability domain. In line with Gagné's definition for giftedness, in this study we define academically gifted students as those whose final grade from secondary school (i.e., grade 9) was among the top 10% of the participants. Previous studies show that there is a positive relationship between academic achievement and environmental awareness (e.g., [28]) and that academically gifted students rank higher in moral reasoning and ethical sensitivity than their average-ability peers [29–31]. Naturally, academic achievement also coincides with more knowledge on a given school topic. Furthermore, gifted students have been characterized as having a high sense of responsibility, as well as a keen interest in working with issues that involve their lives and global issues [32,33]. Gifted students also tend to be good problem-solvers, enjoying tackling big challenges [30,34]. As these characteristics describe climate competent citizens, and many are essential to becoming transformationally gifted, we hypothesize that academically gifted students may show more readiness towards transformational giftedness than their peers. In other words, we view climate competence as a prerequisite for transformational giftedness. However, as Sternberg et al., discuss, academic giftedness will not automatically result in transformational giftedness [6]. Rather, transformational giftedness needs to be nurtured through education and social interactions. Therefore, our second hypothesis is that academically gifted students attending a school for gifted students may show more readiness towards transformational giftedness than gifted students in general education schools. Accordingly, this study aims to explore the following two research questions:

1. How do academically gifted students' climate competencies differ from average-ability students' competencies?
2. What type of effect does a school have on academically gifted students' climate competencies?

2. Materials and Methods

2.1. Sample and Data Description

The data for this study was collected in the fall of 2021 from five Finnish high schools, located in different parts of the country (Helsinki, Vantaa, Tampere, Mikkeli and Kajaani). Four of the selected schools were general education schools, called Normal Schools in this study. These schools required students to have completed secondary school with moderate to good final average grades. The four Normal Schools can also be considered representative of a typical Finnish high school, as the mean score of the participants was not much higher than the national average of high school students (8.83 vs. 8.67) (see [35]). The fifth school participating in this study was a more homogenous school of gifted students. To get accepted to this school, students must have an excellent final average grade from secondary school (median 9.71).

The research was conducted following the guidelines of the Finnish Advisory Board on Research Integrity TENK [36]. Following the guidelines, ethics approval was not required for the study. Approval for the study was given by the municipalities or school principles. Furthermore, the caregivers of the students were informed about the study in advance, giving them the opportunity to decide, together with their child, whether to participate in the study or not. Though all the students were encouraged to join the study by filling out a questionnaire during class time, it was clearly stated to them, both before data collection and in the online form, that participation was voluntary. Furthermore, students were informed that they can withdraw from the study at any point, even after the completion of data collection.

Out of the 2970 students attending the schools, 2191 completed the questionnaire. After omitting participants who incorrectly answered the two control questions, the remaining sample size was 1973 students. The Finnish National Agency of Education (FNAE) was contacted to receive information regarding the participating students' final grades from secondary school. After omitting students whose secondary school grades could not be tracked, the final sample size was 1703 participants. Out of these students, 670 were at the beginning of grade 10, 614 were in grade 11 and 419 in grade 12. Further information on the schools is provided in Table 1. As noted in the table, the schools have different emphases. In practice, this means that schools provide more of certain courses, giving students the *opportunity* to delve deeper into some subjects. This also means that students' interests may determine which schools they are attracted to. As the school for gifted students has a science focus, we examined the course descriptions of their extra courses. Based on the descriptions there is no reason to believe that students in that school are exposed more to climate change and sustainability issues in their science classes than students in other schools. Furthermore, as climate change is a multidisciplinary issue, not only an issue to be addressed in science class, we cannot assume that merely having a science focus would mean that students are exposed more to climate change issues than in another schools. Unfortunately, it was beyond the scope of this study to conduct interviews and classroom observations to determine what really happens in class.

2.2. Measures

The initial questionnaire consisted of 11 sections and 97 questions and took around 30–40 min for students to complete. Among them, we used 47 items that were relevant to this study aim as presented in Table 2 (See Appendix A for list of questions used). Reliability and validity of the measurement have been reported in the following section.

Table 1. Background information of the five schools that took part in the study.

	School 1	School 2	School 3	School 4	School 5
School type	Normal Schools (Public school for all students)				Gifted School (Public school for gifted students)
Location	Urban	Urban	Urban	Urban	Urban
School emphasis	Media, Sports	Music, Sports	Music, Sports	none	Languages, Science and research
Size of school (grade 10–12)	≈500	≈550	≈650	≈850	≈450
Number of participants (Male %)	322 (32%)	229 (34%)	353 (40%)	521 (40%)	279 (23%)
Average grade of participant Mean (SD)	8.97 (0.47)	8.88 (0.17)	8.70 (0.60)	8.85 (0.49)	9.67 (0.24)
Median grade of participants	8.94	8.88	8.65	8.82	9.71
Lowest grade of participant *	7.76	7.47	7.41	7.24	9.00

* In Finland, students are given a grade between 4–10, where 4 = fail, 8 = good.

Table 2. Measurements used in this study.

What Was Measured?	Number of Items	Scale	Further Information
Climate change knowledge	10	multiple choice	Original questionnaire by Libarkin et al. [37] contains 21 items. We chose 10 items based on Rasch analysis from our previous study [14] concerning levels of difficulties and overall response time of the questionnaire.
Value		−1–7	This questionnaire, developed by Steg et al. [21] examines individuals biospheric, altruistic, egoistic and hedonic values.
Biospheric	4		
Altruistic	4		
Hedonic	4		
Egoistic	3		
Willingness for mitigative action			The questionnaire measures student's willingness to take climate action in three domains: as individuals, as members of a group and as future citizens (e.g., through career choices). This is a new questionnaire, inspired by the findings of Vesterinen et al. [38].
Individual action	4	1 to 5	
Group action	4		
Emotion	3	1 to 5	Three questions examined students' concern and emotions towards climate change.
School support:		1 to 5	This questionnaire examines how students perceive their schools to support them in agency and taking up future careers related to climate change. This is a new questionnaire and is inspired by the relevance framework (see [39]).
Student agency	4		
Future career	4		
Supportive teacher	4	1 to 5	This questionnaire, developed by Ojala [40] examines how students perceive their teachers to talk about climate change. This study used three of the questions that measure teachers' positive outlook.
Responsibility	3	1 to 10	This questionnaire measures who individuals consider responsible for climate change mitigation. This is a new questionnaire developed for this study.

2.3. Data Analysis

Initial data analysis was conducted to determine how the data should be grouped. To examine whether there is a difference between the average-ability students (Group 1) and the gifted students (Group 2, i.e., the top 10% in academic achievement) attending the normal schools, a t-test was conducted. The results showed that gifted students in normal schools (M = 6.38, SD = 1.42) had a significantly higher level of knowledge of climate change issues (t = -7.10, df = 191.41, $p < 0.001$, d = 0.56) than average-ability students (M = 5.48, SD = 1.78). On the other hand, the average scores on climate knowledge did not show statistically significant differences between Group 2 and Group 3 (the gifted students at a gifted school, M = 6.70, SD = 1.35). Therefore, Group 1 and Group 2 were considered distinct from each other while Group 2 and Group 3 indicated a similarity.

Second, we assessed the validity and reliability of the constructs using exploratory factor analysis (EFA), confirmatory factor analysis (CFA), and Cronbach's alpha values. Initially, we randomly divided our sample into two equal parts and conducted EFA on one half, while the other half was used for CFA. For EFA, we applied the principal axis factoring with varimax rotation, and we considered factor loadings higher than 0.5 to belong to the respective factors. Subsequently, we performed CFA to confirm the factors identified by EFA, incorporating all latent variables under their specific factors based on the EFA results. The model fit indices indicated a satisfactory fit (CFI = 0.93, TLI = 0.92, RMSEA = 0.04). However, due to a low factor loading (0.44) for item SUP1, as presented in Table 3, we excluded it from further analyses. Finally, each factor exhibited a Cronbach's alpha value higher than 0.7, indicating good reliability of the constructs.

Table 3. Reliability and validity results.

Category	Subcategory	Item	EFA	CFA	Cronbach
Value	Biospheric	BIO1	0.77	0.69	0.86
		BIO2	0.84	0.69	
		BIO3	0.80	0.83	
		BIO4	0.67	0.83	
	Altruistic	ALT1	0.71	0.62	0.72
		ALT2	0.61	0.59	
		ALT3	0.77	0.76	
		ALT4	0.72	0.59	
	Hedonic	HED1	0.82	0.75	0.75
		HED2	0.87	0.88	
		HED3	0.73	0.55	
		HED4	0.51	0.53	
	Egoistic	EGO1	0.80	0.72	0.79
		EGO2	0.79	0.71	
		EGO3	0.86	0.85	
Willingness for mitigative action	Individual action	I-ACT1	0.81	0.75	0.84
		I-ACT2	0.80	0.78	
		I-ACT3	0.84	0.80	
		I-ACT4	0.68	0.71	
	Group action	G-ACT1	0.78	0.71	0.85
		G-ACT2	0.82	0.81	
		G-ACT3	0.85	0.81	
		G-ACT4	0.70	0.72	
Emotion	Environmental concern	EMO1	0.88	0.84	0.86
		EMO2	0.91	0.87	
		EMO3	0.85	0.73	
School support	Student agency	AGE1	0.71	0.70	0.78
		AGE2	0.75	0.71	
		AGE3	0.71	0.71	
		AGE4	0.71	0.63	
	Future career	FUT1	0.82	0.79	0.90
		FUT2	0.88	0.86	
		FUT3	0.86	0.88	
		FUT4	0.83	0.82	
	Supportive teacher	SUP1 *	0.79	0.44	0.77
		SUP2	0.70	0.70	
		SUP3	0.71	0.84	
		SUP4	0.70	0.82	

* SUP1 was removed for further analyses due to the low factor loading (0.44 in CFA).

Third, after confirming validity and reliability, we conducted measurement invariance tests before latent mean analyses. Specifically, the model's configural, metric, and scalar invariances were assessed and compared across groups. The configural invariance model assumes the same number of factors and items across groups without imposing equality constraints on other parameters. The results of the configural invariance measurement indicates that the variables being studied measure the same constructs across groups. Following that, metric invariance is evaluated by constraining factor loadings across groups. If the results demonstrate factor loading invariance, it suggests that the measures are operating on the same scale. Lastly, scalar invariance is tested by constraining both factor loadings and item intercepts across groups. If no significant differences are observed, latent means can be compared across groups. For these model comparisons, two indices, ΔCFI and ΔTLI, were assessed. To confirm invariance between the models, ΔCFI should be equal to or less than 0.01, and ΔTLI should be equal to or less than 0.05 [41]. According to the result, no differences were found between configural, metric, and scalar models for the motivation factors (ΔCFI < 0.01, ΔTLI < 0.05) as presented in Table 4.

Table 4. Measurement invariance results.

Model	χ^2 (*df*)	RMSEA	CFI	ΔCFI	TLI	ΔTLI
1 Configural	3831.23 (1860)	0.043	0.928		0.919	
2 Metric	3902.18 (1916)	0.043	0.928	0.000	0.921	0.002
3 Scalar	4045.75 (1972)	0.043	0.925	0.003	0.919	0.002

Finally, we compared latent means between the groups to answer our research questions and the results are presented in the following section. For all these structural equation modeling analyses, Mplus 7.4 was used with the maximum likelihood with robust standard errors and the Chi-squared (MLR) estimator and missing data were estimated using full information maximum likelihood estimation (FIML) [42]. Traditional cutoff values were applied for assessing the quality of measurement and structural model fit ([43] the root-mean-square error of approximation (RMSEA) was below 0.05 or 0.08, the comparative fit index (CFI) and Tucker–Lewis index (TLI) were above 0.90 or 0.95).

3. Results

RQ 1: How do academically gifted students' climate competencies differ from other students' competencies?

First, we compared latent mean differences between the three groups while controlling gender and climate change knowledge. Concerning the value scales, as shown in Table 5, the average-ability students in the normal schools (hereafter Group 1) indicated higher hedonic and egoistic values than gifted students from the gifted school (hereafter Group 3). Except the value scales, on the other hand, Group 3 students indicated higher latent means than Group 1 students in all other measured constructs such as willingness, concern, and school environment. In other words, Group 3 students had more environmental concerns, they were willing to take more climate action in different domains, they viewed their schools' climate change education more positively and they even had lower non-environmentally friendly values (hedonic and egoistic values) comparing to Group 1.

Table 5. Mean, standard deviation, and latent mean differences between three groups.

Category	Subcategory	Group 1 N = 1281	Group 2 N = 144	Group 3 N = 278	G2 vs. G1 LMD	G2 vs. G1 *d*	G3 vs. G1 LMD	G3 vs. G1 *d*	G3 vs. G2 LMD	G3 vs. G2 *d*
Value	Biospheric	6.42 (1.29)	6.32 (1.02)	6.52 (1.10)	−0.07	0.09	0.12	0.08	0.19	0.19
	Altruistic	7.08 (1.07)	7.06 (0.84)	7.09 (0.99)	−0.01	0.02	0.02	0.01	0.03	0.03
	Hedonic	4.41 (1.32)	4.08 (1.14)	4.13 (1.29)	−0.32 *	0.27	−0.29 *	0.21	0.04	0.04
	Egoistic	6.86 (1.20)	6.76 (1.08)	6.53 (1.10)	−0.11	0.09	−0.31 **	0.29	−0.20	0.21
Willingness for mitigative action	Individual action	3.41 (0.76)	3.72 (0.67)	3.81 (0.73)	0.28 **	0.43	0.35 **	0.54	0.08	0.13
	Group action	2.23 (0.90)	2.46 (0.81)	2.68 (0.9)	0.20 *	0.27	0.43 **	0.50	0.23 *	0.26
Emotion	Environmental concern	2.64 (0.94)	3.02 (0.81)	3.15 (0.96)	0.40 **	0.43	0.48 **	0.54	0.08	0.15
School support	Student agency	2.31 (0.59)	2.29 (0.52)	2.56 (0.64)	−0.01	0.04	0.26 **	0.41	0.27 **	0.46
	Future career	1.90 (0.69)	1.90 (0.65)	2.17 (0.74)	0.01	0.00	0.26 **	0.38	0.25 **	0.39
	Supportive teacher	2.29 (0.69)	2.18 (0.63)	2.58 (0.75)	−0.06	0.17	0.19 **	0.40	0.25 **	0.58

Note. * $p < 0.01$, ** $p < 0.001$, Group 1 (G1): average-ability students at normal schools, Group 2 (G2): gifted students at normal schools, Group 3 (G3): gifted students at gifted schools, LMD: Latent Mean Difference.

However, when comparing gifted students from normal schools (hereafter Group 2) to Group 1, the differences between the groups become less distinct. Namely, Group 2 students showed a higher willingness to take individual and group action as well as environmental concerns but did not show differences in their perceptions of the school environment. Interestingly, we also found a difference between the gifted student groups regarding the perceived school environment. That is, the gifted students in the gifted school (Group 3) showed better perceptions of school environments concerning climate change education than the gifted students in the normal schools (Group 2). Additionally, Group 3 students presented a higher willingness for group action than Group 2 students.

Finally, we also found some differences in how gifted and average-ability students view responsibility. All groups viewed politicians as most responsible, businesses and individuals as least responsible (see Table 6). However, gifted students (both Group 2 and 3) viewed the responsibility of all three entities as higher than average-ability students, though statistically significant differences were only seen in two of the groups.

Table 6. Mean, standard deviation, and observed mean differences between three groups (responsibility items).

Category	Subcategory	Group 1	Group 2	Group 3	G2 vs. G1 *d*	G 3 vs. G1 *d*	G3 vs. G2 *d*	F
Responsibility	Individual	6.31 (2.11)	6.63 (1.93)	6.58 (2.06)	0.16	0.13	0.03	F = 3.02
	Politicians	7.96 (1.73) [a*]	8.41 (1.49) [b**]	8.71 (1.25) [a*b**]	0.28	0.50	0.22	F = 27.23 **
	Business company	7.76 (1.89) [a*]	8.14 (1.44) [b**]	8.58 (1.54) [a*b**]	0.23	0.48	0.30	F = 25.64 **

Note. * $p < 0.01$, ** $p < 0.001$, [a] Significant difference between G1 and G3. [b] Significant difference between G2 and G3. Group 1 (G1): average-ability students at normal schools, Group 2 (G2): gifted students at normal schools, Group 3 (G3): gifted students at gifted schools

RQ 2: What type of effect does a school have on academically gifted students' climate competencies?

As the results above showed that there are differences between gifted students from normal schools (Group 2) and gifted students from a gifted school (Group 3), we explored these differences in more detail. Again, comparing the two groups of gifted students in Table 5, we found they did not have differences in their knowledge, values, or individual action. However, gifted students from the gifted schools (Group 3) were more willing to take societal climate actions, and they perceived their education to provide them with more relevant skills for their everyday lives and their future careers. Furthermore, the students perceived their teachers talked about climate change in a more relevant way. Accordingly, we could assume that while factors that are more relevant to individual dimensions such as knowledge and values were more influential on individual actions, factors that are more relevant to school dimensions such as having supportive teachers or school environments equipping students for future careers were more effectful on willingness in group actions. Interestingly, the differences between Group 2 and Groups 3 were not individual dimensions but school dimensions. Thus, we investigated the relationships between the school dimension factors as shown in Figure 1 to understand the reasons as to why students in the gifted school (Group 3) perceive they get more from their education. To be specific, we wanted to know whether this difference between the groups was (i) because of differences in what actually happens in classrooms or (ii) because of what possibly happens in the school hallways when like-minded, gifted students come together. For this, we created a dummy variable (0 = Group 2, 1 = Group 3) measuring the school effect and controlled gender and knowledge effects.

According to the results as presented in Figure 1, the school effect (dummy) variable indicates significant positive correlation with all school environments factors (0.49, 0.61, and 0.40 with Student agency, Supportive teacher, and Future career, respectively). That is, similar to the results presented in Table 5, when gifted students were placed in the gifted school, they were more likely to value their school's climate education compared to the gifted students at normal schools. At the same time, the school effect variable indicates a direct effect (B = 0.23, $p < 0.05$) on willingness to environmental group actions after controlling for the effects of the three school factors on the group actions. Thus, it seems likely that the differences between Group 3 and Group 2 cannot be merely explained by differences in teacher competencies or school climate education, but rather, by some other factors such as what happens in the hallways of schools where gifted students come together.

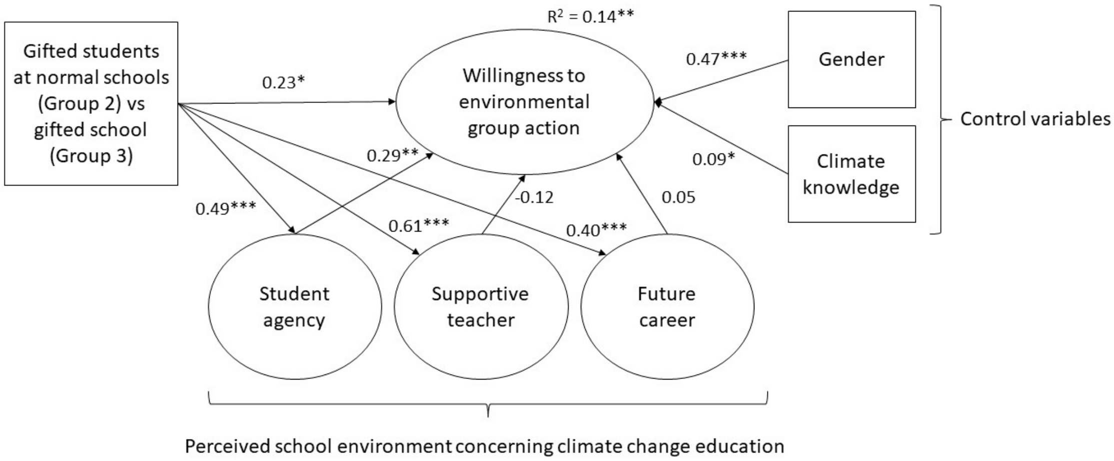

Figure 1. Effect of different schooling (normal vs. gifted) on gifted students' willingness. Note. RMSEA = 0.044, CFI = 0.959, TLI = 0.951. The values presented are standardized coefficients. Ellipse: latent variable. Rectangle: observed variable. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

4. Discussion

In recent years there has been much discussion on developing students' competencies to take meaningful climate action. However, though previous studies acknowledge that academically gifted students may be more concerned about environmental issues and are morally sensitive when it comes to environmental issues [32], the relationship between academic giftedness and willingness to take climate actions has received little attention. This study contributes to this discussion through two main findings:

1. Academically gifted students show more climate competencies, including more willingness to take climate actions, than average-ability students and
2. Academically gifted students that attend schools for gifted students show more willingness to take societal actions related to climate change than gifted students from normal schools.

These findings have major implications to the research field, as we discuss below.

The findings of this study suggest that gifted students are more likely to have action competence than their peers. This notion is supported by the finding that academically gifted students show more knowledge, concern and willingness to take climate action than their peers. Furthermore, the notion is supported by previous studies, which have discussed how gifted students tend to show a high sense of responsibility, good problem-solving skills and they enjoy tackling big challenges (see, e.g., [30,32,34]), all of which are qualities of action competent citizens. Similarly, these are also important components of transformational giftedness. Referring to the definition of transformational giftedness, it can be hard to define what counts as an "extraordinary and meaningful contribution" to environmental issues, but our results indicate that gifted and talented students score high on constructs related to willingness to undertake societal actions, such as participating in public demonstrations and decision-making processes, as well as challenging politicians and businesses to do more to mitigate climate change. Researchers and stakeholders tend to agree that such actions are impactful and potentially transformative for society [1], supporting the notion that academically gifted students have more readiness to become transformationally gifted than their peers.

Furthermore, the core values of academically gifted students show some signs of higher readiness for transformational giftedness than their peers. Namely, academically gifted students showed lower hedonic values than their peers. This finding makes sense, as hedonic values coincide with seeking pleasure and instant gratification, something that may not be a good recipe for academic success. As hedonic values also have a negative correlation with pro-environmental behavior [21,22], values may also have an indirect effect on why academically gifted students showed more willingness to take pro-environmental actions than their peers. That said, we need to be careful about how much we can read into this result as students in all three groups considered other values to be more important to them than hedonic values. According to the Value-Belief-Norms theory [44] an individuals' core values influence their actions. As in our study other values were more dominant than hedonic values, it is uncertain whether these low levels of hedonic values would have a significant impact on how the different groups act, despite finding a statistically significant difference in hedonic values. In other words, it is possible that the core values overrule the hedonic values in all three groups just as strongly. Further research should be conducted to examine whether differences in low-priority values truly have an impact on an individual's life, or whether more important values "override" such low-priority values.

4.1. Differences in Schools

One of the aims of education should be to train students to become active, transformationally gifted citizens. Interestingly, gifted students in the gifted school showed higher willingness to take societal actions than their gifted peers attending normal schools. This is despite the fact that the gifted students in both groups did not show differences in the level of their climate change knowledge. A supportive school environment seems to play a key role in developing readiness towards societal action, as the students in the gifted school perceived their teachers to be more supportive, and their climate education to be more relevant for them. As this study did not examine how climate change education was implemented in the schools, we don't know exactly why the students in the gifted school perceived their education to be more relevant. There are at least two, partially contradicting points of view. The first way to look at it is to assume that the quality of the education is better in the gifted schools, because a prestigious school may attract more competent teachers. However, even if the teachers were more competent in teaching their given subjects (though we don't know this), there is little reason to believe that this subject-specific confidence would translate into them teaching more about climate change per se. Furthermore, even if there were a difference in teacher competence, it is not translated into students having higher levels of knowledge on climate change than their peers, as seen in the results. Therefore, the more plausible explanation is that it may be so that climate change education in the gifted and normal school are more or less similar, but the students in the gifted school *perceive* their education to be more relevant for one reason or another. For instance, it is possible that the students in the gifted school merely perceive their education to be more relevant, due to psychological biases, such as the halo effect or endowment effect [45]. Afterall, they are attending a prestigious school, to which it is hard to get into, so one might assume that the quality of teaching in that school must also be better. It may not make a difference whether this subjective view is true or not, as studies on the halo effect have shown that one's perceptions affect how much that thing is cherished. In the case that education is perceived as relevant, this may result in a higher level of engagement and therefore, better learning results. Another option is that in the gifted school students are surrounded by other gifted students, impacting the type of discussions students engage in, not only during class, but also, outside of class. These "hallway discussion" may impact how relevant students see their school experience, which may then be projected into how relevant students see classroom education. In fact, based on our findings it seems that the group differences between the two gifted groups are not merely explained by differences in teacher competencies or the relevance of what happens in classrooms. Rather, some other factors such as socialization seem to be at play when gifted students come together. As students in the school for gifted are more willing to take societal actions than other gifted students, it could be that in the gifted school different social norms have formed. This would be in line with Ajzen's Theory of Planned Behavior [25], which describes social norms as an important component of pro-environmental behavior.

4.2. Limitations of the Study

It was beyond the scope of this study to examine the differences in school curricula or teachers' teaching methods. As mentioned, the school for gifted students had an emphasis on science and languages, meaning that students in this school had the *opportunity* to take more courses in these subjects. In this study we did not examine which specific courses students had taken. However, we can assume that the school emphasis in itself does not have a major contribution to our results for two reasons. First, according to the national curriculum [8], climate change issues are mainly addressed in science courses, which are compulsory to all students in all schools. Furthermore, based on the names of these extra courses, provided by the school for gifted students, there is no indication that the courses examine climate change or sustainability issues. Rather, they mainly include courses such as lab courses, astronomy, and review-courses. Second, climate change issues are addressed not only in science, but also in other school subjects, such as in ethics. Therefore, having a science-focused school does not ensure that climate change issues will be dealt with more in such schools. In fact, as the Finnish curriculum is open ended, the teachers in Finland are given a lot of autonomy in how they interpret and implement the curriculum. Therefore, the interests of individual teachers tend to have a bigger impact on CC-Ed than the curriculum or a specific school emphasis (see, e.g., [9]). That said, an in-depth analysis, including teacher interviews, would have been beneficial to explore school differences and differences in teaching practices. As this was beyond the scope of this study, the results need to be examined with caution, as we were only able to examine a few of the various cofounding factors at play (e.g., type of school, focus, classroom discussion, teacher competence, teacher interests towards CC, peer relationships, family influence etc.)

4.3. Supporting Gifted Students

To become action competent or transformationally gifted, education must go beyond teaching about the science of climate change. In all, the participants in this study had fairly good knowledge on climate change, though we did see differences between gifted and average-ability students. However, in our study we saw differences among the students even when we controlled for gender and knowledge. This suggests that climate competencies, especially willingness to take climate action, cannot be explained merely by gender differences or differences in knowledge. Rather, other aspects, such as moral sensitivity and sense of responsibility may be at play.

We know from previous studies (e.g., [13]), that students need to be provided with opportunities to work with authentic, real-world dilemmas and problems. Authentic learning can take place when the challenges in learning are situated in some meaningful real-world tasks, solving real-world problems. Moreover, schools need to help students develop the skills to collaborate, and work in teams. This is especially important when dealing with multidisciplinary issues, such as climate change. As teamwork requires ethical and moral sensitivity in order to understand the other members' views, attitudes and values, this may be easier for academically gifted students, as they tend to rank higher in moral reasoning and ethical sensitivity than their average-ability peers [29–31].

Furthermore, to support gifted students it is important that their learning goals are ambitious enough [46] and are aligned with their abilities. In the case of gifted students, it is important that they have a chance to create something new and are guided to reflect the purposes of their learning with the beyond-the-self orientation, supporting the development of transformational giftedness. In other words, the learning goals should be meaningful to the students, while contributing beyond the self to make the world a better place. In the learning process it is important to receive feedback from the learning results. The Authors argue that gifted students need to learn to appreciate the importance of both receiving and giving peer-review in constructive and ethical ways [46]. Additionally, the learning results should not only be assessed with the criteria of excellence, but also with ethics. By also assessing how a school project enhances the wellbeing of humankind, and not only some gifted individuals, but the evaluation can also promote transformational giftedness.

As a concrete example, such a learning approach has been implemented in a non-formal education program for gifted students, where the students were given real-world problems by industry leading companies and universities to solve (see [47]). Over the period of the projects, students not only increased their knowledge and developed creative solutions to real-world problems, but the projects also opened academic and professional opportunities for the students. Furthermore, it helped gifted students get to know each other better, meet experts and have fun together, all while having engaging and deep conversations on socio-scientific and environmental issues. Though this example is from a non-formal education setting, many of the same principles can be applied to formal education. However, it may be easier to implement such learning approaches in gifted schools, as all the academically gifted students already have a good level of base knowledge needed to work with real-world problems. Furthermore, they show high levels of engagement and interest towards working with global issues [32,47]. As gifted students in normal schools seem less engaged than those in gifted schools, our results indicate that they need more support in becoming transformationally gifted. To do so, teachers first need to recognize gifted students, and then provide them with engaging and challenging enough tasks, as discussed above. At times, gifted students should also be connected with other gifted students, to challenge and inspire each other. By taking an active role in supporting the gifted students, the teacher can help them become transformationally gifted, helping solve the local and global problems of today and tomorrow.

Author Contributions: Conceptualization, S.T.; data curation, S.T. and J.K.; formal analysis, J.K.; methodology, J.K. and S.T.; investigation, S.T.; validation, J.K. and S.T.; formal analysis, J.K; writing—original draft preparation, review and editing S.T., J.K. and K.T.; visualization, J.K. and S.T.; project administration, S.T.; funding acquisition, S.T. and K.T. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Ethical review and approval were waived, according to FABRI (2012) guidelines. More specifically, ethical reviews were not needed as participants were over 15 years old, the questions were not sensitive in nature, and the participants had the right to refuse to participate in the study.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author. The data are not publicly available as further data collection and analysis is still ongoing. Data-rights may also restrict the availability of data.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Survey questions included in this study.

Category	Items
Knowledge (see Libarkin et al., 2018) [37]	Choose the right answer (multiple choice): • According to climate scientists, how has the amount of carbon dioxide in the atmosphere changed since the start of the Industrial Revolution 150 years ago? • According to climate scientists, which of the following statements about global warming over the past 50 years is most accurate? • Which is the best description of the differences between climate and weather? • Which of the following contributes to the transfer of thermal energy from place to place around the Earth? • How does sunlight affect temperature on Earth? • Which of the following will occur if the amount of ice floating in the ocean decreases? • Which of the following would most likely occur if the oceans stopped absorbing carbon dioxide? • Which is the best definition of a positive feedback loop in the climate system? • Which of the following is the best definition of a greenhouse gas? • How much incoming sunlight do greenhouse gases absorb?

Table A1. *Cont.*

Category	Items
Value (see Steg et al., 2014) [21]	Answer the following questions using the following scale (−1–7). Give the highest score (6 or 7) only to one or two of the principles which are most important to you. • EQUALITY: Equal opportunity for all • RESPECTING THE EARTH: harmony with other species • SOCIAL POWER: control over others, dominance • PLEASURE: joy, gratification of desires • UNITY WITH NATURE: fitting into nature • A WORLD AT PEACE: free of war and conflict • WEALTH: material possessions, money • AUTHORITY: the right to lead or command • SOCIAL JUSTICE: correcting injustice, care for the weak • ENJOYING LIFE: enjoying food, sports, leisure, etc. • PROTECTING THE ENVIRONMENT: preserving nature • INFLUENTIAL: having an impact on people and events • HELPFUL: working for the welfare of others • PREVENTING POLLUTION: protecting natural resources • SELF-INDULGENT: doing pleasant things
Willingness to take individual action	How much effort are you willing to put into each of the following activities? • Making lifestyle choices that will have a minimal negative impact on climate change. • Finding out which products and services cause minimal harm to the climate. • Reducing carbon emissions in my daily life • Talking to friends and family about climate change related issues so that we can all become more aware of what to do about the problem.
Willingness to take group action	How much effort are you willing to put into each of the following activities? • Challenging politicians and businesses to do more to mitigate climate change • Be a member of a local or national youth group/forum that promotes climate issues. • Seek opportunities to participate in decision-making processes at national and international levels regarding climate issues. • Participate in public demonstrations (e.g., climate strikes) to support the climate change movement.
Environmental concern	On a scale of 1–5 • How worried are you about climate change? • How anxious are you about climate change? • How much guilt do you feel about climate change?
School support: Student agency	Use the following scale to answers the questions: (1 = does not apply at all; 4 = applies very well) • School teaching and activities have provided me with interesting new knowledge, skills and experiences about climate change related issues. • School teaching and activities have given me ideas on how I can put knowledge, skills and experiences about climate change into practice in my everyday life. • School teaching and activities have enabled me to understand how I can help my local community and my country to mitigate climate change. • School teaching and activities have enabled me to understand my own role as a member of society in mitigating climate change

Table A1. *Cont.*

Category	Items
School support: Future career	Use the following scale (1–4) to answers the questions: (1 = does not apply at all; 4 = applies very well) • School teaching and activities have enabled me to get ideas on what type of career I could pursue in order to work with climate change related issues. • School teaching and activities have helped me understand what type of further education is required of me if I wish to pursue a career where I could work with climate change related issues. • School teaching and activities have enabled me to understand the skills that are necessary in the professions related to climate change. • School teaching and activities have helped to understand what it could be like to work in a career position related to climate change
School support: Supportive teacher (see Ojala, 2015) [40]	Use the following scale (1–4) to answers the questions: (1 = does not apply at all; 4 = applies very well) • I have teachers who talk about societal and environmental issues related to climate change in a thought-provoking way. • I have teachers who take up how I, as a young person, can alleviate various societal and environmental problems related to climate change. • I have teachers who in talking about societal and environmental problems related to climate change indicate possible ways to solve those problems in the future.

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education sciences

Article

Talent Development Programs for Secondary Schools: Implementation and Evaluation of a Model School

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Abstract: A school profile of talent development including model classes has been implemented at BG/BRG Keimgasse. This paper evaluates the impact of the actions taken by the school and compares the effects of both the model classes and the regular classes, with a school without a special focus on talent development. The aim of this study was to investigate the influence that the change in profile and teaching strategies had on both types of classes. This was conducted through initial qualitative interviews, followed up by quantitative questionnaires. It was found that the model classes had significantly higher scores in terms of school satisfaction, class climate, self-efficacy, mastery goal orientation, and in hope of successes, as well as scoring significantly lower on classroom pressure. This was achieved while shortening the education for the model-class students by one year and adding extracurricular activities. When comparing the regular classes at BG/BRG Keimgasse with classes from a regular school, the scores differed only slightly. This suggested that the concepts integrated at BG/BRG Keimgasse were successful in catering to the gifted students, without compromising the quality of the regular education.

Keywords: talent development programs; gifted education; actiotope model; school profile

Citation: Jöstl, G.; Hinterplattner, S.; Rogl, S. Talent Development Programs for Secondary Schools: Implementation and Evaluation of a Model School. *Educ. Sci.* **2023**, *13*, 1172. https://doi.org/10.3390/educsci13121172

Academic Editors: James Albright, Kirsi Tirri and Valerie Margrain

Received: 31 May 2023
Revised: 8 November 2023
Accepted: 11 November 2023
Published: 22 November 2023

1. Introduction

In German-speaking Europe, gifted education has a long tradition, with measures to support gifted children dating back to the late eighteen century [1]. However, the promotion of gifted students in Austria is still limited to separate interventions [2]. Regular schooling starts in Austria at the age of six with four years of primary school. After primary school, students regularly attend four years of lower secondary school where they can decide between attending a high school or a middle school. Thereafter, students regularly attend four or five years of higher secondary school where students can decide between several school types. More details of the Austrian school system can be seen in Figure 1.

The regular schooling in Austria offers a base for talent development with its different school types, different specializations in various branches, and voluntary additional classes. Moreover, high-achieving students have the opportunity to skip grades up to three times during a student's school career, with nine years of schooling still being compulsory. Students may start earlier in school as well, if they meet certain requirements, and pass a set of tests to ensure their readiness. In terms of enrichment, it is possible to attend revolving-door programs for high-achieving students allowing them to leave their regular classroom to attend additional courses. However, this is only possible if teachers offer this possibility. Similarly, students can attend university classes during school, that will be credited later to their respective university studies. Special clubs for gifted and/or high-achieving students, studios for artistic or creative work, facilities for self-regulated learning, additional and advanced instructional offerings during and beyond the hours of normal instructions, and tutoring programs are common [1].

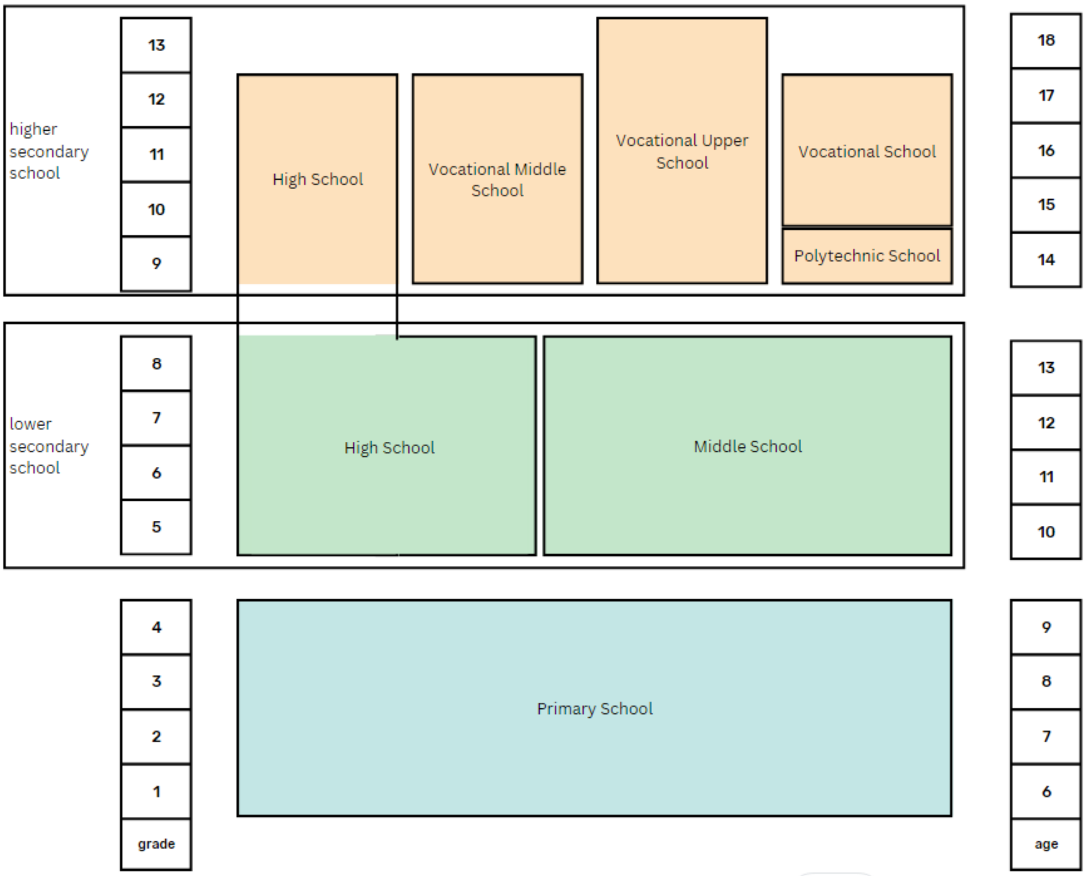

Figure 1. The regular school system in Austria with its different school types and the corresponding grades and starting age.

There is an additional supportive offer by regional coordinators in every school region: they counsel gifted students, their parents, and school boards, support school development, and organize programs for gifted students and for teachers' professional development. A comprehensive program that offers inclusive and integrated promotion throughout the educational path from primary education until university studies is still missing [2,3].

However, research shows that it is essential that gifted students have control over their learning experience regarding the educational environment, a challenging curriculum, a complexity in their learning experiences, and teachers who care about teaching and their students [4]. Most talent-development models have highlighted the significance of educational opportunities and practices in nurturing the talent of gifted individuals [5,6]. For instance, challenging educational opportunities can affect creative productivity [7]. Gifted students can acquire new knowledge quickly, understand new concepts at once, and have an excellent memory [8–10]. They often know 40–60% of the content being taught [11]. Keeping this in mind, a lot of waiting time occurs for gifted students in regular classes [12–14]. But waiting can cause boredom [4,15], leading to unsatisfactory behaviours, underachievement, and school dropout [16–18]. To counteract this trend, gifted students need support to foster their abilities and develop their talents [19–21].

The importance of this educational environment for gifted students in their development will be highlighted in this article, where a model school is presented, designed as an ideal learning system with its offerings. The school "BG/BRG Keimgasse" wants to close this gap by supporting talents throughout their secondary school years with initiatives including primary and tertiary education. The teachers at the school have developed a fundamental pedagogical principle aiming to support giftedness and talent in schools. In this paper, the school profile and the special model classes for gifted students and talent development are presented and evaluated. In this research project, the systemic interventions are evaluated in comparison with the conventional school program. In contrast to previous support measures in Austria that are usually offered separately as described before, here, the curriculum and organisation as a whole are changed and designed to promote giftedness. The learning environment of the school has been designed to promote giftedness and the authors have evaluated whether this also supports the development of giftedness in the students. For this reason, this paper also includes a systemic approach for the theoretical framework for the research.

2. Theoretical Background

2.1. Giftedness

The view of giftedness has changed considerably in recent decades. The idea of a genius blessed with inherently great talents such as high intelligence independent of the outside world has given way to a systemic perspective [22,23]. In tradition with Renzulli's historical three-ring model (1978), in which a highly gifted behaviour is seen as a combination of high intelligence, engagement, and creativity, giftedness is now generally understood as a person's potential that can be brought to fruition through the interaction of various factors [24–27]. The Munich model of giftedness by Heller and colleagues distinguishes here, for example, between noncognitive and nonsomatic personality traits (moderators), performance area (criteria), environmental characteristics (moderators), and talent characteristics (predictors) [25]. Ziegler and Stöger (2017) distinguish between exogenous and endogenous resources. Exogenous resources are economic, social, cultural, infrastructural, and didactic educational capital. Endogenous resources are organismic, attentional, telic, actional, and episodic learning capital [28].

Analogous to the described change from one-dimensional conceptions of giftedness via three-component-definitions or multidimensional models to systemic approaches, this paradigm shift can also be observed in pedagogy and didactic recommendations for talent development [29]. Gifted education and research are closely interrelated. The theoretical concepts of giftedness are and have been influenced by giftedness education and vice versa. A pedagogical approach that takes into account the multiple interrelationships and components of the system as a whole reflects our contemporary approach to the world in its complexity and system interrelationships quite well and can respond to the demands on schools in the 21st century [30]. Human beings are no longer seen as individuals with attributes assigned to them (for instance, intelligent, gifted or high achievers), but these attributes are seen in relation to the environment through which they develop, grow, are nurtured but also decline if the environment and challenges do not fit. A 21st century school should see itself as a multilayered systemic learning environment and treat its students as important parts of this system. Separative individual programmes achieve at best an analogous individual improvement. A gifted systemic environment supports the dynamic development of giftedness, as Ziegler constated, "a holistic approach has to equally address the person and the learning environment" [29]. For these reasons, a systemic model was chosen for the theoretical background of our research on the evaluation of the model school. Ziegler introduced his actiotope model of giftedness (AMG) into the scientific discourse as a framework model for the systemic connections [26,28,31–34], which is described in more detail below.

2.2. The Actiotope Model of Giftedness

Albert Ziegler's actiotope model of giftedness (AMG) [31,32] serves as the theoretical framework for this study. The AMG is a systemic model for explaining giftedness as part of the person's systemic environment. In Ziegler's model, the gifted individual is considered in constant interaction with the environment. Analogous to the concept of the biotope, whose influencing factors form the basis for the emergence and development of life forms, the AMG takes into account the various internal and external factors and their interactions, which lead to corresponding actions of a person. The AMG is a framework model for the systemic analysis of effects and interactions of various components with the individual as the centre. These components are the action repertoire, the subjective action space, goals, and the environment in which the person acts.

A person's action repertoire is understood to be all possible actions which this person would be objectively capable of at a given point in time. The subjunctive indicates that by no means all of these potentially usable alternative actions can actually be implemented. For this to happen, a certain alternative action must (1) be considered in the first place, (2) a corresponding intention must exist, and (3) the environment must permit the execution of this action [32]. The current action repertoire describes the pool of action alternatives actually available at a certain point in time.

The subjective action space is the psychological component, which describes the possibilities for action that a person considers to be available to him or her. It comprises the action- and self-related thinking of a person, which determines which possibilities of action concretely come to consciousness. This component can also be seen as the multitude of conceivable action steps that one goes through in an anticipatory and controlling manner during action planning and action regulation [32]. The subjective action space is mainly influenced by motivational variables. For example, the degree of self-efficacy of a person can have a promoting or limiting effect. The classic phenomenon of underachievers in giftedness research [23,27] may be related to limited subjective action space. Too little ambitious goals can also be a reason here, which leads us to the next point.

The central guiding component for action selection are a person's goals. They determine the selection of those subjectively available action alternatives that appear suitable for achieving a desired result. In addition to their role as guideposts in action planning, they also function as a yardstick and regulator during action execution, in that already achieved results are compared with the desired results of action.

In addition to these first three components, which are located within the person, the environment in which a person interacts reflects the manifold external influences to which he or she is exposed. It includes all situations, structures and persons that are relevant for the formation of action intentions as well as for the execution of actions.

An important aspect of the systemic AMG approach is that all components of the actiotope are in constant interaction with each other. Thus, the subjective action space cannot be imagined independently of the current action repertoire. An expansion of the action repertoire can lead to an expansion of the subjective action space (e.g., through higher self-efficacy expectations) in the case of transparent feedback through the realistic assessment of the increased possibilities for action. Conversely, it is also possible that the elimination of motivational restrictions and thus an increase in the subjective action space enable more intensive learning experiences by setting more ambitious goals. This, in turn, leads to an expansion of the current action repertoire. All of this takes place in constant interaction with the environment, which creates the decisive conducive or restrictive situations and conditions in various structures such as family, school, or profession, in the form of parents, teachers, peers, or superiors. Since the emergence of the AMG, it has been used repeatedly as a framework in various international studies [34–36].

In order to systematize the various different variables and their interactions that are of interest in this evaluation, the AMG is ideally suited. For example, self-efficacy expectations, mastery goal orientation, and hope for success can be assigned to the subjective action space interacting with the student's goals, and the use of various learning strategies can be assigned to the students' action repertoire in combination with the subjective action space. Different goal orientations also provide information about the goals of the students as well as school satisfaction, school and classroom climate show the attitude towards the environmental component. An overview is shown in Figure 2. In the section describing the model school, the environmental component of the AMG is referred to in detail by describing the multitude of special activities at BG/BRG Keimgasse.

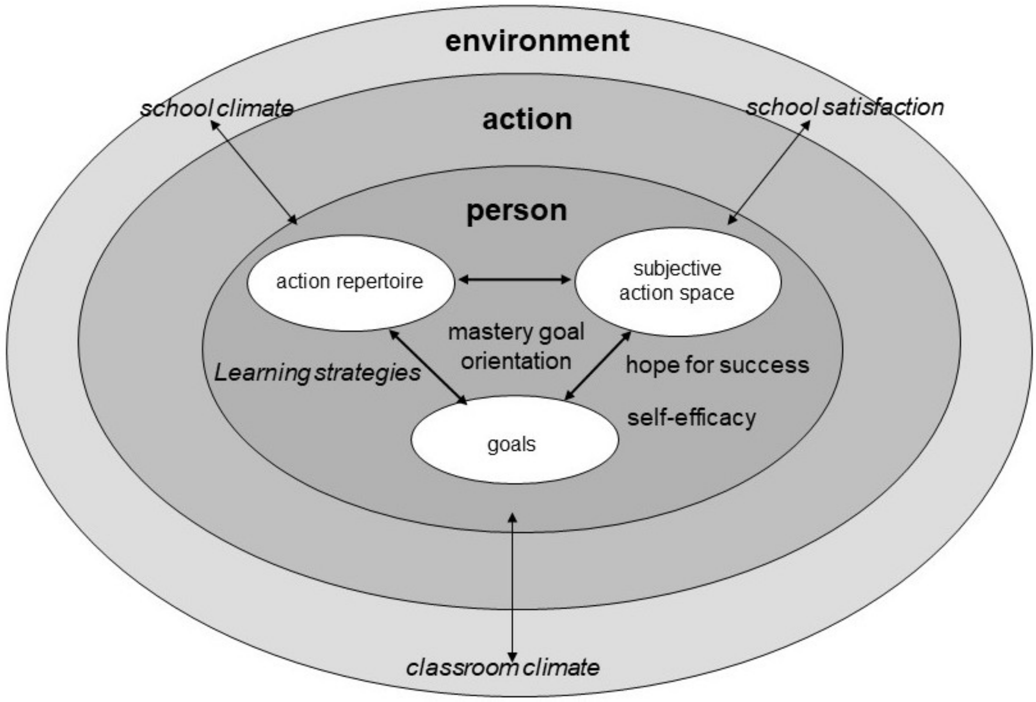

Figure 2. The actiotope model of giftedness in relationship with the different variables and their interactions that are of interest in this evaluation [32].

2.3. Guiding Principles of the Model School

Looking at the diverse interventions of BG/BRG Keimgasse (see next section), two guiding principles stand out: promoting self-regulated learning (SRL) and fostering intrinsic motivation by meeting the basic needs of Deci and Ryan's self-determination theory [37–40]. Despite a variety of theoretical approaches [41–44], SRL is generally separated into knowledge and reflective use of learning strategies (cognitive, metacognitive, and resource strategies), as well as motivational strategies such as goal reifications [45], self-efficacy [46], and affective aspects. This assumes a cyclical process of forethought, performance, and self-reflection [47,48] on learning activities in which learning can be optimized through the metacognitive strategies of monitoring and regulating the learning process. The relationship between SRL and achievement has long been documented [49].

In this study, the motivational aspects of SRL such as self-efficacy [50], mastery goal orientation [45], hope for success [51], and school satisfaction [52] were of particular interest. One of the most influential theories for promoting intrinsic motivation is SDT [53,54]. Deci and Ryan assume that three basic needs must be met in order to act intrinsically motivated: autonomy, competence, and relatedness. These basic needs have also been explored in numerous empirical studies in the context of schools [55] as well as in students' homes [56,57]. In order to prevent gifted students from losing their motivation and willingness to perform, it is important to give them a sufficient amount of autonomy so that they can use their intrinsic motivation to motivate themselves [58]. Also, studies show that a sense of competence is important for intrinsic motivation [38]; this can be achieved, for example, if the tasks have just the right level of difficulty for the students [59]. In terms of relatedness, empirical studies show that gifted students focus more on grades than on community [60], but this also often leads to cohesion among students [55]. Numerous studies show that SDT corresponds well to other theories already described, such as SRL [61]. However, SDT also provides a good framework in general with respect to giftedness [62,63]. The extent to which the interventions offered in the model school promote SRL and the fulfilment of basic needs can be understood in the following section.

3. The Model School

BG/BRG Keimgasse is located in Mödling, a city with nearly 21000 habitants in lower Austria. The school offers lower secondary and higher secondary classes with the graduation "Matura", the Austrian university entrance qualification. The school attend to 1039 students in 43 classes with 100 teachers teaching them. What is special about BG/BRG Keimgasse is the focus on promoting talents. For this purpose, a fundamental pedagogical principle was developed and employed in all classes through the schools. The principle is based on theories that address the development of expertise and best-practice examples of differentiated curricula and pedagogies for gifted and talented students referring to research that shows that this approach supports the development of giftedness [64–66]. This includes a wide range of voluntary classes, competitions, the revolving-door model and various events open to both gifted and interested students having challenges and opportunities of research in this area in mind [67]. Moreover, the school offers a special model class for gifted students that is intended for pupils with particularly good abilities who learn not only quickly but with high levels of self-motivation. The concepts of the model classes is based on acceleration and enrichment.

3.1. School Profile: Talent Development

The promotion of talents has always been a major concern of the school; therefore, a wide range of voluntary classes and events for all students and their diverse interests are offered, e.g., language certificates (Cambridge, DELF, DELE), IT classes (Lego Mindstorms, network technology, physical computing), chemistry and mathematics Olympiad, intensive classes in all foreign languages, stage play, school newspaper, musical soirée, literature competition, school academy, where all students have the possibility to perform on a big stage in the field of music, dance, sports, and stage play, or the "Long Night of Talents", where all students can show their talent to other students and train with them.

Besides these activities that are offered in the students' spare time, it is also possible to leave the regular classes for enrichment classes. The revolving-door model enables gifted students with individual elements (e.g., attending a higher school level or an extracurricular class, or work on a personal project) to further enhance the personal learning experience of each student. Moreover, students from upper secondary classes can give their own classes to students in lower secondary classes if they have special knowledge in a field. The students in these enrichment classes take over the responsibility for their own learning, with the aim of developing their full potential.

In the class "Social Learning", upper secondary students get trained to be mentors for first-grade students or to accompany students from primary schools to support them in their talent development by doing mathematical riddles together, creating stop motion videos, or philosophizing with children. This initiative aims to promote young talents but also the students from upper secondary classes.

3.2. Model Classes for Gifted Students and Talent Development

The aim of the model classes for gifted students and talent development is to offer an adequate environment for students who are particularly eager to learn. The concept for the classes in based on acceleration and enrichment. More talent-promotion initiatives are included such as special lesson design, coaching and mentoring, and quality assurance. Within the framework, learning, organizational, and didactic measures are envisaged that should support children to (self-)identify talents and promote them as well as develop their intellectual and social skills. In the next paragraphs, the main aspects of model classes are presented.

3.2.1. Acceleration

The regular lower secondary school in Austria lasts four years. In the model class, all mandatory teaching units from these four years are already taught in three years. The difference with skipping a school grade is that in the model class, no mandatory teaching units are skipped. In the three years of lower secondary school, the same number of mandatory teaching units are completed like in the regular four years of lower secondary school. Moreover, additional classes are offered resulting in more voluntary teaching units. The model class also contributes to the socio-emotional development with a positive consolidation of the self-image of gifted students based on research [68]. This should help to prevent underachievement in the group of gifted students.

3.2.2. Enrichment

The curricula of the model classes contain only minor additions to the curricula of the regular classes. Enrichment is beneficial for all students through high levels of engagement and the use of enjoyable and challenging learning experiences that are constructed around students' interests, learning styles, and preferred modes of expression [66,69]. In particular, the scientific subjects are supplemented by practical laboratory work and the subject computer science is added. In each model class, the students work at least one week of the school year together on a class project. The topic and approach depends on the individual strengths and interests of the students. In addition to learning basic skills in project management, the focus is on getting to know the strengths of others as well as assessing one's own abilities. During the project, mandatory evaluations of the work process have to be conducted and discussed within the group. The project work ends in a presentation of the class project as part of the "Long Night of Talents" event. In the upper secondary school, "Plus Courses" can be taken and the subject "Project Module" is added. Plus courses focus on an individual topic where the class teachers are experts in the field or areas in which students have special interest. The offer is presented in a separate topic-oriented course booklet. Students from the model class have to choose at least 12 weekly lessons of plus courses in 11th (10th school year) and 12th grade (11th and final school year). Examples are body language and rhetoric; water is life: different aquatic ecosystems; sports science: training theory; training planning; social dimensions of sport; singing: the voice as a multifaceted instrument; lyrics: the power of words in music, among others. In the project module, the students work on individually chosen scientific or humanities topics. In addition to the acquisition of academic knowledge, the project module focuses on the practical learning of basic project management skills like creating a schedule, creating a project plan, and distribution of tasks.

3.2.3. Coaching and Mentoring

Each student of the model class is accompanied by a supporting teacher with appropriate coaching training. Based on research that shows the effectiveness of initiatives like these [70], it should support gifted students in their development. The coaching starts with an initial contact within the framework of the introductory days as part of a school event for the students. Afterwards, the supporting teacher and the student keep in regular contact. Supporting teachers are mostly working in the field of personality development and strengthening self-esteem and do not teach the model class regularly. The support contains mediation and conflict advice, behaviour advice and coaching, communication and cooperation (problems in the class community burdens in the family environment). To ensure the confidentiality and efficiency, the support lessons are held in individual settings. Conversations about problems in the class communities are also possible in a group setting if required. The contact teacher takes minutes of the discussions held. All students attend the first-grade course "Social Learning" led by a teacher and by mentors of the higher secondary school.

3.2.4. Lesson Design

A variety of methods are used to meet the needs of the gifted students: individualization, differentiation, open learning, among others. Students are encouraged to observe their learning behaviour and to explore different methods and areas besides the academic fields to develop in self-reliance, self-organization, error correction, strategy of research, planning, and organization. Twice in the school year are two special weeks called FLipiK (German acronym for "Open learning individually and person-oriented in the BG/BRG Keimgasse") planned. The students of the model classes can do their assignments from all subjects individually and independently. In addition to the contents of the curriculum, creative as well as challenging tasks can be chosen. The focus in these weeks lies on the personal responsibility and self-competence of the learners, as well as the accompanied self-reflection of the learning process.

3.2.5. Quality Assurance

For quality assurance, regular internal evaluations (class conferences, feedback loops), and external evaluations (through scientific institutions such as the Austrian Research and Support Centre for the Gifted and Talented, the University of Education in Lower Austria, or the Institute for Educational Sciences at the University of Vienna) are carried out.

3.2.6. Organisational

The lower secondary school of the model class contains four grades in three years (5th to 8th grades) and the upper secondary school of the model class contains four grades in four years (9th to 12th grades). The maximum number of students allowed in the lower secondary school is 24—at most, 20 to 22 students are attending the model class. In the regular class, usually, 25 to 28 students are attending. Teachers of the model classes are trained in talent promotion or other relevant fields. Special training and regular further training in teaching methods and new approaches of teaching are mandatory for all teachers of the model classes.

3.2.7. Admission

The admissions process is carried out by external experts in the field of gifted diagnostics. The process contains the following steps: (1) getting to know each other: child, parent, psychologist, teacher; (2) standardized cognitive ability test; (3) group assignments where, among others, social learning and teamwork are observed. The evaluations of the getting-to-know step and the group assignments have to be positive and in the standardized cognitive ability test, a high ability has to be diagnosed in every giftedness domain with the threshold set as the 85th percentile. The maximum number of students allowed in the model classes is limited to 24. In the last years, around 50% of the applications for the model class met the criteria for admission.

4. Materials and Methods

In order to determine the impact of the multiple measures on students, the authors were asked by the school administration of BG/BRG Keimgasse to conduct a comprehensive evaluation in the fall of 2021. None of the authors was part of the development of the school's talent program. From 2007 to 2008, a school team under the scientific supervision of Prof. Dr Friedrich Oswald and with the support of the regional school administration developed the concept of this separative model of talent promotion. Since then, the model classes have been continuously developed and evaluated both internally and externally. The head of the model classes, Prof. Wurzer, is primarily responsible for the now established and recognized concept.

This study examined the impact of model classes and regular classes compared to a control school without a special focus on talent development. The nearby comparison school, BG/BRG Perchtolsdorf, is of the same school type as BG/BRG Keimgasse and provides lower secondary and higher secondary classes leading to the Austrian university entrance qualification, "Matura". The numbers of students (950), teachers (90), and classes (35) are comparable to those of BG/BRG Keimgasse. In addition to sharing the same geographical location, school type, admission criteria, and enrolment figures, students' socioeconomic status and the distribution of gender is similar. To gain an understanding of the variations in talent development promotion among the two schools, Table 1 provides an overview.

Table 1. Overview of the initiatives to support talent development at BG/BRG Keimgasse and BG/BRG Perchtolsdorf.

		Model Classes BG/BRG Keimgasse	Regular Classes BG/BRG Keimgasse	BG/BRG Perchtolsdorf
Talent development school profile		X	X	
Acceleration:	Skipping classes [1]	X	X	X
	Shortening duration [2]	X		
Coaching		X	X	
Enrichment:	Class project	X		
	FLipiK project	X	X	
	Plus courses	X		
	Project module	X		
	Revolving door model	X [3]	X [3]	X [4]
	Social learning	X	X	
	Students' teaching	X	X	
	Talent classes	X	X	X
Events		X	X	X
Mentoring		X	X	
Voluntary classes		X	X	X

[1] Skipping a whole grade with all the classes in that grade. [2] Completing the lower secondary school in three years instead of the regular four without skipping classes. [3] Possible in every subject. [4] Possible only in foreign language "English".

4.1. Research Questions

The following research questions were investigated for both the lower and upper secondary grades.

Question 1: To what extent is there a difference between regular classes, model classes from BG/BRG Keimgasse, and classes from BG/BRG Perchtolsdorfwith respect to the variables school satisfaction, school climate, classroom climate, use of elaborated learning strategies (elaboration), self-efficacy, mastery goal orientation, and hope for success, which can be located in different areas of the AMG?

Question 2: Do the measures in the model classes radiate to the regular classes at BG/BRG Keimgasse ? (Is there a difference between regular classes at BG/BRG Keimgasse and BG/BRG Perchtolsdorf?)

4.2. Data Collection

For the development of the questionnaires, 30 qualitative interviews with students were conducted in January 2022. An important result of the interviews was that both model and regular students were very satisfied with their school form and that the modern instructional design was noticeable for both forms. Therefore, the evaluation design was extended to compare not only model and regular classes but also to examine another school as a control group. A detailed analysis of the interview data will be published at a later date.

Subsequently, based on the findings from the interviews, two online questionnaires were programmed on the online platform SurveyMonkey, one version for BG/BRG Keimgasse and one version for BG/BRG Perchtolsdorf, which could be won as a control group for the quantitative survey. The students worked on the questionnaire in class in June 2022. The response formats of the various scales used were standardized for this purpose. The quantitative items were answered using a sliding rule on a scale from 0 to 100. The questionnaires were checked for comprehensibility of content and form as well as functionality by means of pretests.

4.3. Data Analysis

To answer the research questions, the students of the regular classes, model classes, and the students of BG/BRG Perchtolsdorfwere compared by means of several univariate analyses of variance (ANOVAs) including post hoc tests (Bonferroni). Data analysis was performed using SPSS computer software. Since a differentiation according to individual school levels would go beyond the scope of the study, a distinction was only made between lower secondary and higher secondary levels in order to provide a more differentiated picture.

4.4. Sample

During the evaluation, the regular classes of BG/BRG Keimgasse and BG/BRG Perchtolsdorfas well as the model classes of BG/BRG Keimgasse were examined. In the lower secondary level (grades 5 to 8), 336 students from regular classes at BG/BRG Perchtolsdorf, 396 from regular classes at BG/BRG Keimgasse, and 58 students from model classes took part in the evaluation. In the higher secondary level (grades 9 to 12), there were 179 students attending a regular class at BG/BRG Perchtolsdorf, 161 students attending a regular class at BG/BRG Keimgasse, and 52 students attending a model class. The gender distribution of the survey was as follows: in the model classes of BG/BRG Keimgasse, 22 students identified themselves as female, 30 as male, and 6 students did not specify their gender identity at the lower secondary level; at the higher secondary level, 21 students identified themselves as female, 27 as male, and 4 did not specify their gender identity. In the regular classes of BG/BRG Keimgasse, 179 identified as female, 197 as male, and 20 did not specify their gender identity at the lower secondary level. At the higher secondary level, 73 identified as female, 73 as male, and 15 did not specify their gender identity. In the regular classes at BG/BRG Perchtolsdorf, 176 identified as female, 152 as male, and 8 did not identify as female or male at the lower secondary level. At the higher secondary level, 97 identified as female, 69 as male, and 13 did not specify their gender identity. An overview of the distribution of the participants can be seen in Table 2.

Table 2. Distribution of the participants of the conducted survey.

	Level [1]	Female	Male	Other [2]	Total
BG/BRG Keimgasse	I	179	197	20	396
	II	73	73	15	161
	I + II	252	270	35	**557**
BG/BRG Perchtolsdorf	I	176	152	8	336
	II	97	69	13	179
	I + II	273	221	20	**514**
Model classes	I	22	30	6	58
(BG/BRG Keimgasse)	II	21	27	4	52
	I + II	43	57	10	**109**
Regular classes	I	333	319	21	673
(BG/BRG Keimgasse- and	II	149	115	24	288
BG/BRG Perchtolsdorf)	I + II	482	434	45	**961**
Total		**525**	**491**	**55**	**1071**

[1] Level I for lower secondary level, level II for higher secondary level. [2] Students who did not mention their gender identity or did not categorize themselves as female or male.

4.5. Scale Description

The quantitative questionnaire was designed to provide as comprehensive a picture as possible of the various aspects that could be influenced by the different measures. For this purpose, scales from different questionnaires were combined in one instrument. The questionnaire was intended to serve as a basis for comprehensive school development measures, and it was possible to interview the students during class time. In this article, we focused only on excerpts from the entire survey. The selected scales are described in Table 3. The scales used have already been used in many international and national studies and are considered to be widely known. Therefore, a satisfactory validity can be assumed. The reliabilities of the scales used can be seen in Table 3 and refer to the present sample with the adjusted scaling (0–100).

Table 3. Selected scales of the quantitative questionnaire.

Scale	Description	Cronbach's α	Sample Items
School satisfaction [71]	Students' satisfaction with school	0.68	I like being in this school. Life would be boring without school.
School Climate [72]	Students' subjective perceptions of their learning environments	0.92	The mood at our school is mostly cheerful, happy—depressed, listless. The teachers are generally friendly—unfriendly.
Classroom climate: classroom pressure [72]	Individual aspects of the learning environment in the classroom	0.81	If we don't study on weekends, we hardly accomplish what is asked of us. The teachers often explain things so quickly that you can hardly keep up.
Classroom climate: readiness to learn [72]	Individual aspects of the learning environment in the classroom	0.57 [1]	Most of the students in this class love to learn. Often, we students still talk about things that were discussed in class, even during the breaks.
Self-efficacy [50]	Students' beliefs in their capacity to act in the ways necessary to reach specific goals [2]	0.81	I can solve even difficult questions if I try hard. I am confident that I can do well on schoolwork/tests at school.
Elaboration [73]	Student self-report their learning strategies, highlights strengths and weaknesses)	0.65	I learn new terms, definitions, etc. by imagining corresponding examples and situations. I try to express the material I am learning in my own words.
Mastery goal orientation [74]	Coping behaviour and their attributions [2]	0.88	At school, I learn primarily.... ...because many things interest me. ...because I like to learn something new
Hope for success [51]	Elicits explicit achievement motives and covers the domains of hope for success as well as fear of failure	0.83	I enjoy working on problems that are a bit difficult for me. I am attracted by situations in which I can test my abilities.

[1] This low reliability corresponds to the published reliability. Since it is a common and proven instrument, the scale was retained. [2] This scale was developed at the Department of Educational Psychology at the University of Vienna in the course of a Sparkling Science project with the collaboration of one of the authors.

Ethics

Since the study was conducted in a school, the consent of the parents and the school administration was obtained in advance. The students were free to decide whether they wanted to participate in the study or not, and they were also free to discontinue their participation at any time. The data were processed and analysed anonymously.

5. Results

In order to answer the first two research questions, the quantitative data were examined. As mentioned earlier, the evaluation was designed to provide a comprehensive picture of many different aspects that could be influenced by the different measures to support gifted children. Therefore, within the scope of this article, it was only possible to give a selection of the results and to present the most important aspects. An overview of the results can be seen in Tables 4 and 5. The results of the ANOVAs were examined in detail by means of post hoc tests (Bonferroni).

Table 4. Mean values, standard deviations, and results of the analysis of variance for the lower secondary school.

Scale	Model Classes BG/BRG Keimgasse	Regular Classes BG/BRG Keimgasse	Control Group BG/BRG Perchtolsdorf	
	M (SD)	**M (SD)**	**M (SD)**	**ANOVA, Sign.**
School satisfaction	77.6_a (20.5)	67.08_b (22)	66.84_b (23)	F (2. 799) = 6.23, p = 0.002
School climate	77.44_a (15.1)	66.05_b (19.6)	63.83_b (19.3)	F (2.799) = 12.45, p < 0.001
Classroom climate—classroom pressure	46.16_a (25.43)	53.7_b (26.85)	54.3_b (27.73)	F (2.796) = 2.27, p = 0.1
Classroom climate—readiness to learn	57.89_a (23.58)	42.2_b (21.99)	43.79_b (22.33)	F (2.796) = 12.33, $p \leq 0.001$
Elaboration	54.15_a (24.1)	53.39_b (25.1)	54.27_b (22.8)	F (2.797) = 0.13, p = 0.88
Self-efficacy	80.4_a (21.9)	72.04_b (24.2)	70.82_b (24.9)	F (2.796) = 3.83, p = 0.02
Mastery goal orientation	67.04_a (21.8)	55.24_b (25.9)	55.74_b (24.9)	F (2.796) = 5.72, p = 0.003
Hope for success	59.5_a (23)	49.1_b (25)	50.46_b (25.4)	F (2.788) = 4.31, p = 0.01

Note: means with different subscripts differ at the p = 0.05 level according to Bonferroni's test.

Table 5. Mean values, standard deviations, and results of the analysis of variance for the higher secondary school.

Scale	Model Classes BG/BRG Keimgasse	Regular Classes BG/BRG Keimgasse	Control Group BG/BRG Perchtolsdorf	
	M (SD)	**M (SD)**	**M (SD)**	**ANOVA, Sign.**
School satisfaction	69.33_a (21.11)	61.6_b (21.62)	58.73_b (22.93)	F (2.394) = 4.65, p = 0.01
School climate	70.18_a (16.63)	54.26_b (19.42)	52.5_b (16.84)	F (2.395) = 20.3, p < 0.001
Classroom climate—classroom pressure	40_a (25.13)	64.52_b (23.98)	65.7_b (24.14)	F (2.395) = 24.42, p < 0.001
Classroom climate—readiness to learn	46.55_a (23.24)	34.02_b (19.05)	38.98_b (20.58)	F (2.394) = 8, p < 0.001
Elaboration	65.1_a (19.7)	55.49_b (24.2)	53.92_b (22.4)	F (2.395) = 4.8, p = 0.008
Self-efficacy	80.71_a (18.52)	72.26_b (21.22)	69.97_b (23.8)	F (2.395) = 4.8, p = 0.009
Mastery goal orientation	58.29_a (25.13)	47.58_b (25.12)	43.37_b (243)	F (2.393) = 7.46, p = 0.001
Hope for success	60.68_a (26.8)	46.13_b (27.55)	41.16_b (25.01)	F (2.393) = 11.1, p < 0.001

Note: means with different subscripts differ at the p = 0.05 level according to Bonferroni's test.

5.1. School Satisfaction

School satisfaction differed significantly between the three groups at the lower secondary level (F (2.799) = 6.23, p = 0.002). Satisfaction was highest in the model classes (77.6), followed by the regular classes at BG/BRG Keimgasse (67.08), and the regular classes at BG/BRG Perchtolsdorf (66.84) at about the same level. In the upper secondary level, the differences were also significant (F (2.394) = 4.65, p = 0.01) and followed the same pattern. Thus, the highest satisfaction was in the model classes (69.33), followed by the regular classes BG/BRG Keimgasse (61.6), and the lowest satisfaction was in the regular classes at BG/BRG Perchtolsdorf (58.73).

5.2. School Climate

The perception of the school climate was also significantly different at the lower secondary level (F (2.799) = 12.45, $p < 0.001$) as well as at the upper secondary level (F (2.395) = 20.3, $p < 0.001$). At the lower secondary level, the model classes perceived the school climate most positively (77.44), the regular classes at BG/BRG Keimgasse second most positively (66.05), and the regular classes at BG/BRG Perchtolsdorfleast positively (63.83). At the upper secondary level, it was also the model classes that had the most positive impression (70.18) of the school climate, although this was no longer as pronounced as in the primary level sample. As for the lower secondary level, the regular classes of the upper secondary level at BG/BRG Keimgasse (54.26) had a slightly but not significantly more positive impression of the school climate than the regular classes of the upper secondary level at BG/BRG Perchtolsdorf.

5.3. Classroom Climate

Regarding class climate, the difference in the subscale classroom pressure was not significant at the lower secondary level (F (2.796) = 2.27, $p = 0.1$), but this was assessed as significantly different at the higher secondary level (F (2.395) = 24.42, $p < 0.001$). Thereby, the model classes at the upper secondary level rated the teaching pressure the lowest (40), followed by the regular classes from BG/BRG Keimgasse (64.52). The regular classes from BG/BRG Perchtolsdorfrated the teaching pressure slightly but not significantly higher (65.7) at about the same level.

The subscale readiness to learn also showed that it was significantly (lower secondary: F (2.796) = 12.33, $p \leq 0.001$; upper secondary: F (2.394) = 8, $p < 0.001$) higher in the model classes of both lower secondary and upper secondary levels (lower secondary: 57.89; upper secondary: 46.55) than in the regular classes of both schools (lower secondary BG/BRG Keimgasse: 42.42; upper secondary BG/BRG Keimgasse: 34.02; lower secondary BG/BRG Perchtolsdorf: 43.79; upper secondary BG/BRG Perchtolsdorf: 38.98).

5.4. Elaboration

In the scale elaboration, there were no significant differences at the lower secondary level (F (2.797) = 0.13, $p = 0.88$) but there were at the upper secondary level (F (2.395) = 4.8, $p = 0.008$). At the lower secondary level, the values of the three samples were similar: the model classes had a value of 54.15, the regular classes of BG/BRG Keimgassehad a value of 53.39, and the regular classes in BG/BRG Perchtolsdorfhad a value of 54.27. At the upper secondary level, on the other hand, the model classes had the highest value of 65.1, followed by the regular classes in BG/BRG Perchtolsdorfwith 55.49, and the regular classes in BG/BRG Keimgassehad the lowest value of 53.92.

5.5. Self-Efficacy

Significant differences were evident in self-efficacy at both lower secondary (F (2.796) = 3.83, $p = 0.02$) and upper secondary levels (F (2.395) = 4.8, $p = 0.009$). At the lower secondary level, the model classes had the highest value of 80.4, followed by the regular classes of BG/BRG Keimgasse with 72.04, and the regular classes from BG/BRG Perchtolsdorf (70.82). At the upper secondary level, there was a similar picture: the model classes had a value of 80.71, followed by the regular classes of BG/BRG Keimgasse with 72.26, and the regular classes from BG/BRG Perchtolsdorfwith 69.97 at a similar level.

5.6. Mastery Goal Orientation

There was a significant difference in mastery goal orientation both at the lower secondary level (F (2.796) = 5.72, $p = 0.003$) and at the upper secondary level (F (2.393) = 7.46 $p = 0.001$). At the lower secondary level, it could be seen that the students of the model classes (67.04) had a higher mastery goal orientation than the students of the regular classes at BG/BRG Keimgasse (55.24) and the regular classes at BG/BRG Perchtolsdorf (55.74). The same effect could be seen at the upper secondary level but somewhat weaker; there, the model classes (58.29) had a higher mastery goal orientation than the regular classes at BG/BRG Keimgasse (47.58) or at BG/BRG Perchtolsdorf (43.37).

5.7. Hope for Success

The model classes differed significantly from the two regular classes at the lower secondary level in terms of hope for success (F (2.788) = 4.31, $p = 0.01$). On this scale, the model classes at the lower secondary level had the highest scores (59.51) followed by the regular classes from BG/BRG Perchtolsdorf (50.46), and just below that, the regular classes from BG/BRG Keimgasse (49.11). At the upper secondary level, all three samples differed significantly (F (2.393) = 11.1, $p < 0.001$); there also, the model classes had the highest value (60.68) followed by the regular classes from BG/BRG Keimgasse, and a slightly lower value for the regular classes from BG/BRG Perchtolsdorf (41.16).

6. Discussion

To address the first research question about the differences between regular classes, model classes from school A, and classes from school B with respect to the variables which can be located in different areas of the AMG, the various measures to promote giftedness at BG/BRG Keimgasse appeared to be having the intended effect. Thus, significantly better values were observed in the model classes than in the regular classes of BG/BRG Keimgasse and BG/BRG Perchtolsdorfin the areas of school satisfaction, school climate, classroom climate, the use of elaborated learning strategies (elaboration), self-efficacy, mastery goal orientation, and hope for success.

Our results are consistent with findings from several studies [75] that collectively show that high-ability students benefit from ability groupings such as the model class here. Looking specifically at evaluation studies of enrichment programs and their effects on participants' self-concept and self-esteem, however, we find mixed findings [75]. While some studies found no effects, others even found a reduction. Such decline is typically also found in support measures with ability grouping and explained via social comparison (see also the big-fish–little-pond effect, [75]. In our study, on the other hand, we were able to document that the grouping of gifted students in special classes did not actually lead to any loss in the assessment of their own abilities.

Regarding question 2, the assumption which derived from the interviews that the teaching forms of the model classes would radiate to the regular classes of BG/BRG Keimgasse could not be confirmed by the quantitative data. However, it should be noted that BG/BRG Perchtolsdorf, which served as a control group, was also a highly renowned school in the same area. For further research, a more representative cross-section of several Austrian schools would be useful as a control group.

If the individual variables are examined in the context of the measures implemented in the model classes against the background of the AMG [31], the interactions between the three basic needs from the SDT (e.g., [40]) and the areas of the SRL become obvious. The majority of school-based measures (e.g., project work, plus courses, FlipiK—offered from the environmental component of the AMG) are entirely focused on students learning autonomously (SDT) and self-directedly (SRL). Thus, it can be assumed that the independent elaboration of different topics promotes the use of elaborated learning strategies [41] and the individual working speed makes competence experiences more easily possible. In addition, it could be assumed that the positive perception of environmental variables such as school and classroom climate (fostered by social courses as environmental offer) and the associated high level of school satisfaction (relatedness, SDT) have an effect on the subjective action space of the students, who approach school tasks with higher self-efficacy and hope for success, both important motivational aspects in SRL. Thus, it is obvious that students' goals lie in the acquisition of knowledge and skills rather than in simply completing school requirements (mastery goal orientation SRL, competence, SDT). This is also accompanied by the use of more elaborate learning strategies [41] and thus an increase in the student's action repertoire (competence). However, this is only one of the many possible interactions that are conceivable between the individual areas. With its systemic, holistic view, the AMG assumes intensive interactions between all areas. Even though it is therefore not always possible to clearly assign individual areas in the AMG, it is clear from the data that the modern, scientifically based approach to promoting giftedness at BG/BRG Keimgasse has a highly positive effect on the students' actiotope.

Expertise is described by other research [29] as a process of adaptation to certain environments. In order to examine and analyse expertise as a process in a more differentiated way, the concepts of educational and learning capital are introduced as endogenous and exogenous resources (and subsequently recommended for practical talent development). In the context of our survey, this means that we collected data on the following individual aspects of the regulatory processes required for expertise: cultural (values, thought patterns, guiding principles), social (people), infrastructural (material), and didactic (know-how for designing and improving educational and learning processes) educational capital [29], which was measured with school satisfaction, school climate, and classroom climate. The endogenous resource, the learning capital, is divided by [29] into organismic, actional, telic, episodic, and attentive, measured with the use of elaborated learning strategies (elaboration), self-efficacy, mastery goal orientation, and hope for success.

The present results are of particular importance in Austria, because they represent the first systematic full-scale study of a whole school with the focus on gifted education, with a control group. In order to encourage schools to introduce gifted education, it is of immense importance to provide robust evidence for the success of such interventions. Due to the systemic perspective against the background of the AMG, the effects and interactions of the various measures described could be highlighted. Since the effect of such programs is always under discussion, we hope that this study will provide evidence for the effectiveness of such measures and that this best practice example will provide other schools with the theoretical and practical background for designing more gifted education programs.

7. Conclusions

Through the initial interviews, it was shown that at BG/BRG Keimgasse, both students in the regular and the model classes found their school structure advantageous. The modern lesson designs and teaching style were appreciated not only by the model-class students but by the regular students as well, who also received lessons from teachers involved with teaching the model classes. It also became evident that the enrichment efforts in the model classes were highly appreciated by the students, together with the shortened school duration, whilst the lower pressure in the classrooms and the fewer hours at school were seen as positive by the regular-class students. It is worth noting that both regular-class students and model-class students expressed that there was little contact between the two groups. Moreover, the interviews highlighted the importance of including another secondary school for a comparison of the questionnaires, to better understand how the modern forms of teaching and the splitting of the school intro regular and model classes affected the regular classrooms.

The results of the final questionnaires showed significant increases in class climates, readiness to learn, elaboration, mastery goal orientation and hope for success, when comparing the model classes to the regular classes. This points towards a successful implementation of the acceleration, enrichment, coaching and mentoring, lesson design, and quality assurance. The lower perceived classroom pressure of the model classes suggests a well-functioning admission policy and a good organization of the classes. Also, the high regards for the social aspects among students point to a good organization and a well-working school profile, with focus on the individual as well as the class as a whole, for both regular and model classes.

As an outlook, it must be mentioned that the school has now been successfully implementing this concept for its students for more than a decade. in the meantime, it is to be transferred from the school pilot status to the regular school system. The insight that could be gained on the basis of our evaluation can only welcome this endeavour.

Author Contributions: Conceptualization, G.J., S.H. and S.R.; methodology, G.J. and S.R.; software, G.J.; validation, G.J. and S.H.; formal analysis, G.J. and S.H.; investigation, G.J.; resources, G.J., S.H. and S.R.; data curation, G.J.; writing—original draft preparation, G.J. and S.H.; writing—review and editing, G.J., S.H. and S.R.; visualization, S.H.; project administration, G.J. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Data are contained within the article.

Conflicts of Interest: The authors declare no conflict of interest.

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Article

Intersectional Program Evaluation: Considering Race, Class, Sex, and Language in Gifted Program Effectiveness

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Abstract: Gifted education is an effective intervention for high-ability students who need more academic challenges. However, the relationship between program effectiveness and demographic categories has been scantly evaluated. Research focused on the effectiveness of gifted education infrequently considers the intersections of ability, race, sex, socioeconomic status, and language. To fill this gap, I used an ex post facto quasi-experimental design to conduct a cross-sectional evaluation of gifted service models at the intersections of cultural identity groups in Ohio. Findings underscore the relationship between the type of gifted service model and achievement on standardized math test scores varying across demographic groups.

Keywords: gifted and talented education; program evaluation; intersectionality; achievement; equity; best match

Citation: Kuykendall, T.M. Intersectional Program Evaluation: Considering Race, Class, Sex, and Language in Gifted Program Effectiveness. *Educ. Sci.* **2023**, *13*, 719. https://doi.org/10.3390/educsci13070719

Academic Editors: Kirsi Tirri and Valerie Margrain

Received: 23 April 2023
Revised: 10 July 2023
Accepted: 11 July 2023
Published: 14 July 2023

1. Introduction

Gifted and talented education (GATE) programs in the United States have largely remained segregated well after Brown v. Board of Education [1]. There is a wealth of research on the underrepresentation of minoritized groups in GATE, as researchers in the field continue to raise the alarm on inequitable access issues related to the assessment and identification of students from minoritized groups [2–7]. Representation is not only an outcome of access; representation is also an impetus for persistence. For minoritized students identified as gifted, research indicates issues related to retaining these students in GATE [8]. Many studies evaluate the general effectiveness of various models of gifted service provision in the United States [9–11]. However, much of the extant research on the effectiveness of GATE does not take an intersectional approach to evaluate service models at the intersections of ability, race, socioeconomic status, and English learner status.

The underrepresentation of minoritized students in gifted programs is often mirrored in GATE research, as research on this topic is largely based on samples from racially homogenous populations. The broader implication is that policies about gifted education are shaped by research in which students from minoritized groups, whose needs may differ from their peers, are not represented. This study aims to make a case for intersectional [12] program evaluation and research. Data from the state of Ohio, a state that mandates gifted identification, mirror the nationwide trend; students with economic disadvantages and students who are Black or Hispanic are underrepresented in gifted programs. White and Asian students are overrepresented in identification for gifted programs. In Ohio's statewide review of five years of gifted data, there were no conditions in terms of district urbanicity, poverty level, or population size in which Black students had proportional representation in identification [13]. Though Ohio has a policy that requires screening, assessing, and identifying gifted students, the state does not require districts to provide services related to gifted identification [14]. Ohio also does not have a formal process for evaluating and promoting effective gifted programs and interventions. Program evaluation is essential to ensuring support and services are appropriately aligned to students' needs.

In this study, I reviewed four years of Ohio programming data to evaluate the relationship between types of gifted service models and the math achievement of gifted-identified students across demographic groups and document how the relationship between the types of gifted service models and achievement on standardized math test scores varies across demographic groups. The focus was to determine if some service model types were associated with higher mean math scores for students based on their cultural group membership than others. In line with consequential research on culturally responsive teaching and culturally responsive pedagogy [15], findings from this research could help move understanding closer to identifying if and which particular models of service are more responsive to students based on their group identities. Intersectionality is used in my analysis to frame how the evaluation of GATE program effectiveness is typically organized around meeting the needs of some students while making invisible the needs of others at the margins of race, SES, and ability.

2. Materials and Methods

2.1. Sample and Sources

This study was conducted in SY19-20 before the onset of COVID-19. Criterion sampling was used for this research. The Ohio Department of Education (ODE) provided student-level data for all Ohio elementary students in grades third through fifth who were reported as gifted identified between School Year (SY) 2015–16 and SY 2018–19. In Ohio, students may be identified as gifted using various state-approved instruments, including the Cognitive Abilities Test (CogAT), i-Ready Assessment, Measures of Academic Performance (MAP) Growth, Naglieri Nonverval Ability Test Third Edition (NNAT3), PSAT, SAT, ACT, The Iowa Assessments, Wechsler Intelligence Scale for Children Fifth Edition (WISC V), and others [16]. From this data, students who were identified as gifted in math and/or superior cognitive and receiving services, as indicated by one of ODE's approved service models, were included in this study. See Table 1 for descriptions for each service model. This study included 149,907 observations of student math scores from the Ohio State Tests. Of these students, 125,972 (84.03%) received gifted education, while 23,935 (15.97%) were not provided gifted education. Students that were provided gifted education had higher mean scores on the math portion of the Ohio State Tests (m = 774.81, s.d. = 31.45) than students who were not provided gifted education (m = 767.43, s.d. = 36.04). Students were provided services through service models such as post-secondary enrollment options, early entrance to kindergarten, self-contained classrooms, grade acceleration, innovative services, cluster grouping, pullout enrichment, art instruction by a trained art instructor, International Baccalaureate program, mixed models, subject acceleration, guidance services, advanced placement, educational options, honors classes, other services, and differentiation in the regular classroom. Regular classroom is used throughout this paper to be consistent with ODE's program language and refers to the general classroom or where a student's learning takes place absent gifted programming. Descriptions for each service model are in Table 1.

Table 1. Descriptions for each service model.

Service Models	Based on the Ohio Department of Education Descriptions
Cluster grouping	Several gifted students are deliberately placed in one class and provided services.
Pullout enrichment	Students are regularly assigned (but less than 100% of time) to a resource room for gifted students instead of their regular classroom. The instruction is differentiated and delivered by a GIS who is not the teacher of record.
Self-contained gifted classroom	Courses that are primarily designed for gifted students and the instructor is credentialed in gifted education.
Subject acceleration	A gifted student is placed in a classroom with other students who are at a higher grade level than would normally be expected. Report this code for a student in the year one or more courses in the specific subject sequence are skipped.

Table 1. *Cont.*

Service Models	Based on the Ohio Department of Education Descriptions
Differentiation in the regular classroom	Services are provided in the regular classroom, and gifted students are not specifically grouped in the class (in contrast to Cluster Grouping).
Honors classes	Specific subject area classes which are differentiated from a regular (same) subject area class in terms of breadth, depth, and complexity.
Other services	Use of this service model should be rare and is likely to generate a request from the ODE for additional information from the district to document the nature of the "other service".
Educational options	Educational options provide experiences for individual students who need services not available in the regular school setting. They may include independent study, mentoring, and distance learning.
Grade Acceleration	A gifted student is moved to a higher grade level than would normally be expected for the current year, such as a double promotion at the end of the prior year or a midyear promotion during the current year.
Innovative services	An innovative service is a service not already described in the Gifted Operating Standards that offers a sustained and challenging experience, based on evidence or research suggesting the service is effective or is a promising practice, to meet the unique needs and interests of the district's students who are gifted.
Guidance	Services received from a guidance counselor and/or a guidance program specifically designed to meet the social and emotional needs of gifted children, including making academic and career choices.
Advanced placement	College-level courses with corresponding examinations in multiple subject areas (e.g., mathematics, art, and history). Credit for college may be obtained if a student takes in an AP examination sponsored by the College Entrance Examination Board and given in the spring of each school year.
International Baccalaureate	Services through an International Baccalaureate course.
Post-secondary enrollment options/CCP	Students may enroll in college-level courses and receive college credit and credit toward graduation from high school at the same time.
Art instruction by a trained art instructor	Services through a trained arts instructor trained in the arts areas of dance, visual arts, drama/theater, ormusic.
Early kindergarten	Students are admitted to kindergarten or first grade before they have reached the district's usual cut-off age and date for kindergarten or first grade.

2.2. Outcome Variable

Academic achievement. The ODE requires the administration of standardized assessments for students in grades three to twelve annually in the spring across Ohio [17]. The procedures for administering standardized assessments include ensuring the assessment is proctored by staff who have completed a test administrator (TA) certification course. The standardized assessments include a math exam for Grades 3–8. The standardized assessments for Grades 9 through 12 and advanced students in lower grade levels include algebra and geometry or integrated math 1 and 2. Students have between 150–180 min for math exams. Based on the number of questions students answered correctly on the assessment, raw scores are converted to scaled scores, the proportion of the overall questions students answered correctly, to allow for a consistent comparison of results. Scaled score range on the assessment is as follows: Grade 3, 587–818 (m = 719.56, s.d. = 47.92, Grade 4, 605–835 (m = 728.85, s.d. = 49.05), and Grade 5, 624–804 (m = 711.09, s.d. = 39.20) [17].

2.3. School-Level Variables

Service models. Gifted programs and services are delivered to gifted-identified students using service models. There are approximately eleven types of service model options listed in Chapter 3324.07 of the Ohio Revised Code (ORC): a differentiated curriculum; cluster grouping; mentorships; accelerated course work; the college credit plus program; advanced placement; honors classes; magnet schools; self-contained classrooms; independent study; and other options identified in rules adopted by the department of education [18] (p. 4). The regular classroom teacher or a gifted intervention specialist can deliver these service models. ORC requires boards of education to develop a plan for service of gifted students, including service models from the state-approved list [19]. In this study, the categorical variables of service were recoded into a series of dichotomous dummy variables. The referent group in the dichotomous coding signifies the group of well-represented students that the underrepresented student groups were compared with.

Students who received gifted education through cluster grouping were coded as 1, and those who were not serviced through cluster grouping were coded as 0. Students who received gifted education through educational options were coded 1, and students who did not were coded 0. When grade acceleration was used to provide gifted programming, the coding was 1, and when services were provided through a different model, the coding was 0. Gifted programs that used guidance as a service model were coded as 1, and programs that did not use guidance as a service model were coded as 0. Students who received gifted education through Honors classes were coded as 1, and those who did not were coded as 0. When International Baccalaureate (IB) was used to provide gifted education, students were coded as 1, and students were coded as 0 when IB was not used. Students who received gifted education through innovative services were coded as 1, and those who did not were coded as 0. Students who received gifted education through post-secondary enrollment were coded as 1, and those who did not were coded as 0. Students who did not receive services were the referent group. When pullout services were used to provide gifted programming, the coding was 1, and when services were provided through a different model, the coding was 0. Gifted programs that used enrichment in the regular classroom as a service model were coded as 1, and programs that did not use enrichment in the regular classroom as a service model were coded as 0. Students who received gifted education through subject acceleration were coded as 1, and those who did not were coded as 0. When "other" services were used to provide gifted programming, the coding was 1, and when services were provided through a different model, the coding was 0. Students who received gifted education through self-contained classrooms were coded as 1, and those who did not were coded as 0. Some of the service models were originally coded separately if they were provided by a classroom teacher or a gifted intervention specialist. Those service models were combined for analysis in this study because of collinearity.

Cultural identity. Students identified as gifted are typically White, medium-to-high SES, male, have no disability status, and are not English learners [20]. These characteristics were used as the demographic variables representing student cultural identity and modeled as binary predictors. Economic disadvantagement represented a student's free or reduced-priced meal status and was a proxy for socioeconomic status for this study. In Ohio, schools with 40% or more students eligible for free or reduced-priced meal status, directly certified based on government assistance, homelessness or runaways, migrant, participating in Federal Head Start, or a confirmed foster child, are eligible for the Community Eligibility Provision [18]. The Community Eligibility Provision (CEP) allows schools to provide all students with school meals at no cost to the students [18]. When CEP was first made available, the ODE did not create new coding options to distinguish economically disadvantaged students in CEP schools from those not economically disadvantaged. However, the ODE has since made new codes to remedy this prior limitation [21]. In this study, economically disadvantaged students were coded as 1, and students who are not were the referent group. The disability status variable is a measure of the students who have a learning disability condition (SWD), which according to the ODE EMIS manual chapter 2.5 [21] (p. 5) can include multiple disabilities (other than deaf–blind), deaf–blindness, deafness (hearing impairment), visual impairments, speech and language impairments, orthopedic impairments, emotional disturbance (SBH), intellectual disabilities (formerly mental retardation, developmentally handicapped, or cognitive disabilities), specific learning disabilities, autism, traumatic brain injury (TBI), other health impaired (major), other health impaired (minor), and developmental delay. Students with a disability were coded as 1, and students without a disability were the referent group. English learner (EL) status is assigned to students for whom English is not the primary language and who have not yet achieved a score high enough on the Ohio English Language Proficiency Assessment (OELPA) to be coded as not EL. Students who were English language learners were coded as 1, and students who were not EL were the referent group. Sex in this data was a binary variable represented as female (1), and male was the referent group. Black and Hispanic are included as the race variable. Black and Hispanic were included as a combined variable due to collinearity in the preliminary analysis of the data. If a student is Black or Hispanic, they were coded as 1, and all other race and ethnicity groups were coded as 0.

3. Research Design

This research used an ex post facto quasi-experimental design to conduct a cross-sectional evaluation of gifted service models at the intersections of ability, race, socioeconomic status, and English learner status. Given ethical and practical considerations concerning manipulating access to education-related services and instruction, ex post facto designs are commonly employed in education and social science research [22]. Using an ex post facto quasi-experimental design allowed this study to use data that have already been collected for the purposes of teaching, learning, and state assessment to test a hypothesis about the causal relationship between the independent variable, service model type, and the dependent variable, achievement on the math portion of the Ohio State Tests, even though the independent variable cannot be manipulated as it would be in a true experimental design.

4. Analytic Plan

The 15th version of Stata, a statistical software package, was used to model the mixed-effects multilevel regression needed to evaluate the relationship between types of gifted service models and the math achievement of gifted-identified students across demographic groups and document how the relationship between the types of gifted service models and achievement on standardized math test scores varies across demographic groups. In multilevel analysis, there should be a minimum of 20 level-two units [23], represented in this study by schools. For educational research, the smallest number of level-two units used should be 30, and the most frequently used number of level-two units is 50 [24]. Level-two units with sample sizes that are less than 50 may have standard error estimate bias at the group level [24]. This study met and exceeded the minimum threshold and most frequently used number of level-two units.

The effect size was calculated using the standardized group mean. The effect size was measured using Cohen's d, which is calculated by dividing the difference in the treatment group mean and the referent group mean by the overall population standard deviation [22]. The rule of thumb guidance suggested by Cohen is $d = 0.20$ is a small effect size, $d = 0.50$ is a medium effect size, and $d = 0.80$ is a large effect size [25]. This effect size is a measure of practical significance, which is how meaningful the result is in a practical or real-life context.

A regression analysis provides the best model for predicting the outcome variable: student math achievement scores. As the data contain individual student-level data that are nested within schools, a mixed-effects multilevel regression was used to control for school characteristics and account for lack of independence in error due to this clustering [23]. Dummy coding was used to create multiple dichotomous variables, because the predictor variable is categorical. This coding allowed for a more meaningful interpretation of differences between predictor variables on achievement scores than would have been possible if the predictor variables were coded as multiple-group categorical variables [22].

Appropriate measures were taken to screen the data for missing values, outliers, non-normal distribution, balance, and multicollinearity. These measures included using frequency distribution tables, descriptive statistics analysis, scatter plots, bar charts, and a plan for handling missing and extreme values [22]. Missing values were handled using casewise deletion. Casewise deletion removes all cases with missing or incomplete data, ensuring that the analysis is consistently based on the same cases [26]. Removing whole cases from the dataset could threaten the strength of the analysis if too many cases are removed [26], but the large sample size in this study made it robust enough to overcome this threat. The data screening process also involved checking that assumptions for conducting regression analyses have been met. Regression analysis assumptions are that the relationship between the independent and dependent variable is linear, there is no multicollinearity between the independent variables, and that the variables have homoscedasticity, normally distributed residuals, and no extreme outliers [22].

Achievement regressed on service model as moderated by cultural identity. Multilevel regression analysis was to evaluate whether the characteristics of a student's cultural identity (i.e., sex, race/ethnicity, SWD, SES, and EL) have a moderating effect on each service model's impact on student math achievement.

Level 1. $Math_{ij} = \beta_j + \epsilon_{ij}$

Level 2. $\beta_j = \gamma_0 + \gamma_1 ServiceX_j + \gamma_2 IdentityX_j + \gamma_1 ServiceX_j \gamma_2 IdentityX_j + \zeta_j$

In this set of models, $Math_{ij}$ is the predicted mean score of a schools' Ohio State Test math achievement β_j. In Level 2, β_j is a school's mean math score as predicted by service model type. The second model also includes γ_1, the intercept coefficient for the service model, γ_2, the intercept coefficient for cultural identity, the interaction effect of the two factors, and ζ_j, the school-level deviation from the overall mean. $IdentityX$ represents a series of dummy variables that represent different cultural identities. A sex dummy variable was scored 1 for students who are female. A race variable was scored 1 for students who are Black and/Hispanic. The variable SWD was scored 1 for students with disabilities. The variable SES was scored 1 for students who are from low-income households. The variable LEP was scored 1 for students who are English learners. The interaction between each service model and cultural identity is represented as $\gamma_1 ServiceX_j \gamma_2 IdentityX_j$.

Cultural identity, service model type, and the interaction between cultural identity and service model type were included in the model. School was included as a level-two variable to control for unobserved school characteristics. These are the models that were used for the third question. The variables that represent cultural identity are heterogeneous, and within group differences likely exist for students with disabilities and the other groups represented in this study. Having a robust sample size and controlling for unobserved school factors helps improve the effectiveness of these variables while moving the research closer to answering the question of which service model(s) is the best match. Research from Vygotsky provides lasting insights from a social constructivist perspective into the learning and development of children, which informs readers of the crucial role social and cultural contexts play in child development [27]. Children from underserved cultural groups are often disadvantaged by familial and environmental circumstances and need culturally responsive educational opportunities [28]. Including cultural identity in the model is necessary for a more nuanced evaluation of service model effectiveness than the first model of the study.

5. Results

There were statistically significant differences in mean math scores for students from minoritized cultural groups who received gifted education when compared with gifted-identified students in the referent groups who were not provided gifted education. I controlled for unobserved characteristics of schools, cultural identity, and the interaction between service model type and cultural identity. Gifted-identified students in the referent groups had higher average math achievement than students who were female ($\gamma = -3.79$, $p < 0.00$, $d = 0.30$), English learners ($\gamma = -6.82$, $p < 0.00$, $d = 1.66$), Black and/or Hispanic ($\gamma = -15.23$, $p < 0.00$, $d = 0.54$), students with disabilities ($\gamma = -16.14$, $p < 0.00$, $d = 0.35$), or low-income students ($\gamma = -28.66$, $p < 0.00$, $d = 0.76$); see Table 2.

The main effects of each service model were also evaluated (Table 3). For the referent group gifted-identified students, early entrance to kindergarten ($\gamma = 11.86$, $p < 0.01$, $d = 3.68$) was associated with the highest average math achievement compared with students not provided gifted education. Grade acceleration ($\gamma = 5.99$, $p < 0.00$, $d = 0.54$), self-contained classrooms (γ = 3.91, p < 0.00, d = 0.28), guidance services (γ = 3.57, p < 0.00, d = 0.99), pullout enrichment (γ = 2.18, p < 0.00, d = 0.32), and cluster grouping (γ = 1.12, p < 0.00, d = 0.31) were also associated with math achievement scores that were higher than those of referent group gifted-identified students who were not provided gifted education. Other service models used with referent group gifted-identified students were associated with average math achievement that did not significantly differ from those of those who were not provided gifted education. These service models include the International Baccalaureate program, innovative services, post-secondary enrollment options, advanced placement, art instruction by a trained art instructor, and using more than one service model. The service model that was associated with the lowest average math achievement of the referent group gifted-identified students were honors classes (γ = −6.05, p < 0.00, d = 0.33). Educational options (γ = −5.01, p < 0.00, d = 0.49), differentiation in the regular classroom (γ = −4.27, p < 0.00, d = 0.32), subject acceleration (γ = −2.02, p < 0.00, d = 0.31), and other services (γ = −1.99, p < 0.00, d = 0.48) were also associated with average math scores that were significantly lower than average math scores of the referent group gifted-identified students who were not provided gifted education.

Table 2. Main Effects of Gifted Service Models on Student Math Achievement based on Mixed-Effect Multilevel Regression.

Predictor	Coef. (γ)	Std. Err.	Effect Size Key
			Large +
SEX	−3.79 ***	0.30	medium +
LEP	−6.82 ***	1.66	small +
RACE	−15.23 ***	0.54	no effect
SES	−16.14 ***	0.35	small −
SWD	−28.66 ***	0.76	medium −
			large −

Note: Referent group students in the dichotomous dummy coding are students who are not Black and/or Hispanic, students with medium to high SES, students identified as male, students without a disability, and students who are proficient in English. Effect size as indicated by green coloring with a + symbol represents positive effect sizes, while red coloring with a − symbol represents negative effect sizes. *** p < 0.001.

Table 3. Moderation Effects of Gifted Service Models on Student Math Achievement based on Mixed-Effect Multilevel Regression.

	Predictor	Coef. (γ)	Std. Err.	Effect Size Key
				Large +
typical gifted student	Early kindergarten	11.86 **	3.68	medium +
	Self-contained gifted classroom	3.91 ***	0.28	small +
	Grade acceleration	5.99 ***	0.54	no effect
	Cluster grouping	1.12 ***	0.31	small −
	Pullout enrichment	2.18 ***	0.32	medium −
	Subject acceleration	−2.02 ***	0.31	large −
	Guidance services	3.57 ***	0.99	
	Educational options	−5.01 ***	0.49	
	Honors classes	−6.05 ***	0.33	
	Other services	−1.99 ***	0.48	
	Differentiation in the regular classroom	−4.27 ***	0.32	

Note: Effect size as indicated by green coloring with a + symbol represents positive effect sizes, while red coloring with a − symbol represents negative effect sizes. *** p < 0.001, ** p < 0.01.

Additionally, the effect of service models on math achievement based on cultural identity (Table 4) was estimated. The estimated effect of the service models for each cultural identity indicated the size of the effect varied across cultural groups (i.e., gender, race, disability status, socioeconomic status, and language learner status). For female students, the effects of post-secondary enrollment options (γ = 41.33, p < 0.00, d = 3.71), honors classes

(γ = 4.05, p < 0.00, d = 0.52), innovative services (γ = 2.59, p < 0.05, d = 1.16), educational options (γ = 2.01, p < 0.05, d = 0.78), and cluster grouping (γ = 1.97, p < 0.00, d = 0.42) were significantly higher than the effects for male students. The largest positive difference in service model effect for female students was a 37.54-point increase in mean math score associated with post-secondary enrollment options. The effects of subject acceleration (γ = −1.49, p < 0.01, d = 0.48), other services (γ = −2.52, p < 0.01, d = 0.73), guidance services (γ = −5.23, p < 0.00, d = 1.25), International Baccalaureate (γ = −13.71, p < 0.00, d = 3.41), and advanced placement (γ = −18.90, p < 0.05, d = 8.65) were lower for females than males. The largest negative difference in service model effect for female students was an 18.40-point decrease in mean math score associated with advanced placement. When considering grade acceleration, pullout enrichment, differentiation in the regular classroom, self-contained classrooms, art instruction by a trained art instructor, and early entrance to kindergarten, and when more than one service model was used to provide services, there was no significant effect on the math achievement of female students when compared to males.

Table 4. Estimated Effect of Gifted Service Models Based on Cultural Identity.

Predictor	Typical	Sex	Race	SWD	SES	LEP
Post-secondary enrollment options	−3.95	37.54	−82.37			
Early kindergarten	11.86 ***				−8.68	
Self-contained gifted classroom	3.91 ***		5.60	18.63	1.26	15.79
Grade acceleration	5.99 ***		13.39			
Innovative services	0.07	2.66	18.43			
Cluster grouping	1.12 ***	3.08	7.68	19.07	4.65	
Pullout enrichment	2.18 ***		−2.56	−2.56	−0.99	
Art instruction by a trained art instructor	2.51					
International baccalaureate	1.59	−12.12		27.95		
More than one service type	0.67			−8.08		
Subject acceleration	−2.02 ***	−3.51			−4.48	
Guidance services	3.57 ***	−1.66	18.18		−0.65	
Advanced placement	0.50	−18.40				
Educational options	−5.01 ***	−3.00		19.03		−83.32
Honors classes	−6.05 ***	−2.00	2.81	17.46	−0.10	
Other services	−1.99 ***	−4.51	2.47			
Differentiation in the regular classroom	−4.27 ***		−13.50	11.95		

Note: Blank cells indicate that the effect for females, Black and/or Hispanic students, students with disabilities, low-income students, and English learner students was not statistically significantly different than that for students in majority cultural groups (p < 0.05). *** p < 0.001.

For Black and/or Hispanic students, the effects of innovative services (γ = 18.36, p < 0.00, d = 7.73), guidance (γ = 14.61, p < 0.01, d = 5.32), honors classes (γ = 8.86, p < 0.00, d = 2.46), grade acceleration (γ = 7.4, p < 0.05, d = 3.27), cluster grouping (γ = 6.56, p < 0.00, d = 0.82), and self-contained classrooms (γ = 1.69, p < 0.05, d = 0.81) were significantly higher than the effects for White students. The largest positive difference in service model effect for Black and/or Hispanic students was an 18.43-point increase in math score associated with innovative services. The effects of pullout enrichment (γ = −4.74, p < 0.00, d = 0.91), differentiation in the regular classroom (γ = −9.23, p < 0.00, d = 1.21), and post-secondary enrollment options (γ = −78.42, p < 0.05, d = 37.57) were lower for Black and/or Hispanic students than White students. The largest negative difference in service model effect for Black and/or Hispanic students was an 82.37-point decrease in mean math score associated with post-secondary enrollment options. When considering educational options, International Baccalaureate, subject acceleration, and art instruction by a trained art instructor, and when more than one service model was used to provide services, there was no significant effect on the math achievement of Black and/or Hispanic students when compared to White students.

For students with a disability, the effects of the International Baccalaureate (γ = 18.36, p < 0.00, d = 7.73), educational options (γ = 14.61, p < 0.01, d = 5.32), honors classes (γ = 8.86, p < 0.00, d = 2.46), cluster grouping (γ = 6.56, p < 0.00, d = 0.82), differentiation in the regular classroom (γ = 7.4, $p < 0.05$, d = 3.27), pullout enrichment ($\gamma = -4.74$, $p < 0.00$, d = 0.91), and self-contained classrooms (γ = 1.69, $p < 0.05$, d = 0.81) were significantly higher than the effects for students without a disability. The largest positive difference in service model effect for students with a disability was a 27.95-point increase in math score associated with International Baccalaureate. The effects of when more than one service model was used ($\gamma = -9.23$, $p < 0.00$, d = 1.21) were lower for students with a disability than students without a disability. The largest negative difference in service model effect for students with a disability was an 8.08-point decrease in mean math score associated with when more than one service model was used. When considering grade acceleration, guidance services, innovative services, other services, subject acceleration, and art instruction by a trained art instructor were used to provide services, there was no significant effect on the math achievement of students with a disability when compared to students without a disability.

For students from low-income families, the effects of honors classes (γ = 5.95, $p < 0.00$, d = 0.92) and cluster grouping (γ = 3.53, $p < 0.05$, d = 0.49) were significantly higher than the effects for students from middle-to-high income families. The largest positive difference in service model effect for students with a disability was a 4.65-point increase in math score associated with cluster grouping. The effects of subject acceleration ($\gamma = -2.46$, $p < 0.01$, d = 0.73), self-contained classrooms ($\gamma = -2.65$, $p < 0.00$, d = 0.48), pullout enrichment ($\gamma = -3.17$, $p < 0.00$, d = 0.54), and guidance services ($\gamma = -4.22$, $p < 0.01$, d = 1.32) were lower for students from low-income families than students from middle-to-high income families. The largest negative difference in service model effect for students with a disability was an 8.68-point decrease in mean math score associated with early entrance to kindergarten. When considering educational options, grade acceleration, International Baccalaureate, innovative services, other services, post-secondary enrollment options, differentiation in the regular classroom, and art instruction by a trained art instructor, and when more than one service model was used, there was no significant effect on the math achievement of students from low-income families when compared to students from middle-to-high income families.

For English learner students, the effects of self-contained classrooms (γ = 11.88, $p < 0.00$, d = 2.91) were significantly higher than the effects for students without a language learner status. The largest positive difference in service model effect for English learner students was a 15.79-point increase in math score associated with self-contained classrooms. The effects of educational options ($\gamma = -78.31$, $p < 0.05$, d = 30.74) were lower for English learner students than students without a language learner status. The largest negative difference in service model effect for English learner students was an 83.32-point decrease in mean math score associated with educational options. When considering cluster grouping, grade acceleration, guidance services, honors classes, other services, pullout services, differentiation in the regular classroom, and subject acceleration, and when more than one service model was used, there was no significant effect on the math achievement of English learner students when compared to students without a language learner status.

6. Discussion

As a theoretical frame, intersectionality sharpens the focus on the structural dimensions of GATE experienced by students at intersections of ability and race/ethnicity, language, socioeconomic status, and sex. Crenshaw (1989) defined intersectionality as the ways in which systems of oppression such as racism, sexism, and other forms of discrimination overlap to create a unique synthesized experience of burdens for Black women at the intersection of multiple identities. The number of intersecting identities a person can experience, according to Crenshaw [29], depends on the kind of discrimination, policies, and institutional structures that play a role in excluding some people and not others. The work of Hill-Collins [30] focuses on the overall power dynamics and social organization that allow intersectional oppressions to be born, developed, and thrive.

Access to appropriate GATE programs and advanced coursework is constrained at the intersections of ability and race/ethnicity, language, socioeconomic status, and sex. Experts in the field note that Black students are the most underrepresented racial group in gifted education in the United States and that Black males are even more underrepresented than Black females (Ford and King, 2014). Francis and Darity Jr. [31] add the following:

> *Structural and historical forces, such as racialized tracking, that contribute to an initial condition of fewer black students in advanced courses can create an environment where black students are more likely to be isolated from other members of their racial group, relative to white students (p. 1).*

Patrick et al. [32] reviewed data from the "Civil Rights Data Collection" and the "Common Core of Data". They found that for every 100 Black or Hispanic students in elementary GATE programs in Ohio, 71 Black and 39 Hispanic students, respectively, would need to be added to achieve "fair representation." GATE programs that are not well aligned with students' needs can have unintended negative consequences. The absence of educational opportunities that best match student needs could result in adverse academic outcomes, such as underachievement and dropping out [33,34], and adverse social and emotional outcomes, such as loneliness, isolation, anxiety, and depression [35,36]. Though the issue of access to GATE programs is central for children from minoritized groups, the isolation these students experience in educational environments due to their culture and cultural experiences not being represented in classes, curriculum, and instructional practices indicates a lack of appropriate or effective educational experience. The following is a discussion of findings by identity group.

Poverty level is an important factor in the effect of gifted education. Economically disadvantaged students were 24% of the students in this study. The main effect of being economically disadvantaged was associated with a mean math score of 16.4 points lower for these students than those not economically disadvantaged. This finding was consistent with what scholars describe as an opportunity [37] and academic [38] gap attributed to low income and less access to resources. Galindo and Sonnenschein [38] and Plucker et al. [39] recommended early access to enriched learning environments as a solution for economically disadvantaged students. However, the results indicate that the effects of early entrance to kindergarten were associated with the lowest average mean math achievement of students from low-income families. As students from low-income backgrounds who attend a high-poverty school are even less likely to be identified for gifted programming than students from a low-income background that do not attend a high-poverty school [4], these results could reflect the double disadvantage of being from a low-income family and attending a high-poverty school. Given variations in programming and settings, early entrance to kindergarten does not guarantee students will experience an enriched learning environment. Alternatively, these results could reinforce the importance of enriched learning environments for children during prekindergarten ages and continuing through the elementary grade levels [40]. Plucker et al. [39] also recommended grade acceleration and concurrent enrollment in middle and high schools. In this study, students from low-income families who were provided gifted education through grade and subject acceleration had mean math scores that were not significantly different than students from middle- to high-income families. In Ohio, not every district permits early entrance to kindergarten, and the requirements are that whole-grade screening only must be done twice in a K–12 school career. One of those screenings must happen while a student is in grades K–2 and then once more during grades 3–5 [16]. Educator bias in not recommending economically disadvantaged students [41] and district policies that wait to whole-grade screen in second or later grade levels may cause delays in identification for and access to gifted education. These delays are critical when gifted education's early intervention is needed to offset what Hair et al. [40] and Clark [28] describe as the deleterious effects of poor learning environments.

Service models like enrichment are described in past literature as offering benefits related to developing a talent pool of gifted potential and increasing identification opportunities [42,43]. The effect of self-contained classrooms was associated with a positive difference in the mean math scores of economically disadvantaged students when compared with economically disadvantaged students who did not receive gifted education. The effect of cluster grouping was associated with the highest mean math scores for students from low-income households. The effects of clustering grouping were also positive for referent group gifted identified students, female students, Black and/or Hispanic students, and students with disabilities. These findings mostly supported the findings of Brulles et al. [10] that cluster-grouped gifted students from all cultural backgrounds had more significant achievement gains than students who were not cluster grouped. The positive effect of cluster-grouping challenges old conceptions from Feldhusen and Kolloff [44] and Renzulli [45] that these models lack a theoretical base and are not definitive enough in identity to justify their use. Grouping students by ability may make it easier to provide differentiated instruction. Additionally, clustering students may allow students to be with their peers.

Black and/or Hispanic students were 8.03% of the students in this study. The main effect of being a Black or Hispanic student was associated with a mean math score of 15.23 points lower than that of White students. Being part of the community and representation is important to recruiting, retaining, and instructing Black and/or Hispanic students [1,31]. The effect of cluster grouping was associated with a 7.68-point increase in mean math scores for Black and/or Hispanic students. Given the academic achievement outcomes of this study, this finding supports the finding of Delcourt et al. [46] that students in within-class programs, such as cluster grouping, had higher self-perception of scholastic competence than students in separate-class programs, such as self-contained classrooms. Despite the positive effect of these services models for Black and/or Hispanic students, two additional service models were associated with higher mean math scores for these students.

Of the Black and/or Hispanic students who were provided gifted education, those whose services were provided through innovative services and guidance services had the highest average math achievement. Innovative services were associated with the largest effect, an 18.43-point increase, and guidance services were associated with the second largest effect, an 18.18-point increase in average math achievement for Black and/or Hispanic students. These findings make sense in that Black and/or Hispanic students face stereotype threat [47,48] and are more susceptible to big-fish-little-pond effects [49]. According to research from project M2 (Mentoring Young Mathematicians), a research project focused on incorporating advanced math in kindergarten curriculum, higher math scores in elementary students were observed when acceleration was paired with mentoring [50]. Race was not a variable in this M2 study. Grade acceleration was also among the service models that were not associated with statistically significant differences in math scores for Black and/or Hispanic students. Pairing math intervention with mentoring or guidance is an innovative service. In Table 3, guidance services did not appear to be associated with positive increases in math achievement. However, by including sociocultural factors in the model, the positive effect of this service model was illuminated. The effect of additional service models became visible for students with disabilities.

Students with disabilities represented only 2.75% of the students in this study. The largest gap in mean math achievement was between students with a disability and those who do not have a disability. The main effect of being a student with a disability was associated with a mean math score of 28.66 points lower than that of students who did not have a disability. According to existing research, service models like differentiation, acceleration, and AP, which focus on strength-based talent development, are recommended for twice-exceptional students [51,52]. This study included talent development models such as differentiation and enrichment through pullout services. Both these service models were associated with higher mean math scores for students with a disability compared with the mean math score of students who did not have a disability. Enrichment through pullout was associated with a 14.93-point increase, and differentiation was associated with a 16.22-point increase in mean math scores relative to students who did not have a disability.

The effect of educational options was associated with a large increase in mean math scores for students with disabilities when compared with students who did not have a disability. Students with disabilities who were provided services through educational options had a mean math score that was 24.04 points higher when compared with students who did not have a disability. Educational options as a service model are not specifically mentioned in the literature, but given their statistical and large practical significance in this study, this is an interesting new finding that should be further explored in future research.

Ableism in schools can result in students with disabilities being excluded from gifted services due to the greater focus on services related to their disability and are overlooked for gifted identification and appropriately challenging academic coursework [53–55]. This is supported by the findings in this study that when students with a disability are identified as gifted and provided gifted education, the effect of honors classes and International Baccalaureate programming was associated with higher mean math scores than students who did not have a disability. The effect of International Baccalaureate programming was associated with a 27.95-point increase in average math achievement for students with a disability. Though it is unclear specifically what services are provided through educational options, this service model was also associated with a 24.04-point increase in mean math scores compared with the mean math score of students who do not have a disability.

Cluster grouping and self-contained classrooms were also associated with improvements in the mean math scores of students with disabilities. The difference in scores for students with disabilities who were provided services through grouping models was practically and statistically significant compared with students without disabilities. In the research literature, gifted self-contained classrooms often assume that gifted children generally have the same needs and provide full-time programming for these needs [56]. Given the fact that students with a disability have needs that vary based on both their area of giftedness and type of disability, gifted self-contained classrooms may provide more benefit than no gifted services, because these models address the strengths of these students but do not provide as much benefit as educational options, honors classes, and enrichment through pullout services because learning challenges are not addressed well enough.

In this study, among the students with a disability identified as gifted, only 8.03% were Black and/or Hispanic, and of those, only 5.13% were provided gifted education. In comparison, 14.21% of gifted students with a disability who were White received gifted education. The current literature informs readers that Black and/or Hispanic students are not only less likely to be identified as gifted but are often educated in places of "disciplinary exclusion" and "academic exclusion" [55,57,58]. Black and/or Hispanic gifted students with a disability cannot access enrichment, honors classes, and other forms of gifted education from places Annamma [57] describes as special education rooms, credit recovery, GED classes, and spaces of incarceration. This important finding should be more deeply explored in future research. Whereas students were very underrepresented by race and disability status, the balance shifted with sex.

Just under 42% of the students in this study's sample were coded as female. The main effect of a student being female was associated with a 3.79-point decrease in mean math score and was not practically significant. The lack of practical difference in math scores between female and male students is not surprising, given the literature that indicates no difference in the math abilities in female and male learners [59]. Additionally, in this study, female students are almost as represented in gifted math programming as male students, but at the elementary level, participation may be less reflective of self-selected courses than in middle or high school.

Service types recommended for use with female students, and included in this study, were counseling or mentoring (guidance), enrichment, and authentic learning experiences (educational options, innovative services, or "other" services). The effect of the post-secondary enrollment option was the only service model that was associated with a large increase in average math achievement for female students. It is not clear why post-secondary enrollment options had this effect. Considering the optimal match compromise described by Robinson and Robinson [60] for these students, it is possible that being matched with peers of similar intellectual maturity and achievement in college courses is more important than matching based on age and average intelligence. Innovative services and cluster grouping were also associated with positive changes in the mean math scores of female students, but the effect was smaller than in post-secondary enrollment options. Unlike all other cultural identity groups, self-contained classrooms were not associated with a significant change in mean math scores.

Overall, the results for sex as a variable might be explained by the existing literature that advances the understanding of gender as a nonbinary social construct. The lack of practically significant difference for most service models could be attributed to the murky pool of literature attempting to categorize gender definitively, when this construct seems to vary by individual and by a perception of what is typical [61]. Even findings that suggest a difference in math scores, such as the increase associated with post-secondary enrollment options, have to be viewed with skepticism, as the student's ability to "do gender" or how closely their feelings of masculinity and femininity match their biological sex could also be an influence [62,63]. The fact that males are highly represented in physics, engineering, and architecture [28] is still true, as is the fact that females are less likely to pursue STEM subjects [64].

The main effect of being a student learning English is associated with a mean math score of 6.82 points lower than the mean math score of students who were not English learners (EL). The gap in mean math achievement between students who are ELs and those who are not ELs is relatively small. However, EL students were the most underrepresented cultural group in this study. Less than 1% of the students were EL students. This observation is not surprising, given EL students are underrepresented in gifted education and are less likely to be recognized for their academic strengths [65,66].

The past literature indicates that Hispanic EL students who are not native to the United States are often strong in math [67]. The specific ethnicities of the EL students in this study are unknown. Still, when identified as gifted and provided gifted education in self-contained classrooms, the effect was associated with a 15.79-point increase in mean math scores. The only other service model associated with both a statistical and large practical significant difference in the mean math score of EL students, when compared with students who are not ELs, is educational options. The large difference of -83.32 in mean math scores compared with students who are not English learners is noteworthy. It is difficult to make meaning of this finding without a clear description of what those educational options included. If these services were based on a differentiated learning experience that combined language acquisition with instruction that was tailored to the student's math skills [68], the expected outcome would be a higher mean math score. However, if the intervention followed a deficit thinking model and focused mostly on language acquisition, as is often the case [65,66], then these results are unexpected. Given the low representation of EL students in this study, the findings for this group of students should be considered with caution.

7. Conclusions

Cultural identity moderates service model effectiveness. This study is significant because the findings demonstrate a need for culturally responsive intersectional research approaches, service provision, and program evaluation. These findings could improve opportunities for underrepresented and underserved students to access their best match for support and services. This study reaffirms that the typical student identified as gifted in the United States is White, from a middle- to high-income family, does not have a disability, and is not an English language learner. However, in this study, there was an equitable balance between the sexes. Research in gifted education that does not explicitly include sociocultural factors may have findings that reproduce biases toward majority cultural group gifted-identified students. Given the variation of effects of service models in this study, the needs of students between cultural identity groups are not necessarily the same. There are no one-size-fits-all solutions to programming, not even within cultural groups. Best-match programming considers and addresses each students intersecting identities.

Researchers and educators who engage in intersectional research and evaluation bolster their abilities to promote equity in education for students in their spheres of influence.

8. Limitations

This study provided a detailed analysis of the effects of service models as associated with the differences in math achievement for gifted-identified elementary students in Ohio. Like any study, there were limitations. In general, more research is needed to fill the gaps in the literature. This research clearly indicates that there are between-group differences. Also important to recognize is that students from a shared cultural group do not have monolithic experiences. Gifted education services that work for some students in a cultural group may not work for all students in the same cultural group.

Much detail is unknown about the application of some service models. For example, English learner students who were provided services through educational options had mean math scores that were 78 points lower than students who were not English learners. Conversely, educational options were associated with increased mean math scores for students with disabilities. Table 1, based on the Ohio Department of Education's descriptions of service models, lists potential educational options; however, it is not clear which of these approaches were taken with students in the district(s) that reported using this service method.

Additionally, there are many teaching styles, forms of curriculum, and service model types, and any combination of these factors could produce different results. Data related to the type of curriculum each district or school used were not included in this research and is an important consideration. For example, differentiation involving content modification might produce different results than differentiation involving process, product, or learning environment modification. Multilevel modeling was used to account for the data being nested; however, the classroom was not included as a specific level. Therefore, differences associated with teacher-level variables were not controlled for. Type of instruction is a different piece of the puzzle that if asked, answered, and combined with this research could move understanding even closer to identifying culturally responsive practices for minoritized and underserved gifted students of color. Each part of the puzzle is important, and no one study will provide all the answers; this study is just one piece. Future studies can help address some of these limitations.

Funding: This research received no external funding.

Institutional Review Board Statement: The study was approved by the Institutional Review Board of Cleveland State University (IRB-FY2020-139) and 1 April 2020.

Informed Consent Statement: Not applicable.

Data Availability Statement: Restrictions apply to the availability of these data. Data were obtained from the Ohio Department of Education and may be requested directly from that state education agency.

Conflicts of Interest: The author declares no conflict of interest.

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Article

Underrepresented Students in Gifted and Talented Education: Using Positive Psychology to Identify and Serve

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Abstract: The representation gap in gifted and talented education poses a persistent challenge in educational systems worldwide. This theoretical manuscript presents the Bull's Eye Model for Affective Development—Expansion (BEM-e) an innovative framework designed to address this gap. By incorporating elements from positive psychology, the BEM-e aims to identify and nurture traditionally underrepresented students who possess camouflaged gifted and talented abilities. Drawing upon the Engagement, Perseverance, Optimism, Connectedness, and Happiness model (EPOCH), along with measures of hope and metacognition, BEM-e provides a comprehensive approach to talent identification and service. The model emphasizes the holistic development of individuals by considering affective factors, engagement, perseverance, optimism, connectedness, happiness, hope, and metacognition. Additionally, dynamic assessment is integrated during the implementation of BEM-e modules, allowing for personalized and adaptive identification processes.

Keywords: positive psychology; giftedness; talent; identification; underrepresentation; talent development; differentiation; social–emotional; Bull's Eye Model for Affective Development (BEM)

Citation: Arnstein, K.B.; Desmet, O.A.; Seward, K.; Traynor, A.; Olenchak, F.R. Underrepresented Students in Gifted and Talented Education: Using Positive Psychology to Identify and Serve. *Educ. Sci.* **2023**, *13*, 955. https://doi.org/10.3390/educsci13090955

Academic Editors: Kirsi Tirri and Valerie Margrain

Received: 7 August 2023
Revised: 24 August 2023
Accepted: 25 August 2023
Published: 19 September 2023

1. Introduction

The need for alternative approaches to identify diverse students for gifted education services has been well documented for many years [1–6]. Despite various solutions and implementation efforts to ameliorate the underrepresentation of racially, ethnically, and economically diverse students, including those from rural locales (e.g., teacher nominations, universal screening, and local norms), the underrepresentation of these groups persists [7–10]. Peters [11], for example, estimates that students with disabilities are underrepresented by 75%. Often, identification practices that rely heavily on norm-referenced, intellectual, or academic measures in universal screening and the (mis)application of local norms fail to identify students' multifaceted strengths, interests, and latent or emerging potentials, especially in those from underrepresented groups [6,12]. Gifted education's historical focus on cognition for identification has left relevant affective skills understudied, contributing to the representation gap in gifted education.

In this paper, we propose adopting a positive psychology approach to identifying and serving gifted and talented students to reduce the representation gap, the Bull's Eye Model for Affective Development—Expansion (BEM-e). As such, we propose to shift the focus of identification and services toward affective (e.g., well-being, perseverance, and hope) and metacognitive strengths promoted through content area curricula. These identification and service efforts are rooted in the emerging, evidence-based literature supporting the social, emotional, and psychological components of giftedness among those from minoritized groups, including those with disabilities and those from economically challenged environments (hereinafter referred to collectively as underrepresented students [13–17]). The BEM-e proposes that teachers integrate positive psychology tasks into academic content and observe students' behaviors and interactions to identify students' interests, motivations, and affective strengths as equally important and co-occurring with students' intellectual abilities. Because our approach is integrated with instruction and assessment available to all students, teachers may observe psychosocial and emotional strengths in students they would not ordinarily identify as having high ability. This powerful curricular integration provides fertile ground for addressing gifted education's persistent underrepresentation problem, thereby promoting equitable access for all students.

Although a significant portion of the literature is focused on IQ, it is important to note that the focus of the BEM-e is to identify students with high potential, not necessarily high IQ. We aim to look for more than cognitive ability, not replace it, as we move beyond intelligence and examine the success variables that lie in emotionality. Measuring talent must extend beyond test scores.

As Seligman and Csikszentmihalyi [18] noted, "treatment is not just fixing what is broken; it is nurturing what is best" (p. 7). Education and psychology should work to remind us of what really matters in life to feel successful. Positive psychology is about happiness and well-being, and when directed toward the future, equates to optimism, hope, and confidence [19]. Lyubomirsky et al. (2005) asserted that happiness is linked to successful outcomes because positive affect engenders success [20]. "Positively valenced moods and emotions lead people to think, feel, and act in ways that promote both resource building and involvement with approach goals" [21,22].

2. Challenges in Identifying and Supporting Students with Gifts and Talents

The identification of gifted and talented students has been fraught with issues of fairness, equity, and elitism for over a century. From the early 1900s to the present day, the works of Hollingworth [23] and Terman [24–26] greatly influenced the identification of gifted and talented students. The current instruments that focus solely on the cognitive domain [27] continue to vex educators and researchers with numerous challenges in accurately identifying exceptional students. First, underrepresented students are excluded from identification as cultural and language barriers, disability, and low socioeconomic conditions are not given careful consideration in the current identification processes. Some primary difficulties encountered in the identification process include the predominant emphasis on the nonaffective domain, cultural and language biases, instrument bias, static assessment schedules, and the need for recognition of asynchrony and the conative domain.

2.1. Solely Focusing on the Cognitive Domain

The identification of gifted and talented students has been primarily centered on cognitive assessments, language-based or verbal tests, and timed assessments. Although these methods may effectively measure certain aspects of intelligence and academic ability, they neglect the affective domain. Consider that any 5- or 6-year-old student with high intellectual ability may not be identified due to limited opportunities to learn prior to kindergarten or that an older student may not be identified due to chronic underachievement. A significant challenge arises when students who possess exceptional gifts and talents in nonacademic areas, such as the arts or athletics, are overlooked due to the limited focus on cognitive abilities alone. Additionally, the exclusion of twice-exceptional (2E) students—those who have both giftedness and a learning or developmental disability—further hampers equitable identification.

2.2. Cultural, Language, and Disability Bias

Another critical challenge in identifying gifted and talented students stems from cultural and language biases present in assessment tools and/or the individuals who make identification decisions themselves. Giftedness is exhibited across all culturally, linguistically, and economically diverse backgrounds, yet these students' underrepresentation in gifted and talented programs remains well documented [28–30]. Students from diverse cultural backgrounds often face obstacles in having their unique strengths and abilities recognized [31]. Referrals for gifted programs can be influenced by biases that fail to appreciate these students' affective characteristics and multicultural strengths. Even when Black students have the same test scores and grades as White students, teachers underestimate and hold suspicions about them, resulting in fewer referrals [32]. It is essential for educators to recognize and address these biases to ensure equitable identification practices. Students identified with a learning disability are often overlooked for gifted and talented assessment and services because few teachers have been prepared to work with students with twice exceptionality [33,34]. Students who are English learners [35,36] or economically disadvantaged [37] are often excluded during the identification process, often because teachers adopt a deficit perspective related to these students' potentials.

2.3. Instrument Bias and Static Assessment Schedule

The presence of instrument bias poses yet another hurdle in accurately identifying gifted and talented students. English learners are particularly susceptible to bias in assessments due to cultural, language, and contextual factors. As Sattler (1992) noted,

> . . .probably no test can be created that will entirely eliminate the influence of learning and cultural experiences. The test content and materials, the language in which the questions are phrased, the test directions, the categories for classifying responses, the scoring criteria, and the validity criteria are all culture-bound [38].

Standardized tests do not adequately capture the full extent of an English learner's abilities, resulting in their underrepresentation in gifted programs [36]. The United States continues to struggle with identifying gifted students given the diverse makeup of its student body. Gonthier et al. [39] as well as Gonthier and Gregoire [40] suggest we consider that differential item functioning hides the fact that student ability is increasing over time and that cultural bias in the WAIS subtests masks giftedness [39,40]. Inequity due to sampling shortcomings has been established among the 10 most frequently used tests in the United States [41]. There exists a representation problem [7], yet utilizing a dynamic assessment process focused on affective, cultural, and linguistic diversity can promote fair and accurate identification [42].

2.4. Asynchronous Development and the Conative Domain

The primary characteristic of giftedness is asynchrony in the cognitive, social, emotional, and physical development of individuals [43,44]. This asynchrony, or mismatch between a student's cognitive development and their other developmental trajectories, is a critical factor often overlooked in the identification of gifted and talented students [45–51]. Students with exceptional cognitive abilities may struggle with emotional regulation or social skills, leading to their giftedness being overshadowed by challenges in other areas. Educators often do not have the professional training to recognize the characteristics of the gifted and talented student, leading to referrals of mostly high-achieving students who meet their conceptions of giftedness [28]. Moreover, factors such as disability, racial/cultural diversity, and family income can intersect and impact a student's ability to self-regulate. Many cognitive tasks, as assessed for gifted services, are dependent upon the brain's ability to govern emotions [52,53]. Recognizing and addressing the conative domain [17], which encompasses an individual's motivations, interests, and personal strengths, can provide a more comprehensive understanding of giftedness and talent, including how to equitably identify and appropriately serve these students.

The identification of gifted and talented students is a complex and multifaceted process that requires the careful consideration of various factors. The challenges discussed in this section, including the overemphasis on the cognitive domain, cultural and language biases, instrument and educator bias, and the lack of recognition of asynchrony and the conative domain, have a significant impact on the accuracy and equity of identification practices. Educators, researchers, and policymakers must collaborate to develop more inclusive and comprehensive strategies for identifying and nurturing the gifts and talents of all students, regardless of cultural, linguistic, or economic diversity. The challenges discussed in this section are due to the primary focus on the cognitive domain for identification.

2.5. Opportunities to Identify and Support Students with Gifts and Talents

The literature that supports the critical value of noncognitive assessment for underrepresented students is growing. Studies focused on the need for assessment in the affective domain demonstrate that (1) many cognitive tasks are, in fact, rooted in segments of the brain governing emotions [52,53], and (2) students who struggle to overcome the barriers to gifted and talented identification from concomitant disabilities, racial and cultural diversity, and/or socioeconomic disadvantages can be identified via alternative means in the affective domain [15,54,55]. This growing affective and neuropsychological evidence supporting the need for alternative identification strategies that focuses on students' interests, motivation, and social and emotional strengths to identify and serve students through gifted programming has inspired our proposal to stress the importance of identifying relevant affective characteristics along with cognitive strengths more equitably and fairly.

Identification that is not restricted to cognitive assessments has focused on nonverbal and behavioral rating scales reflective of the affective domain, but attention to the conative domain, the will of an individual to purposefully act, is virtually nonexistent in any current assessment procedures for gifted education identification [17,56]. Conation is "the manner in which an individual with goal orientation or motivation sets about acting on that motivation in pursuit of achieving goals" [17] and "without conation, cognition cannot come to fruition" [57]. Other researchers, such as Renzulli, Reis, and Subonik, have focused the conative aspects in their work on motivation [56,58,59] leaving out relevant strengths that may play a pivotal role in successful talent development. Sternberg and his theory of successful intelligence hint at practical intelligence that involves some aspects of conation beyond motivation [60].

Therefore, we present the Expanded Bull's Eye Model for Affective Development (BEM-e), an innovative approach to identifying and serving gifted and talented students. The BEM-e uses positive psychology measures coupled with positive psychology approaches to identify students' affective, conative, and metacognitive strengths that often support high academic achievement.

3. The Bull's Eye Model for Affective Development and Its Expansion

3.1. The Original Bull's Eye Model for Affective Development (BEM)

The original BEM is a research-based theoretical perspective on the affective development of students with gifts, creativity, and talents [61,62]. It was originally intended as a lens for understanding affective development among gifted and talented people. Over time, however, the BEM became a mechanism for addressing talent development throughout the lifespan for individuals who present with a variety of disabilities yet also possess camouflaged gifted and talented abilities [62]. Termed twice exceptional (2E) in the literature, this population is more accurately referred to as multiply exceptional to reflect the fact that many 2E persons grapple with an array of challenges that encompass more than one disability and occasional psychosocial or other challenges related to underrepresentation [13].

3.2. The Bull's Eye Model for Affective Development—Expansion (BEM-e)

We propose an expanded BEM (BEM-e), extending the original conceptualization of affective development to the identification of gifted students using positive psychology traits [63,64]. These traits include engagement, perseverance, optimism, connectedness, happiness, hope, and its subconstruct of agency through dynamic assessment [65,66]. The BEM-e frames identification for gifted services through explicit connections to affective studies in positive psychology, metacognition, and dynamic assessment. To support underrepresented students, identification is based on affective traits as opposed to the cognitive traits typically used for identification.

Figure 1 depicts the BEM-e and its four basic parts. [1]***Natural Affect*****:** personality, native social proclivity, natural emotional attributes, innate abilities for handling affective information, genetic predispositions, modifiers imposed by giftedness. [2]***World Contexts*****:** home and family influences, peer pressures, school and work expectations and mores, affective norms of society, views of others about giftedness, "big world" circumstances. [3]***Meta-Affect*****:** affective self-examination, social and emotional regulation, impact of giftedness, adjusting natural affect with world contexts for self-adjustment and coping. [4]***Personal Niche*****:** affective integration (innate with both world contexts and with meta-affects) to find ways for one's social and emotional sense to flourish.

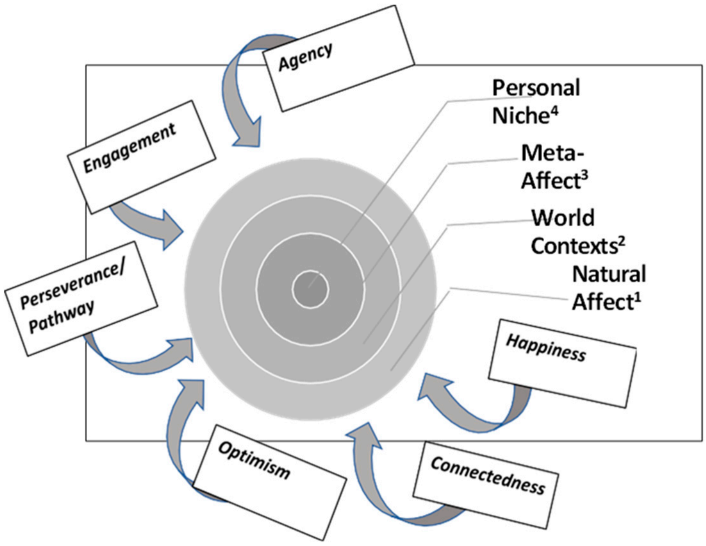

Figure 1. Expanded Bull's Eye Model for Affective Development (BEM-e).

Four of the inputs are based on Kern et al. [64] from their work on Engagement, Perseverance, Optimism, Connectedness, and Happiness (EPOCH), while the ***Agency*** input is based on work from Snyder [67] and Snyder et al. [68] in the development of the Children's Hope Scale (CHS). The ***Perseverance/Pathway*** input is integral in the works of both Kern et al. [64] and Snyder et al. [68]. ***Agency*****:** regulating one's own behavior, resisting social pressure, and following one's convictions, even if they conflict with the majority [69,70]. ***Engagement*****:** engaging in a process of interacting with others in various contexts while developing one's own potential, including being open to new experiences and willingness to improve over time [71,72]. ***Perseverance/Pathway*****:** setting objectives and goals and making decisions that provide meaning and guidance to one's life [73,74]. ***Optimism*****:** holding a positive outlook for present and future outcomes while managing the context into which activities are placed [75,76]. ***Connectedness*****:** establishing close, trusting, and meaningful bonds with at least one other person, as well as showing concern for the well-being of others and the expression of empathy, affection, and intimacy [77,78]. ***Happiness*****:** holding positive attitudes and feelings of satisfaction and acceptance of oneself, others, and life in general, including both good and bad qualities [79,80].

The BEM-e, targeting developmental psychosocial attributes, allows for the assessment of preexisting affective characteristics as well as the unmasking of affective strengths that can frequently be camouflaged by comorbid disabilities [81–84], racial and cultural diversity [62], and socioeconomic disadvantages. These affective characteristics are well documented in the positive psychological literature as noted in Figure 1, and they are assessed in both EPOCH and CHS. Hence, our project will function as a positive psychology approach to identification.

The BEM-e includes developmental features that are both fixed and fluid. For example, within the original BEM [61], the construct of *Natural Affect* embraces psychosocial proclivities with which one is born, while *Meta-Affect* encompasses one's ever-growing and ever-adjusting tendencies and skills for feeling about one's own feelings (e.g., affective self-examination akin to metacognition or cognitive self-examination). The BEM rings, which are flexible depending on time, events, and life changes, among other variables through the lifespan, encompass all constructs except *Natural Affect*.

The inputs from Kern et al. [64] are variable and provide a contextual and temporal frame for the Bull's Eye rings. Each of the inputs is dependent on events in an individual's life at any moment in time and serves to shape the Bull's Eye rings, again, with the exception of *Natural Affect*. Although Figure 1 appears to have static boundaries, the rings are fluid and, therefore, do not have static, well-defined boundaries. The inputs are factors aligned with the EPOCH model and measure the adolescent application of Seligman's [84] Positive Emotion, Engagement, Relationships, Meaning, and Accomplishment (PERMA) model described in *Flourish*, a book that established a grounded, intervention-oriented foundation for positive psychology.

4. Empirical Foundation

The BEM-e builds on promising evidence from four major lines of research: evidence in favor of (1) Dynamic Assessment (DA), (2) metacognitive skill development, (3) affective support and psychosocial coaching, and (4) positive psychology as an alternative to identify students with gifted and talented abilities.

4.1. Dynamic Assessment

Dynamic assessment for gifted and talented education was first introduced in the early 1990s and 2000s [85–89]. Back then, DA was used to improve the equitable identification of culturally and linguistically diverse students [85,87,88]. Researchers found that DA successfully identified students with gifts and talents who were not identified via traditional static tests. Researchers have recommended DA for culturally and linguistically diverse students because gifted and talented identification procedures should consider the necessity of academic support for students from culturally and linguistically diverse populations [89]. Traditional cognitive-ability and achievement tests rely on previous educational experiences and, therefore, discriminate against those with limited access to educational experiences [90–92]. Similarly, students with disabilities are at a disadvantage while taking traditional static tests, which often do not accommodate special needs. A common alternative within gifted and talented identification procedures for traditional cognitive assessments is educator nominations, but those also may be biased against 2E and ME students. Research shows that general education teachers and special education teachers are less likely to refer students with disabilities than students without disabilities for gifted and talented programs [93]. The gifted education field has long promoted a strength-based approach to talent development for all students. Nevertheless, students from traditionally underrepresented populations, including 2E and ME, continue to be underrepresented [94]. We argue that this strength-based approach should be extended to *identification* procedures. DA approaches focus on students' strengths first by supporting students in known areas of challenge while assessing their gifts and talents. Dynamic assessment (DA) may allow for the more accurate assessments of gifts and talents. Research on DA for the identification of 2E and ME students is limited, but researchers recently piloted a dynamic assessment of mathematical ability with a sample of 30 students and found DA to be an effective approach to assessing unidentified mathematics potential among 2E students [42].

4.2. Metacognitive Skill Development (Self-Efficacy and Self-Perception)

Metacognition is the process for knowing about what we know. This process involves the monitoring of learning processes where the person has knowledge of and control over ones' cognitive skills [95]. Metacognition "affects the acquisition, comprehension, retention, and application of what is learned, in addition to affecting learning efficiency, critical thinking, and problem solving" [96]. Control and self-regulation over thinking and learning processes and products are directly influenced by metacognitive skills. The BEM-e is focused on self-efficacy and self-perception as active components in the development of metacognitive skills.

Academic self-concept or self-perception has been widely acknowledged as an important factor in talent development [97]. Positive academic self-perceptions play a crucial role in achieving academic success [98]. Research indicates a significant positive correlation between positive academic self-perceptions and academic achievement (r = 0.72, $p < 0.001$) [99]. Furthermore, fostering positive academic self-perceptions enhances students' ambitions for future academic accomplishments, which, in turn, can bolster the perseverance required to attain favorable outcomes [100]. This is particularly noteworthy in the context of gifted individuals, as enhancing their academic self-perception becomes paramount to sustaining long-term achievement and sustaining motivation [101]. In the context of underserved populations, interventions targeting self-efficacy, self-perception, and related constructs assume special significance. Such mediations can prove highly effective in bolstering academic outcomes and fostering aspirations, addressing the unique challenges faced by these groups.

Identity and self-perception can form barriers to achievement for Black gifted students [102] and ME youth [101]. Researchers have argued that this should be acknowledged in recruitment and retention strategies for underserved students to be successful in gifted education [98,99]. Desmet developed a positive psychology intervention involving an affective, small-group, discussion-based curriculum targeting positive self-perceptions, goal valuation, mastery goal orientation, self-regulation, and metacognitive skills—the Achievement Motivation Enhancement (AME) curriculum. Students found the focus on psychosocial skills around achievement motivation helpful and reported that they benefitted from sharing their experiences with peers [97]. The AME curriculum successfully improved students' self-perceptions (d = 0.46), motivation (d = 0.44), and goal valuation (d = 0.16; [100]).

Additionally, Olenchak [103] studied a positive psychology intervention centered on metacognitive thinking and communication with 57 ME students and found significant improvements in self-concept (d = 0.38) for 74% of the students. These studies established an evidence base for affective intercessions targeting positive self-perceptions.

4.3. Affective Support and Psychosocial Coaching

In 2011, Subotnik and colleagues published their thoughts on how to move the field of gifted education forward. In doing so, they highlighted the importance of psychosocial coaching for successful talent development, emphasizing the need to move away from the long-standing paradigm of cognitive development as the central and sole tenet of gifted education. Given the long-standing issues of inequity in gifted and talented education, adopting an affective perspective on gifted education alongside a traditional cognitive one has become increasingly important to promote talent development for all students, including those from traditionally underrepresented populations [56,104]. Creating and evaluating positive psychology identification and service procedures is an innovative and evidence-based approach to emphasizing psychosocial coaching for talent development while improving fair selection.

In general, affective alternative intercessions have been proven effective in promoting both affective and cognitive outcomes for students with ME [46,103,105–108]. For example, research indicates that counseling programs for students with ME resulted in improved social skills and self-efficacy [103,109], hope and confidence [108], career planning [103], and recognition of personal strengths and limitations while identifying appropriate coping strategies [110,111]. Also, counseling intervention can be effective at reducing negative school experiences for students with ME [106,112].

4.4. Positive Psychology Identification

Historically, gifted education has mainly emphasized cognitive development [113–115]. However, many researchers have emphasized the importance of affective and conative skills in talent development as well [56,104,116–120]. Nevertheless, limited research exists on affective identification with gifted and talented students. In a systematic review of the literature, Jen [121] identified only 17 empirical studies published between 1984–2015 on this topic. There is a clear need to extend efforts to develop effective, evidence-based affective intercessions for gifted and talented students. Although, to our knowledge, no other positive psychology identification procedures such as the one we propose have been implemented with gifted and talented students, we build on existing research about similar interventions to support our hypothesis that our positive psychology identification methods targeting hope, self-efficacy and self-perception, goal valuation, mindfulness, gratitude, and metacognition can be successful.

4.4.1. Hope

Hope is an important positive predictor of a multitude of cognitive and affective outcomes related to talent development [15]. Yet, within the gifted education field, hope has received little attention thus far, with Dixson's work being a notable exception [14,15]. Dixson et al. [14] found that hope was positively correlated with GPA ($r = 0.24$), self-esteem ($r = 0.52$), and academic self-concept ($r = 0.44$). Further, Dixson and his colleagues [15] found that hope interventions may reduce the effects of socioeconomic status on achievement. Dixson and Stevens [16] found that hope, after controlling for demographics and previous achievement, explained 17% to 30% of African American students' achievement orientation, underscoring the importance of promoting hope in talent development programs for underserved students. Additionally, research shows that neurodiverse students report significantly lower hope ($M = 24.8$, $SD = 5.6$) than their neurotypical peers ($M = 27.3$, $SD = 4.9$), with autistic youth at the highest risk of having low hope [122]. Greater hope among neurodiverse youth is associated with a higher quality of life ($\eta^2 p = 0.24$) and fewer internalizing symptoms ($\eta^2 p = 0.07$), such as anxiety and depression [122]. The research underscores the importance of hope interventions for neurodiverse youth. To our knowledge, no hope interventions have targeted gifted neurodiverse or ME students. The BEM-e procedures involve an explicit focus on hope as one of several positive psychology traits of interest. Therefore, a clear need for our proposed project exists.

4.4.2. Goal Valuation

Goal valuation also plays an essential role in talent development. Goal valuation or task value refers to the extent to which a person finds the task at hand worthwhile [123]. Both the expectancy–value theory of motivation [123] and the achievement orientation model [124] theorize that students are motivated by goal valuation or task value. Despite little evidence in support of goal valuation intercessions with ME students specifically, there is a well-established evidence base for these interventions to address underachievement and achievement motivation. Rubenstein et al. [125] found that students who participated in a goal-valuation intercession showed great academic growth (i.e., 1.5 point increase in GPA). As reported above, Desmet et al. [100] also found that participation in a discussion-based positive psychology intercession (AME) resulted in improved goal valuation. Goal-valuation interventions have been well established as effective ways to promote STEM talent development among women and people of color. For example, Miyake et al. [126] evaluated a value-affirmation intervention with women in physics courses and found that, on average, participants improved their course achievement by a full letter grade. Harackiewicz et al. [127] also found that a utility–value intervention reduced the achievement gap for underrepresented students by 61%. There is strong evidence that goal valuation interventions are effective and promote talent development among traditionally underrepresented student populations.

4.4.3. Mindfulness

This is a relatively new concept in Western research that has rarely been studied in children and, to our knowledge, not at all in gifted education. Bakosh et al. [128] conducted a quasi-experiment to demonstrate the effectiveness of a 10 min per day mindfulness exercise with 191 elementary school students. They found that the mindfulness exercise significantly enhanced students' grades in reading ($b = 0.15$) and science ($b = 0.22$). Thus, there is some evidence that mindfulness exercises may be effective for academic talent development.

4.4.4. Gratitude

Researchers have argued that gratitude is foundational for human development [129]. It can motivate self-improvement and enables people to navigate their social environments more effectively to achieve personal goals [129]. High levels of gratitude allow people to better cope with stress [130] and demonstrate resilience when faced with adversity [131]. Gratitude is an important positive psychological trait that may be leveraged for talent development. Research on gratitude exercises with children is limited. Froh et al. [132] were among the first to conduct a quasi-experimental evaluation of a gratitude exercise with adolescents. They found that practices centered around counting blessings effectively increased gratitude, optimism, and life satisfaction while decreasing negative affect. Later, Froh et al. [133] found that gratitude exercises were particularly effective for students with a low positive affect (e.g., happy, cheerful, proud, energetic).

5. Conclusions

In conclusion, our proposed theoretical model, the BEM-e (Bull's Eye Model for Affective Development—Expansion), represents an innovative approach to addressing the representation gap in gifted and talented education. By building upon the foundational elements of positive psychology, we expanded the original BEM framework to promote the identification and development of traditionally underrepresented students who may possess hidden gifted and talented abilities.

Through BEM-e, we strive to bridge the representation gap by providing educators and professionals with a more inclusive tool to identify and support gifted and talented individuals from diverse backgrounds. By considering the emotional well-being, social connections, cognitive processes, and personal strengths of underrepresented students, BEM-e offers a more nuanced and comprehensive perspective on talent identification and development.

While this manuscript presents a theoretical model, future research and pilot studies are being conducted to evaluate the practical implementation and effectiveness of BEM-e. This will help refine the model, identify potential challenges, and validate its ability to address the representation gap in gifted and talented education. Overall, BEM-e holds promise for transforming the field by fostering a more inclusive and equitable approach to talent identification and development by embracing the principles of positive psychology.

Author Contributions: Conceptualization, F.R.O.; methodology, A.T.; writing—original draft preparation, F.R.O., O.A.D., K.S. & A.T.; writing—review and editing, K.B.A., O.A.D. & F.R.O.; project administration, F.R.O. & K.B.A.; funding acquisition, F.R.O., O.A.D., K.S. & A.T. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the U.S. Department of Education, Office of Elementary and Secondary Education (OESE): Jacob K. Javits Gifted and Talented Students Education (Javits) Program, grant number S206A220038.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Institutional Review Board of Purdue University—West Lafayette (protocol code IRB-2022-1154, 9 April 2023) for studies involving human participants.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

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education sciences

Article

Non-Native Gifted Students in a Finnish Teacher Training School: A Case Study

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Abstract: It is a global challenge to meet the needs of non-native gifted students in the classroom. This case study investigates how Finland, a country with a high-achieving school system and a growing multicultural student population, serves its non-native gifted students. In interviews at a Finnish teacher training school, non-native gifted students and their parents and teachers described their school experiences. The interviews were analyzed for patterns in two categories: instructional strategies and curriculum design. The findings highlight the fact that Finland's education system is based on egalitarian approaches to learning in inclusive educational settings. The results show that teachers are differentiating for their gifted students and parents and students recognize this.

Keywords: gifted education; diverse student; non-native; differentiation; Finnish education system; teacher training school; a case study

Citation: Stargardter, J.; Laine, S.; Tirri, K. Non-Native Gifted Students in a Finnish Teacher Training School: A Case Study. *Educ. Sci.* **2023**, *13*, 659. https://doi.org/10.3390/educsci13070659

Academic Editor: Jacobus G. Maree

Received: 7 June 2023
Revised: 23 June 2023
Accepted: 25 June 2023
Published: 28 June 2023

1. Introduction

This case study aims to ascertain the experiences of non-native gifted students in a Finnish teacher training school through the practices of teachers (n= 4) and the experiences of students (n = 5) and their parents (n = 4).

A popular and important topic of research in the gifted education sphere is how to serve diverse gifted students [1,2]. For decades, gifted education researchers have recognized and understood the inequalities within gifted education [1,3,4]. Despite the depth and breadth of this research, little has changed regarding equitable services for diverse gifted students [4,5]. Culturally diverse students are still less likely to be seen as gifted, presented with challenging instructional materials, placed in advanced-level classes, or included in enrichment or accelerated programs [4].

Gifted education varies from country to country [6]. In the United States of America, for instance, most school districts formally identify students as gifted [4]. These students are most often white, Asian, and/or wealthy, making students of color and students from lower socio-economic backgrounds under-identified and under-served by gifted programs [4]. A recent study on gifted Syrian refugees in Jordan found immigrants to be under-identified, and therefore, underserved by the education system [7]. In England, they shut down "elitist" and "inequitable" gifted programs in favor of differentiated instruction for all by classroom teachers [6]. In Finland, the focus on equality leads to a lack of formal mention of gifted students with more emphasis on meeting individual learning needs in the classroom [8]. According to Dai and Chen: "It is inevitable that different values and priorities influence the ways we conceptualize giftedness and define the mission of gifted education" [9].

All over the world, gifted students from diverse backgrounds, particularly those from culturally, linguistically, and economically diverse backgrounds, are underserved and overlooked [7,10,11]. According to Davis and Moore, "Although many of these children possess tremendous talents that are of value to their nations, gifted children of color, especially those from economically disadvantaged communities, tend to be the most underrepresented in gifted and advanced programs worldwide" [10] (p. xv). International research evidence shows that schools around the world are not meeting the needs of diverse gifted students.

In an increasingly connected and globalized world, we must prepare our gifted learners to use their talents to "improve human conditions" [12] (p. 156). Dr. Renzulli states that the intended outcome of this goal is "to increase the reservoir of people who will use their talents to create a better world" [12] (p. 156). Often, systems and structures that serve gifted students do not adequately serve students from culturally, linguistically, and economically diverse (CLED) backgrounds [11]. Finnish gifted education researcher, Dr. Kirsi Tirri, explained that gifted students have a right to educational opportunities that meet their needs and advance their future: "This is especially critical for gifted students who face disability, poverty, low socioeconomics, poorly educated parents, and/or live in non-native speaking homes" [8]. It is a global challenge to meet the needs of different learners in a variety of subjects [13].

The terms to describe gifted students vary all over the world. Words may include highly able, talented, high ability, high potential, and gifted and talented. There is also a wide range of definitions of giftedness [9,14]. This study will use the term gifted to describe students with specific cognitive, creative, psychosocial, and psychomotor abilities (see Appendix A). This definition comes from the National Association for Gifted Children's guidebook on Traits of Giftedness.

When discussing non-native gifted students, this study refers to students who are not part of the dominant Finnish culture. The students may also be from linguistically and economically diverse backgrounds. They qualified for this study by not being native to Finland. This means that either they or their parents immigrated to Finland from another country.

1.1. Theoretical Framework

Ford provides a theoretical framework on how to develop the potential of diverse gifted learners [15]. Ford explains three aspects that fuel the continued lack of services for culturally diverse students in gifted education—deficit thinking, white privilege, and colorblind ideology. This theory on underrepresentation explains that to develop the potential of diverse gifted learners, schools and systems must first eliminate deficit thinking, recognize white privilege, and disrupt colorblind ideology. There needs to be an "attitudinal or philosophical change" in how schools actualize the education of underserved gifted students [16]. Our study will look for these elements in student, teacher, and parent responses to interview questions (Table 1).

Table 1. Ford's Theory on Reasons for Underrepresentation [15].

Reasons	Definition
Deficit Thinking	Deficit thinking is grounded in the belief that culturally different students are genetically and culturally inferior to white students.
White Privilege	White privilege is unearned benefits that advantage whites while disadvantaging others.
Colorblind Ideology	The philosophy and practice exist when educators/individuals intentionally or unintentionally suppress the importance of and role of culture in learning, curriculum, instruction, assessment, and expectations.

Ford's theory on underrepresentation lays the foundation for understanding best practices in serving gifted students from ethnically diverse backgrounds in partnership with Baldwin's research.

Alexinia Young Baldwin detailed important considerations when serving gifted students from diverse backgrounds in her research. Her practical approach to curriculum and instruction for diverse gifted learners guides this study. Culturally Diverse Students who are Gifted [1] outlines how to develop organizational and instructional strategies that lead to effective support for diverse learners. Baldwin "expressed the urgency and the great possibilities present in recognizing the high quality of students from diverse backgrounds". [1] (p. 140). Aspects of these practical recommendations for stakeholders in gifted education are the framework for this case study. The two main aspects of program planning that will guide this study are curriculum design and instructional system. The identification components of this theory will also not be included because there are no formal identification protocols in Finland [8]. "A total program plan that recognizes the potential for growth in culturally diverse students is an important factor in meeting the educational needs for gifted children of all cultural groupings" [1]. These recommendations serve as a framework for the rest of the study (Table 2).

Table 2. Baldwin's Recommendations for Serving Diverse Gifted Learners [1].

Program Planning	Description
Curriculum Design	- To provide an opportunity for gifted students of color to experience differentiated curriculum experiences that draw on their cultures. - To help students of all ethnic groups understand the bravery, the strength of character, and cleverness of various cultures, despite negative circumstances. - To increase the knowledge of all students regarding the contributions of all ethnic groups.
Instructional System	Sensitivity Enhancement - Involve the students in activities such as simulations, debates, analysis of rhetoric, and the design of answers to problems. Information Processing - Includes library research using original documents, interviews, the collection of materials for information, role assumptions, field trips, or time capsule strategies. Concept Development - Involves the use of materials from different cultures instead of relying on the traditional materials provided in most schools. Sociopolitical parallels, language structures, graphic and performing arts of the world, and family life are some of the concepts that can be taught by using a combination of materials from different cultures that are standard for most classrooms. Creative Problem-Solving Processes - Involves metaphoric thinking, which makes it possible for students to use one idea to express or explain another; visualization, in which students are able to visualize things they cannot see and play with mental images; and finding order in chaos, in which students prefer visual images that are complex over those that are simple.
Teachers	It is important that identification, program development, and evaluation of the program include parents. The role that parents play can be effective in developing the potential of the child. Karnes (1984) developed activities for Head Start parents to use with their children at home so that the various areas defined as indicators of giftedness could be developed at an early age. She found that sessions with parents on how to recognize and develop this potential helped many students be among those nominated for classes for the gifted and succeed in the program.

Table 2. *Cont.*

Program Planning	Description
Parents	It is important that identification, program development, and evaluation of the program include parents. The role that parents play can be effective in developing the potential of the child. Karnes (1984) developed activities for Head Start parents to use with their children at home so that the various areas defined as indicators of giftedness could be developed at an early age. She found that sessions with parents on how to recognize and develop this potential helped many students be among those nominated for classes for the gifted and succeed in the program.
Evaluation	The evaluative process should include all elements of the program design: goals, objectives, the teacher, the parents, and the administrator. Portfolios of work and reflections of students can determine student outcomes. Objective and subjective assessment can be used in conjunction with portfolios as well. A total evaluative profile of the program would include all of the previous elements and the relationship of outcomes to the goals that were set.

For this study, the focus is on two of the five Program Planning components: Curriculum Design and Instructional System. Students, teachers, and parents are the participants in this study. This case study does not measure evaluation because there is no overall program for gifted students in Finland to evaluate.

1.2. Context of the Study

This study is relevant and unique because Finland is the setting. First, Finland is a model for education reform all over the world because of its consistent success in the Programme for International Student Assessment (PISA), an international measure of student achievement [17]. Second, Finland has seen an increase in immigrant and multicultural populations over the last few years [18]. Last, Finland's focus on egalitarian approaches to teaching and learning has led to no national policy for gifted learners [9]. While there is a body of research on gifted education in Finland, there is a gap in research on the intersection of gifted education and non-native students.

1.2.1. Finland's International Prominence

After a fairly recent reform of the education system and consistent success in international assessments, many other countries look to Finland as an example. Some researchers even call Finland "a supermodel with regard to education" [19] (p. 1) On an international scale, Finland consistently outperforms most countries on the Programme for International Student Assessment (PISA). The PISA is a worldwide measure of student performance in mathematics, science, and reading. Finland scored higher than the average in all three domains in 2018 [20–22]. Often, Finland is a "target for educational tourism" because of this success [18].

Despite consistent top rankings, there has been a slight decline in PISA scores over the past few years. Some researchers theorize that this decline is happening because students, including gifted learners, do not have opportunities to move out of their comfort zone [9,23]. Other researchers wonder if the increase in immigration over the last few years caused this decline in PISA scores [24].

1.2.2. Finland's Multicultural Student Population

Finland is a mostly homogenous country with less immigration than many other European countries. In the last twenty years, however, there has been an increase in immigration. According to Migri, Finland's immigration services, most immigrants are from Russia, Ukraine, India, China, and Somalia. They come to Finland seeking work or asylum [25]. Social mobility is relatively high amongst immigrants, with little difference compared to the native population [26]. This shows that there has been some success with the integration of immigrants into Finnish society.

There are several ways Finland is responding to increasing numbers of non-native students in their schools. There has been a recent focus on understanding multicultural issues in some teacher preparation programs [18,27]. According to the Finnish National Agency for Education, "linguistic and cultural diversity are paid attention to in the national core curricula" [28]. One of the agency's main goals is to "increase equality and open-mindedness in education" [28]. In a study conducted in 2018 about the educational trajectories of immigrant-origin youth, the study found that students were hopeful, with high academic aims and career aspirations [29]. While there have been efforts to serve this growing multicultural study body, PISA scores showed non-native students performed worse than native Finnish students in all areas [18]. Finnish schools are still learning how to best serve their new multicultural populations.

With the changing population in Finnish schools and a trend towards a more multicultural student population, serving gifted students from non-native backgrounds has become essential. According to Sinkkonen and Kyttälä, "students with multicultural backgrounds may be in danger if schools cannot meet these new challenges. To teach heterogeneous groups, it is essential to find good practices that can create effective educational methods aimed at increasing equality and social integration" [18] (p. 180). Thus, it is also important to look at how teachers and schools play a role in the Finnish education system.

1.2.3. Inclusive Education in Finland

The goal of the Finnish education system is to provide equal learning opportunities for all students regardless of their background [18]. "The Nordic countries have a long tradition of fair and equal educational systems that aim to provide equal access to education irrespective of social status, economic situation, gender, language, religious or ethnic background" [19] (p. 1). Finland is one of the Nordic welfare states in which equality and inclusiveness are the main guiding values in educational policy [30,31]. Typically, in policies, the term equality is used to describe educational practices over equity. Since Finland's education reform in the 1970s, they have taken an egalitarian approach to teaching and learning. Inclusive classrooms are the norm in the Finnish education system.

The UNESCO Salamanca Statement is the basis for defining inclusion in the Finnish education system. The Salamanca Statement reads:

> *The guiding principle that informs this framework is that schools should accommodate all children regardless of their physical, intellectual, social, linguistic, or other conditions. This should include disabled and gifted children, street and working children, children from remote or nomadic populations, children from linguistic, ethnic, or cultural minorities, and children from other disadvantaged or marginalized areas and groups.* [31]

The term inclusion often refers more to the services of students with disabilities. The Salamanca Statement broadens this definition of inclusion by mentioning meeting the needs of gifted children as well as students from diverse backgrounds. Inclusive practices in Finland aim to reach all students as listed in the above statement.

In practice, Finland's inclusive education approach differs depending on the classroom and the teacher [14,23,32]. Teachers in Finland have autonomy over their instructional decisions. While differentiation and inclusion are the expectation for all in this educational model, gifted students are often overlooked. With no clear definition of giftedness, these traits are sometimes seen as fixed and not something to nurture [33]. Gifted researchers in Finland believe that gifted students "have a need and a right to educational opportunities and learning that meets their special needs" [33].

1.2.4. Gifted Education in Finland

Because of the emphasis on equality rather than equity, there is no official national policy regarding gifted education in Finland [33]. There are no pull-out programs, identification protocols, or special schools for academically gifted children. Formal identification of students as gifted is not a practice in the Finnish education system [32,33]. There is no clear definition of gifted students to guide teachers and administrators.

Despite the lack of formal gifted education policies, the needs of gifted students are being met in a variety of ways [6,33]. Teachers differentiate for the needs of their students [33]. Starting in kindergarten, gifted students receive instruction based on their intellectual abilities [33]. Most Finnish teachers know gifted students need more challenging assignments [34]. Finnish teachers are expected to meet the special needs of all of their students through differentiated and personalized instruction. This approach to education emphasizes support for all learners, which includes gifted students [33,34]. Based on these ideals, Finland is seen as having effective strategies for teaching gifted learners.

These instructional practices are expected in Finland, but they may not always be carried out in practice. Many teachers focus on meeting the needs of their lowest-achieving students and overlook their gifted students. The findings of Tirri and Laine state: "Often, the gifts and talents of gifted students are not identified at school or they are not supported effectively. There are many reasons for this, such as a lack of teachers' knowledge about gifted students and their special learning needs or a lack of knowledge of evidence-based practices proven to be effective with gifted learners" [14]. These reasons can lead to misconceptions about how to serve gifted students in the classroom.

1.2.5. Finnish Teacher Training Schools

In Finland, teachers are considered ethical professionals with the freedom to plan, organize, and evaluate their own teaching [32]. Researchers Malinen, Väisänen, and Savolainen assert: "Teacher education in Finland is organized in eight universities in eleven campuses that are spread across the country, covering all geographical regions from south to north and from west to east" [35].

The setting for this research study is a teacher training school in a major city in Finland. There are 940 pupils and 110 employees at this school. According to the school's website, the mission is to "foster partnership as our school spirit, characterized by openness, honesty, mutual respect, fairness, shared responsibility, and safety". It aims to "protect and nurture" diversity because the school is "home to people of different backgrounds, ages, and positions" [36]. The school is located in a middle-class district. It serves students based on the neighborhood school principle [37].

2. Data and Methods

2.1. Author Positionality

As researchers conducting this study, it is important for us to acknowledge our positionality and how it may have influenced the research process and interpretation of data. We approached this study as impartial observers with backgrounds in educational research and a shared interest in understanding the challenges faced by non-native gifted students within different educational systems.

It is important to note that the primary author of this study is a monolingual American researcher who conducted research on a culture outside of her own. Recognizing the potential challenges and limitations associated with researching a culture different from her own, the primary author relied on the expertise and insights of the two other contributing authors who have firsthand experience and knowledge of the Finnish culture. Their perspectives were crucial in honoring and valuing the Finnish culture throughout the research process.

2.2. Methodology

This case study aims to investigate the experiences of non-native gifted students and their parents and teachers in a Finnish teacher training school through in-person and video interviews.

The setting for this case study was a Finnish teacher training school in the spring of 2022–2023. The school had primary and secondary levels. There were 940 pupils and 110 employees at this school.

A monolingual English speaker and two bilingual Finnish/English speakers developed the nomination form in English (see Appendix B). It could have been translated to Finnish upon request. It was an online survey that was sent to all teachers at the teacher training school via email. It had eleven questions. The survey collected information about student demographics, students' gifted characteristics, and teacher demographics. It served as a way to collect information about potential participants. The National Association for Gifted Children developed and published the gifted characteristics [38]. The researchers encouraged teachers to fill out the form if they had a gifted student from a multicultural background in their class.

After the formal nomination process, the researchers contacted parents for permission to interview their children and their interest in participating in the study. Once parents granted permission, researchers scheduled the interviews with parents, students, and teachers.

Three researchers developed the interview protocols in English (see Appendix C). The bilingual researchers translated the interview protocols to Finnish, and the researchers compared it to the English version.

The researchers conducted open-ended interviews with school teachers, students, and parents during the spring of 2022 and 2023. The participants interviewed included a subject teacher who taught non-native gifted students in secondary grades (n = 1), class-teachers whose students were in elementary grades (n = 3) and gifted students from non-native backgrounds teachers had nominated (n = 5), and parents of two nominated students (n = 4).

Teachers selected potential student participants based on their extensive training and professionalism regarding their students' needs. While their teachers nominated the participants, they were not required to participate, and thus voluntarily did so. The parent interviews were conducted in English and teacher interviews were conducted in English and Finnish based on participant preference. The student interviews were conducted in English or Finnish also based on participant preference. All parent and teacher interviews were conducted via video conference for 20–30 min. The student interviews were conducted via video conference or in-person for 10–20 min.

The interview questions included a variety of questions related to the student's experiences with challenging instruction in school. If the students went to school in another country, they were asked to compare their experiences. The interview questions for parents included questions about how they perceived their child's experiences in the school with challenging instruction. The interview questions for the teachers included questions about the instructional decisions and scenario-based questions.

All interviews were recorded with permission from the participants. Bilingual researchers transcribed the Finnish interviews into English, and the translated interviews were reviewed by bilingual researchers to assure that the intended meaning was maintained. There were 13 participants.

This study involved five students (Table 3). Three students identified as female and two identified as male. The students were in grades 2, 3, 6, 8, and 9 when they were interviewed. These interviews were conducted in English or Finnish depending on the student's comfort level with the language. There was one student from a Polish and English background, one student from an Estonian background, two students from a Russian background and, one student from a Chinese background.

2.3. Student Profiles

The participants in this case study were five students from multicultural backgrounds whose teachers identified as gifted. Important criteria for the selection of these particular students were their advanced abilities and their non-native backgrounds. The students were all willing to share their school experiences.

Table 3. Student Participants.

Student	Grade	Gender
Ela	Elementary	Female
Sara	Elementary	Female
Hannu	Elementary	Male
Raheem	Secondary	Male
Ada	Secondary	Female

Ela (each of the students was assigned a pseudonym) was born to an English-Polish family. Her early schooling took place in England. Her native language was English. She was an elementary student at the time of the interview. Her teacher described her as having the following characteristics: interest in problem-solving, intellectual curiosity, persistence, independence in work, diversity of abilities, creativeness, high expectations of self, and perseverance.

Sara was an elementary student. She was born to Estonian parents and moved to Finland at the age of two. She spoke Estonian, Finnish, and English. Her interview was conducted in Finnish. Her teacher recognized above-average cognitive abilities in her and nominated her for this study.

Hannu is an elementary student of Chinese origin. Although he spoke Chinese, his preference for language in the study was Finnish. Hannu's teacher noticed his interest in problem-solving, persistent and goal-directed behavior, as well as his independence in work and study. Additionally, he showed talent in mathematics. Given his exceptional abilities, Hannu was selected to participate in this research study.

Raheem was a secondary student of Russian descent. Both his mother and father were of the same origin. Raheem's preference for this interview was Finnish. Raheem demonstrated impressive cognitive abilities as a quick learner with a strong interest in problem-solving, intellectual curiosity, and independence in study. Moreover, he had a keen sense of humor, was highly energetic, flexible, and socially skillful. Although the teacher had only taught him for ten lessons, Raheem's potential and exceptional qualities were apparent and qualified him for this research study.

Ada was Russian. She was in secondary level at the time of her interview. Her mother tongue was Russian, but she also spoke English and Finnish. She was nominated for the study because of her cognitive, creative, and behavioral characteristics.

2.4. Parent Profiles

There were four parents interviewed for this study (Table 4). They were two sets of parents. Each couple had a child nominated for this study. The couples were interviewed together resulting in two interviews for four total parents.

Table 4. Parent Participants.

Parent	Gender	Child
Peter	Male	Ela
Diana	Female	Ela
Hasan	Male	Raheem
Amina	Female	Raheem

2.5. Teacher Profiles

Four teachers agreed to be interviewed for this study (Table 5). There was one subject teacher and three elementary teachers. They were all Finnish and female. These interviews were conducted in English and Finnish. Two of the four teachers nominated students to be interviewed for this study.

Table 5. Teacher Participants.

Teacher	Grade Level	Gender	Ethnicity
Suvi	Elementary	Female	Finnish
Karoliina	Elementary	Female	Finnish
Tuija	Elementary	Female	Finnish
Mina	Secondary	Female	Finnish

2.6. Data Analysis

The data collected from interviews with teachers, parents, and students were analyzed using a hybrid coding approach [39]. First a deductive coding process was used and then an inductive coding process. The analysis focused on pre-determined categories (Table 6) derived from the theoretical framework based on Baldwin's research [1] for the deductive coding. The two main categories were curriculum design and instructional systems. Then, within those two categories, subcategories were determined based on a close reading of the interview transcripts. These subcategories—differentiation, culturally responsive, relationships building, grouping, and teacher knowledge—were formed based on inductive coding. This approach allowed for a systematic examination of the data, aligning the identified categories with the theoretical underpinnings of the study then delving deeper into the data to identify new themes. According to Swain's description of a hybrid approach, this "method is particularly suitable for relatively small qualitative research studies" [39]. This case study has less than 30 interviews, making a hybrid approach to coding a good fit.

Table 6. Main Categories and Subcategories.

Main Categories from Theoretical Framework	Subcategories
Curriculum Design	Differentiation Culturally Responsive
Instructional Systems	Relationship Building Grouping Teacher Knowledge

The interview questions focused on the experiences of students, parents, and teachers. Since there are no official identification protocols in Finland, the questions were mostly about curriculum design and instructional systems. Subcategories were developed for each topic (Table 6). For curriculum design, the categories that emerged from inductive coding were differentiation and culturally responsive strategies. For instructional systems, the categories were relationship building and grouping and teacher knowledge. These categories served as a framework for understanding the experiences of these non-native gifted students.

The initial analysis involved a careful reading of the interview transcripts to identify recurring ideas, concepts, or perspectives related to the response. Codes were generated through an iterative process, ensuring that the identified themes were grounded in the participants' responses. Examples of the categorization process (Table 7) include a review of the interview transcript for a code.

Table 7. Examples of the categorization process.

Unit of Analysis	Code	Subcategory	Main Category
Example 1: "In physics we once had to make a presentation. The teacher chose the topics for each one, and me and my pair were given the most difficult one. And it was really hard. Luckily my pair was good too". (Raheem).	Grouped with similar ability peers	Grouping	Instructional Systems
Example 2: "I think it is quite easy to find small ways to differentiate, for example, in discussions I ask different kinds of questions, easy ones and difficult ones depending on the student". (Tuija)	Changing teaching methods for gifted students	Differentiation	Curriculum Design

The authors who conducted the interviews and analyzed the data engaged in frequent discussions and negotiations. Discrepancies in coding decisions were resolved through consensus and mutual agreement.

Through discussions and negotiations among the authors, the data analysis of the interviews provided insights into the experiences of teachers, parents, and students in serving non-native gifted learners in Finland.

3. Results

The analysis of the collected data revealed several key findings regarding the experiences of non-native gifted students in this teacher training school. The major themes that emerged from the data analysis were organized first by the pre-determined categories and then by the subcategories that emerged.

3.1. Curriculum Design

3.1.1. Differentiation

Differentiation is a common practice for Finnish teachers [8]. In the interviews, many of the students talked about ways their teacher differentiated for them. All the teachers detailed ways they differentiated for their students. Both sets of parents mentioned how their children had differentiated tasks at school.

All the students talked about extra work or additional tasks as a strategy their teacher would use to challenge them, especially when they finished their work early. In her interview, Sara explained: "Yeah, for example, if I'm fast at the end of a project, they will give me first another book to read and then more math. Then, if I have done all of that, the teachers will give me other assignments as the challenge becomes more difficult". All teachers mentioned giving their students extra tasks if they finished their work early.

Some of the students talked about having harder or above-grade-level assignments. Ela, the second-grader, described how her teacher challenged her by giving her third-grade-level math books because she mastered the second-grade skills. "I think she just pushes me to do like harder books. Now I'm on third-class books and that feels like it makes me feel more challenged". Ada also described a similar practice. In her math books, there were more advanced tasks labeled the "blue tasks". Her teacher encouraged her to try the harder blue tasks. "Like, for example, in math we have series and then at the end of each series there's like a blue task that's like considered hard, and those are when you have to put something in that you just learned. But it's a much harder task". One set of parents knew that their child had harder tasks to complete but could not describe them.

Three out of the five students mentioned completing projects as a way of being challenged in the classroom. It was not always clear from their responses if these projects were differentiated or if all students in the class were completing the same project. One student, however, described this type of practice, and he gave an example of being challenged in a physics presentation project: once all students had to make a presentation, but the teacher matched the project level to be appropriate for the student and his friend by giving the most challenging topic to them. One secondary-level teacher mentioned providing the opportunity to participate in competitions. She only offered these national and international competitions to her gifted students. One of the secondary teachers explained that she used projects to personalize the curriculum for her gifted students.

The parents did not comment on project-based learning. Both sets of parents knew that their child may have different tasks at school. Neither couple could explain those tasks in detail.

3.1.2. Culturally Responsive

Students were asked to consider how their cultural and ethnic background influenced their school. Teachers were asked how a student's cultural background might affect instructional decisions in the classroom. Parents were asked to reflect on how their child's multicultural background affected their schooling.

All of the teachers mentioned language as a major barrier to serving their non-native gifted students. One teacher explained that she always allowed students to speak in their native language to their peers who spoke the same language.

The teachers exhibited some colorblind ideals about students' multicultural backgrounds. One of the teachers explained that a student's multicultural background does not inform her decisions about curriculum or instruction. "Well, of course, it [multicultural background] should not. And actually, I think also I don't consider it. When I'm thinking about my students, I really don't even think about that as an issue at all".

On the whole, students felt that their peers and teachers were aware of their multicultural background, but that it did not take away from or negatively impact their school experience. One secondary student may have had the most experience and the language to clearly communicate what it felt like to be gifted, a non-native Finn, and go to school in Finland. She said: "Like definitely I feel like I'm not entirely Finnish. So my culture and my ways of thinking and talking to people might differ, but I don't feel that I'm getting any other kind of treatment than anybody else". Two of the five students stated similar things, saying that they might be asked to speak in their native language or help another student from their culture, but mostly they felt they were treated equally to the other students.

3.2. Instructional System

3.2.1. Relationship Building

All the teachers discussed the importance of building relationships with their students as a means of serving their gifted students from multicultural backgrounds. One teacher explained that building relationships and understanding each student was important when making instructional decisions: "Look at the holistic perspective. So, look at the whole person, not just my subject". The other teacher said, "that it is very important that they feel they belong to the group".

One of the parents requested more communication from their child's teacher so that they could better understand how the teacher was challenging their student. "Because there's the pandemic, there's been a much-reduced amount of contact, there's not the usual sort of, like, in the first year, I suppose we would have maybe chatted to the teacher when picking her up. So which is what we did in the UK, for example. And then any issue was like brought up immediately in person or something like that. But the pandemic has made that sort of communication channel, in my opinion, a bit difficult. So I mean, I know there's this messaging system ... but it's kind of impersonal".

3.2.2. Grouping

Only one of the students mentioned working in groups or being grouped based on their abilities. He continued that it is more challenging for him when they are working in mixed groups, as quite often he needs to guide the group work and tell others what to do. The parents did not mention grouping. However, many teachers talked about grouping based on ability and/or cultural background. One teacher explained that she sometimes groups her gifted multicultural students with those from the same linguistic or cultural background if they need help with assignments. Another teacher explained a flexible ability grouping strategy she employed in math. She and her colleague took turns taking the advanced math group from both classes to provide accelerated learning. She explained that this was not a typical practice used in Finland, but she felt like it was working well.

Table 8 shows some direct quote examples from interviews with students. Meeting the needs of gifted students is important, and students like Ela and Sara felt more challenged when their teachers gave them harder assignments. Ela says that when she found the work too easy, she told her teacher, who would either give her a more challenging task or allow her to work on harder ones. Sara felt that her teacher pushed her to read harder books and gives her more difficult assignments when she quickly finished her work. While these students have different backgrounds, such as Ela's English language education or Sara's Russian heritage, they do not feel that this affects the way they are treated in class. Ada, for instance, acknowledges that she feels different from other students because of her culture, but does not believe that she is any differently treated. However, Sara noted that when working with Finnish students, they spoke Finnish, but were able to freely speak Russian when no Finnish students were present.

Table 8. Student Interview Question Response Examples.

Interview Question	Direct Quotes	Themes
Meeting the needs of gifted students	"Well, if it's too easy, I might tell the teacher and then she'll either, like, give me a harder one, or they'll say, like you can do all of these easy ones and you can go up to this point". (Ela)	Differentiation
	"In physics we once had to make a presentation. The teacher chose the topics for each one, and me and my pair were given the most difficult one. And it was really hard. Luckily my pair was good too". (Raheem).	Grouping
Challenging gifted students	"I think [my teacher] just pushes me to do like harder books. Now I'm on third-classes books and that feels like it makes me feel more challenged". (Ela)	Differentiation
	"Yeah, for example, if I'm fast at the end of a project, they will give me the first book to read then and then the math. Then, if I have done all of that then the teachers will give me other assignments as the challenge becomes more difficult". (Sara)	Differentiation
Acknowledgement of student background	"Like definitely I feel like I'm not entirely Finnish. So my culture and my ways of thinking and talking to people that might differ, but I don't feel that I'm getting any other kind of treatment than anybody else". (Ada)	Inclusive education
	"Well, if you have to do assignments with other Finns, we speak Finnish because it would be rude and then when we are left alone and there are no Finns but we speak Russian freely". (Sara)	Language

Some direct quotes from the parent interviews are displayed in Table 9. Several themes emerged from the quotes provided by the parents. The first section relates to the identification and development of talent. One parent expressed the importance of identifying their child's strengths and nurturing them in the school environment. Another parent highlighted their child's demand for additional challenging tasks in subjects where they found the material too slow and repetitive. The second question focuses on meeting the needs of gifted students. Parents shared their opinions that Finnish schools tend to concentrate more on struggling students and may overlook those who can perform well. Parents also discussed the importance of challenging tasks and assignments for their gifted children, which they felt were not always provided by teachers. The final question relates to the acknowledgment of the student's background. One parent reported that their child's proficiency in English resulted in some difficulties with Finnish terminology. However, another parent did not believe that their child's non-Finnish name had any influence on their education.

Table 9. Parent Interview Question Response Examples.

Interview Question	Direct Quotes	Themes
Identification of gifted students	"I think from my perspective it would be good if you know, her strengths were identified and kind of nourished in the school environment. And this is what seems to be happening and I hope you know it goes even further". (Diana)	Talent development
Meeting the needs of gifted students	"Mathematics is one of the things that she complained about initially that it was just too slow and she was really bored and she said that she started making mistakes because everything was just too boring and repetitive. So this is when she demanded additional things". (Peter)	Differentiation
	"We are kind of telling to him that he should also ask for more challenging tasks from the teachers, because in Finnish school they are more concentrated on students that are stuck and who are not doing good, maybe at school. Because of the resources, and this is my opinion, and the students who can who can do well, they are kind of sometimes left behind and cannot grasp everything which can be taught to them". (Hasan)	Inclusive education
Challenging gifted students	"I know that the teacher has been giving her [my daughter] harder mathematics". (Peter)	Differentiation
	"If he receives more challenging tasks or assignments then he tells them us and he was kind of proud when he received this. And we were proud that he was taking care of those and he was managing those tasks". (Hasan)	Differentiation
Acknowledgement of student background	"At the last parents meeting, the teacher said that she was struggling to give Ela harder things because she has learned maths in English. And so she will ask her in Finnish. 'Have you done multiplication before?' Obviously speaking in Finnish and Ela said no. And then the second the teacher gives her the problems she's just like, 'Oh, I know this I just didn't know the word for it'". (Peter)	Culturally other
	"I don't see there is anything, any problems with his background in his education. No, it doesn't kind of influence I believe, but for instance, because his name is not Finnish, he was asked if he needs support in Finnish language or something like this. But you know it doesn't come to my mind or at least we don't know if it is influencing him or not". (Hasan)	Culturally other
	"She's clearly becoming much, much more aware of this diversity and that she is slightly different from other children. And I think part of it comes from this frustration that she says like, well, they are adult Finnish words that she does not understand". (Peter)	Linguistically other

Table 10 shows sample responses from interviews with teachers. The responses are divided based on the topic of the interview question. In terms of identifying gifted students, teachers recognized the limitations of their identification and relied on their experience and knowledge to identify giftedness. They also acknowledged their role in researching and identifying giftedness in their class. Regarding meeting the needs of gifted students, teachers used different strategies such as challenging students with more difficult tasks. The teachers emphasized the importance of making sure gifted students felt like they belonged to the group. Finally, the teachers also recognized the importance of acknowledging the student's backgrounds and allowing them to speak in their mother tongue, but gave no mention to recognizing cultural differences when designing and implementing the curriculum. The responses provide insights into how teachers recognize and address the needs of gifted students in their classrooms.

Table 10. Teacher Interview Question Response Examples.

Interview Question	Direct Quotes	Themes
Identification of gifted students	"I am old enough to 'smell' it. I have such a long experience in teaching that I think I can quite easily identify giftedness but who knows, maybe I don't identify all the gifted, I might be limited in my identification and identify some kind of giftedness more easily than other kinds". (Karoliina)	Teacher knowledge
	"It is my task to identify and research this issue in my class based on my pedagogical knowledge and knowledge of the subjects I teach". (Tuija)	Teacher knowledge
Meeting the needs of gifted students	"In many ways. I like the differentiation table by Tomlinson that I use to guide differentiation with both low-achieving and high-achieving students. For gifted, I differentiate with different assignments and processes and tasks, I also use different learning environments, for example, the Internet to find ways to meet the needs of gifted students. I think it is quite easy to find small ways to differentiate, for example in discussions I ask different kinds of questions, easy ones and difficult ones depending on the student". (Tuija)	Differentiation
	"We have a group of very high achieving math students. So one of my colleagues, he's also a sixth grade teacher, so he's taking them and we have been doing this the whole year and that's the kind of like not very Finnish because we don't want to like pick them or show the others that you are not achieving so well but it is working well I think". (Suvi)	Grouping
	"I think that's very important that they feel they belong to the group". (Mina)	Culturally responsive
Challenging gifted students	"I challenge them by luring them and demanding them to do more difficult tasks". (Tuija)	Differentiation
	"I give them much more difficult assignments". (Mina)	Differentiation
Acknolwedgement of student background	"I always allow students to speak in their mother tongue". (Suvi)	Culturally responsive

4. Discussion

This case study aimed to understand how the needs of non-native gifted students were being met in a Finnish teacher training school. In a society with a focus on equality and inclusion, it was interesting to see how non-native gifted students fit into this model.

4.1. Curriculum Design

The three components of curriculum design that Baldwin [1] outlines as essential when serving culturally diverse gifted students are (a) to provide diverse gifted students an opportunity to experience differentiated curriculum experiences that draw on their cultures, (b) to help students of all ethnic groups understand the bravery, the strength of character, and cleverness of various cultures, despite negative circumstance, and (c) to increase the knowledge of all students regarding the contributions of all ethnic groups. It is evident that teachers differentiate for their students.

There were no specific examples of integrating culturally relevant pedagogy into curriculum design. However, many teachers mentioned allowing non-native students to speak to their linguistic peers in their native language. Students commented on this practice as well. This allows students to comprehend curricular resources at a deeper level.

There was a clear emphasis on extra work for their gifted students. There are other attempts to differentiate that include projects, accelerated learning, and competitions. These attempts at serving gifted students are only based on ability and not student background.

4.2. Instructional System

On the whole, the students did not feel they were treated differently than others based on their cultural background. Ford theorizes that three factors that lead to inadequate gifted services for diverse students are deficit thinking, white privilege, and colorblind ideology [16]. Deficit thinking is when "educators hold negative, stereotypic, and counterproductive views about culturally diverse students and lower their expectations of these students accordingly" [16]. There was no evidence of deficit thinking in the teachers interviewed for this study. Parents and students also did not mention feeling less than others because they were non-native. White privilege is an interesting concept to consider when discussing it in the context of Finland. All teachers interviewed were Finnish and white and held the privileges that come along with this racial subgroup. The students were ethnically diverse and not from the dominant culture, but many would also be considered racially white. Colorblindness or culture-blindness is another barrier to overcoming underrepresentation [4]. "The philosophy and practice exist when educators/individuals intentionally or unintentionally suppress the importance of and role of culture in learning, curriculum, instruction, assessment, and expectations" [16]. Colorblindness happens when people do not see differences and treat everyone the same. It seemed unintentional on the part of the teachers to declare that they do not take their students' cultures into account when making curricular and instructional decisions. It aligns with Finland's focus on equality and egalitarian approaches to learning. It goes against moral and cultural values to treat students differently based on their identities.

4.3. Limitations and Future Research

There are several limitations to this study, which must be taken into consideration when interpreting the results. Firstly, the nomination form required Finnish teachers to identify students as gifted based on a list of characteristics. In a culture where teachers do not identify students as gifted, this practice may have been foreign and unfamiliar to many teachers. Therefore, many teachers may have chosen not to nominate students for this study.

This study began at the end of the COVID-19 pandemic. International visitors were prohibited from entering Finnish schools at that time. It was difficult to promote the study when all communication with teachers was digital rather than in person. More teachers may have nominated students if there was a connection to the researcher in person. Additionally, most interviews had to be conducted via video conference because of the same reason. Interviews may have been longer and more detailed if they were conducted in-person.

Furthermore, it should be acknowledged that the training school used in this study is a special case, as the teachers are carefully selected based on high pedagogical and academic skills. Additionally, this school does not have a high percentage of students from non-native backgrounds. This means that the findings may not be representative of average schools in Finland or schools with more diverse populations. However, it is still a useful example of practices in serving non-native gifted students in Finland.

Overall, while this study provides valuable insights into the experiences of teachers, parents, and students in serving non-native gifted learners in Finland, the limitations must be considered when interpreting the findings. Further research with larger and more diverse samples would be beneficial to gain a more comprehensive understanding of the topic.

Future descriptive research is needed to address the limitations of the current study and to begin addressing the large gaps in the research on this topic. It would be interesting to learn about the curricular and instructional practices of teachers in other comprehensive schools for non-native gifted learners. Multiple data sources such as direct observation would also be helpful as researchers build the research base in this area.

5. Conclusions

In conclusion, this case study examined how a teacher training school in Finland addresses the educational needs of non-native gifted students within its high-achieving school system and increasing multicultural student population. The findings underscored this Finnish school's commitment to egalitarian approaches to learning and inclusive educational settings. Through interviews with non-native gifted students, their parents, and teachers, the study explored instructional strategies and curriculum design. The results revealed that teachers in this school differentiate their instruction to meet the unique needs of gifted students, and both parents and students acknowledged this effort.

These findings highlight the effectiveness of this school in catering to the needs of non-native gifted students. The emphasis on inclusive practices and differentiation demonstrates a commitment to providing equitable educational opportunities for all students, regardless of their cultural background.

It is important to note that further research and exploration are necessary to fully understand the specific strategies and policies employed by Finland in serving non-native gifted students. Additionally, future studies could investigate the long-term outcomes and academic trajectories of these students to assess the impact of Finland's approach.

Overall, this case study contributes valuable insights to the global conversation on addressing the needs of culturally, linguistically, and ethnically diverse gifted students worldwide, but it is only a small part of what is happening in Finland. This study shows results from a school that is known for best practices in education and the results may not be generalizable to most schools in Finland. With an increasing immigrant population in Finland, it is important to continue to analyze the educational experiences of non-native gifted students.

Author Contributions: Methodology, J.S., S.L. and K.T.; Data curation, J.S., S.L. and K.T.; Writing—original draft, J.S.; Writing—review & editing, S.L. and K.T.; Supervision, K.T.; Funding acquisition, J.S. All authors have read and agreed to the published version of the manuscript.

Funding: A grant from the Fulbright Finland Foundation supported this work.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Administrative Principal of Viikki Teacher Training School (15 November 2021).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A Gifted Characteristics

Table A1. Traits of Giftedness [38]. No gifted individual is exactly the same, each with his own unique patterns and traits. There are many traits that gifted individuals have in common, but no gifted learner exhibits traits in every area. This list of traits may help you better understand giftedness.

Cognitive	Creative	Affective	Behavioral
- Keen power of abstraction - Interest in problem-solving and applying concepts - Voracious and early reader - Large vocabulary - Intellectual curiosity - Power of critical thinking, skepticism, self-criticism - Persistent, goal-directed behavior - Independence in work and study - Diversity of interests and abilities	- Creativeness and inventiveness - Keen sense of humor - Ability for fantasy - Openness to stimuli, wide interests - Intuitiveness - Flexibility - Independence in attitude and social behavior - Self-acceptance and unconcern for social norms - Radicalism - Aesthetic and moral commitment to self-selected work	Unusual emotional depth and intensity - Sensitivity or empathy to the feelings of others - High expectations of self and others, often leading to feelings of frustration - Heightened self-awareness, accompanied by feelings of being different - Easily wounded, need for emotional support - Need for consistency between abstract values and personal actions - Advanced levels of moral judgment - Idealism and sense of justice	- Spontaneity - Boundless enthusiasm - Intensely focused on passions—resists changing activities when engrossed in own interests - Highly energetic—needs little sleep or down time - Constantly questions - Insatiable curiosity - Impulsive, eager and spirited - Perseverance—strong determination in areas of importance - High levels of frustration—particularly when having difficulty meeting standards of performance (either imposed by self or others) - Volatile temper, especially related to perceptions of failure - Non-stop talking/chattering

Appendix B Nomination Form Items

Item
Teacher First Name
Teacher Last Name
Preferred Email Address
Would you be willing to participate in an interview?
Student’s First Name
Student’s Last Name
Student’s Grade Level
Student’s Cultural Background
Student’s Native Language
Can the student participate in an interview in English?
Which gifted characteristics does this student exhibit?

Appendix C Interview Protocol

Interview Questions
For parents: How does your child feel about school? What does your child's teacher do to meet the needs of your child? What does your child's teacher do to make the studies challenging? What are your hopes for your child's future schooling? How does your child's cultural/racial/ethnic background influence their education?
For students: What do you like about school? What do you not like about school? What does your teacher do to make your studies challenging? Describe one example of when you felt challenged in school. Do your classmates receive the same schoolwork as you? (For older students) Describe your past experiences with feeling challenged in school. (For students who went to school in other countries) How does this school experience compare to your past school experiences? How does your cultural/racial/ethnic background influence your education? Do you feel different from the native Finnish students in your classroom? Provide an example.
For teachers: Describe the student you nominated for this study. What traits of giftedness do they exhibit? Why did you nominate them for this study? How do you identify if a student is advanced in your classroom? Describe how you meet the needs of gifted students in your classroom. Describe how you challenge learners in your classroom. How does a child's cultural/racial/ethnic background influence your instructional strategies?
Scenarios for teachers: You have a student in your class who just arrived in Finland from Syria. This student is seeking asylum with their family. The primary language at home is Arabic. The student speaks some English and no Finnish. You notice this student loves math. They take part in all math discussions in English. They are always eager for the math lessons to begin. After the first test, the student is amongst the top scorers in your class. How would you meet the needs of this student in your classroom? You have a student in your class whose mother is Finnish and whose father is Polish. The student speaks Polish, English, and Finnish. You notice this student is exceptionally creative. Their writing is the best in the class. Whenever there is free time, this student reads or continues writing their short stories. While they do not have a lot of friends or socialize much with their peers, they seem generally content in the classroom. How would you meet the needs of this student in your classroom?

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Article

On Being Twice Exceptional in Sweden—An Interview-Based Case Study about the Educational Situation for a Gifted Student Diagnosed with ADHD

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Abstract: The gifted education research area is rapidly expanding in Sweden. In the context of very limited research nationally, demands are increasing for steering documents and addressing of student and teacher needs in practice. However, Swedish research on students that are 'twice exceptional'—students classified as being both gifted and disabled (for instance, through a neurodevelopmental disorder such as ADHD)—is nearly non-existent. In this study, we present an exploratory single case study of a female student in school year seven based on semi-structured individual interviews with the student and her two guardians regarding her educational situation. The data were first inductively coded and triangulated in collaboration between three of the authors. A fourth author later independently and deductively coded one-third of the data based on the previously inductively determined thematic structure and conducted a consensus interrater reliability check, exceeding 85% percent agreement. The three main themes are as follows: (1) *multiplex perspectives on academic outcomes and expectations*, (2) *the intersection between twice exceptionality and academic work*, and (3) *information and perceptions about twice exceptionality*. The results indicate several educational challenges and opportunities for twice exceptional students. Further research is needed regarding twice exceptional students in Sweden.

Keywords: case study; gifted education; inclusive education; special needs education; talented education; twice exceptional; 2e

Citation: Holmgren, A.-C.; Backman, Y.; Gardelli, V.; Gyllefjord, Å. On Being Twice Exceptional in Sweden—An Interview-Based Case Study about the Educational Situation for a Gifted Student Diagnosed with ADHD. *Educ. Sci.* **2023**, *13*, 1120. https://doi.org/10.3390/educsci13111120

Academic Editors: Kirsi Tirri and Valerie Margrain

Received: 8 August 2023
Revised: 23 September 2023
Accepted: 23 September 2023
Published: 9 November 2023

1. Introduction

This article presents an exploratory single case study of a female student in the seventh school year who is considered twice exceptional (2e), being both a gifted learner and diagnosed with ADHD. There is a pressing lack of Swedish research on 2e students and their experiences of and wishes for the educational system. This study is based on individual interviews both with the student and with her guardians.

1.1. A Brief History of Twice Exceptionality

The idea of twice exceptionality and 2e students is a recent one, even though Whitmore [1] in 1981 had already argued that "[i]nterest has been growing in identification and appropriate education of gifted students with handicapping conditions". Additionally, some researchers claim that allusions to 2e students can be traced back to at least the early 20th century [2]. However, approximately 20 years ago, Brody and Mills [3] (p. 282) noted that, at the time, many people had difficulties "comprehending that a child can be gifted and also have learning disabilities". Klingner [4] (p. 1) argues that similar conceptions about 2e students still prevail. Foley-Nicpon et al. [5] (p. 169) note that the term 'twice exceptional' has only recently become known by educators, and Dare and Nowicki [6] write that educators previously tended to find the concept of having high intelligence and learning disabilities inconsistent because intelligence was considered a global construct. According to Brody and Mills [3], children with both special needs and high abilities tended to not be identified or provided with appropriate educational provisions. Unfortunately, more recent studies have found that similar tendencies are still commonly found [7], even though awareness of twice exceptionality among special needs educators and other professionals in the field of gifted education is increasing [8]. Among regular classroom teachers, on the other hand, awareness of the concept of twice exceptionality remains scarcer [5]. Similarly, researchers have found that there is a lack of policies or legislation relating specifically to 2e students [9].

In Sweden, historically, there has been a lack of research and practice for gifted students. However, due to revised steering documents and an increased awareness of the international research field and its expansion, resources are becoming increasingly available to build knowledge nationally in both research and practice. For instance, in the Swedish Education Act [10], it is stated that students' different needs shall be respected and that students shall be provided provisions sufficient for them to develop as far as possible. Additionally, according to the national curriculum for compulsory school [11], education shall be adapted to students' different needs and preconditions. Among the prevailing differences, of course, are high abilities and disabilities; however, there is almost a complete absence of Swedish research regarding 2e students so far. Such research would benefit from an increased emphasis on the identification of 2e students.

1.2. Definitions, Characteristics, and Identification

There are several definitions and characterizations of 2e students in the literature. For example, Dare and Nowicki [6] (p. 208) write that 2e students "have high abilities and co-existing learning difficulties". Some researchers have identified 2e students as those "who possess high ability in one or more talent domains along with one or more disabilities" [12] (p. 1615). Alternatively, Klingner [4] (p. 1) defines the term 'twice exceptional' as "being gifted (highly able) and having challenges with learning or physical disabilities". A definition that has been used by several researchers was given by Reis et al. [13], according to which 2e learners are students who "demonstrate the potential for high achievement or creative productivity in one or more domains such as math, science, technology, the social arts, the visual, spatial, or performing arts or other areas of human productivity AND who manifest one or more disabilities as defined by federal or state eligibility criteria" [13] (p. 222).

Several very recent articles also include educational needs or requirements in their definitions of twice exceptionality or of 2e students. For example, Hulsey et al. [14] (p. 16) describe twice exceptionality as a "blend of gifted and special education characteristics ("exceptionalities") that require a flexible educational approach". In a similar vein, Lien et al. [15] (p. 2) define 2e students as "those who have coexisting giftedness and disabilities in one or more domains that need support from both gifted and disability education".

Further adding to the difficulties in defining twice exceptionality is the fact that several of the words included in many of the definitions presented above—such as "giftedness", "high ability", "disabilities", and "learning difficulties"—are in themselves difficult to define and have received multiple and differing definition proposals in the literature. For example, Sims [16], surveying over 90 research articles, found more than 70 traits and abilities that, alongside having a high IQ, factor into different definitions of giftedness. Similarly, Klingner [4] (p. 1) states that "[u]nfortunately, there is no consensus among educators and psychologists for a comprehensive definition of gifted [sic]". Baldwin et al. [17] also highlight the importance of defining twice exceptionality, stating that there has been no unified method for bringing together the best research into a single definition and that no single definition has been acknowledged by both researchers and practitioners.

Due to the complex and varied nature of the compound notion of twice exceptionality, "[t]wice-exceptional students exhibit many combinations of abilities and difficulties" [6] (p. 208). Firstly, giftedness or high ability may be in one or several areas. Secondly, there might be several different kinds of difficulties or disabilities. For example, some researchers claim that "[l]earning difficulties may stem from attention deficits, specific learning disabilities (dyslexia, dyscalculia, dysgraphia, etc.), communication disorders, emotional and/or behavior disorders, physical problems, and/or sensory issues" [6] (p. 208). Other lists of disabilities include "specific learning disabilities; speech and language disorders; emotional/behavioral disorders; physical disabilities; Autism Spectrum Disorders (ASD); or other health impairments, such as Attention Deficit/Hyperactivity Disorder (ADHD)" [13] (p. 222). Thus, some children who are identified as 2e are diagnosed with ASD [18,19], others with ADHD [15,20], and so on.

This mix of combinations implies that twice exceptionality has a multifaceted nature [8]. Some researchers use abbreviations to distinguish between different forms of twice exceptionality such as 'G/LD' (gifted with learning disabilities) [21], '2e-ADHD' [22], or 'G/T/SLD/ADHD' [6] (p. 208), and some researchers use the phrase 'alphabet children' [23] to refer to 2e children. This multitude of possible combinations also means that it is particularly difficult to draw true generalizations regarding 2e students.

Further adding to the difficulties of the identification of twice exceptionality is the fact that disabilities and giftedness often mask each other [9,14,15,19]. For example, "high cognitive ability may hide disabilities, at least for a while, and severe learning weaknesses may obscure a gifted student's intelligence" [14] (p. 16). It has also been repeatedly reported that many 2e students "score lower on composite intelligence scores due to their areas of weakness [...] and so fail to meet the criteria for identification as gifted" [6] (p. 208).

On the other hand, it has been found that proper identification of 2e students has several positive effects, for example, on the self-esteem of the student identified as 2e [20]. One of the mechanisms behind this is that effective identification can lead to more effective educational approaches for the support of the 2e student, such as acceleration opportunities, which have been shown to have a positive influence on self-esteem [20]. This will be detailed more below (see Sections 1.4, 4.1 and 4.2).

1.3. Prevalence

Due, among other things, to some of the challenges raised above regarding masking and to low levels of awareness of twice exceptionality, it is difficult to judge the prevalence of twice exceptionality. Some researchers suggest that up to 7% of school-age children may be 2e [8]. Another source has estimated that around 6% of students in the US are 2e (cf. [15]), while some studies have found numbers as low as 0.015% [24]. Some have suggested that "5% to 6% of children with disabilities may also be gifted and talented" [2] (p. 69), which would yield a much lower total number among the population at large. Thus, estimates vary substantially, and accordingly, some researchers have suggested that estimates of prevalence should be interpreted with caution [18,19].

1.4. Consequences, Academic Achievement, and Psychosocial Well-Being

Lee and Ritchotte [2] claim that the relative lack of understanding of twice exceptionality is a barrier to nurturing the students' talents. It might also lead to underachievement in school and to frustration [6,25], have negative effects on their socio-emotional well-being [20,21], and therefore lead to long-term negative outcomes for these individuals. Several studies have found that 2e students are vulnerable in psychological traits and often exhibit low-academic self-concept, low academic self-efficacy, and low self-esteem [14,20,26,27]. These vulnerabilities may cause the unreasonably high risk of academic failures of 2e students found in many studies [25,26]. Wang and Neihart [26] claim that the support and care from parents, teachers, and peers are important in order to reach a high academic self-efficacy for 2e students. It is also vital for 2e students' well-being to create positive attitudes toward schooling [26]. Wang and Neihart [26] also show the importance of focusing on 2e students' strengths in their areas of interest. When a student is allowed to succeed, it will likely lead to an increase in academic self-concept. Wang and Neihart also suggest that this will support "positive emotional and behavioral outcomes in their learning" [26] (p.70).

1.5. Parents

Although parents are vitally important for 2e students and have a high impact on their development and experience in school, there are many aspects of parenting 2e students that have not been properly studied in prior research. For example, Mun et al. [28] (p. 533) argue that whereas parents "play a vital role in identifying and cultivating talent for diverse gifted children [. . .] their experiences with schools and educational leaders are rarely studied". Similarly, Dare and Nowicki [6] argue that few studies have examined how parents experience the identification of, or become aware of, their children's twice exceptionality. Interestingly, they also report that in all cases included in their study, it was the parents who were the initiators in the process of identification [6]. Another study [14] found that among surveyed parents of gifted children, 72% of the parents of gifted-only students had suspected giftedness before the age of school entrance, while the number among parents with 2e students was as high as 90%.

In their study, Dare and Nowicki [6] (p. 215) found that "parents told how frustrations manifested at home in tears, anxiety, and self-doubt" and that every parent in their study stated that "their children had experienced some level of frustration due to their twice-exceptionality". Parents can also play an important role in the academic success of their 2e children. For example, Wang and Neihart [27] (p. 148) found that "supports from parents, teachers, and peers influenced 2e students' academic achievement by mediating three behavioral and psychological variables: strategies use, academic engagement, and academic self-efficacy".

It is also important to note that the lack of studies on 2e students, not the least in a Swedish context, likely means that parents have a limited amount of information to base their beliefs and strategies on. This might contribute to an increased risk that parents may not be able to advocate for their 2e child as effectively as otherwise (cf. [6]).

1.6. Peers

Similarly, peers can be of huge advantage for 2e students, but they can also cause them problems. Prior research paints a complex picture of the relationships between 2e students and their peers. Several studies report that 2e students are "exposed to peer rejection" and "can feel isolated due to not finding 'true' peers with whom they can share interests and passion toward specific topics" [25] (p. 1). On the other hand, it has been found that difficulties that have been traditionally associated with the ADHD condition in peer and academic realms can be compensated by giftedness in the case of gifted/ADHD students [20]. Moreover, "the coexistence of two opposing conditions can result in a paradoxical way of constructing meaningful relationships with peers" [25] (p. 1) for 2e students. It has also been found that peers identified as friends to 2e students "clearly recognized the potential and strengths of the [2e] students, and could visibly identify the areas in which the [2e] students were at their best, both academically and in the social/emotional realm" [25] (p. 5). Moreover, these friends showed admiration toward the 2e students and took pride in their accomplishments [25]. Interestingly, the friends managed to identify both sides of the 2e students' characteristics, since they "enthusiastically referred to their friends' strengths, but they could also appreciate the areas in which they struggle" [25] (p. 7).

1.7. Educational Provision

Among the most common educational strategies for meeting the intellectual needs of gifted students in general are ability grouping, enrichment, acceleration [29,30], and differentiation [17,19].

Several studies have found that educators focus their responses to 2e students on support in areas of weakness and management of inappropriate classroom behavior, but not on support in areas of strength [6]. This might be due to a more general tendency to disparage and mistrust students with disabilities, which might take on different expressions, such as not thinking that a student with a certain disability is able to perform and participate in a certain activity, relating to what has been coined 'the impossibility view' in prior research [31].

In a recent review of literature on 2e students, it was found that the most important educational measures to be taken in order to promote the students in inclusive settings were "teacher preparation, [. . .] a continuum of special education interventions, [. . .] collaboration with parents and specialists, and teachers [. . .] focus[ing] on developing strengths as much as remediating difficulties" [32] (p. 1). The authors conclude that it is thus possible to effectively teach 2e students in an inclusive educational setting. It should be noted, though, that the term 'inclusive education' is an ambiguous term in the research literature [33], which can thus take on quite different meanings.

Other researchers have also pushed for the importance of highlighting and building educational strategies upon 2e students' strengths. For example, Baldwin et al. [34] suggest that effective educational strategies aimed at 2e students include addressing the student's strengths and interests, providing social and emotional support, offering adaptations for academic strengths while also offering accommodations for learning needs, and creating a supportive problem-solving culture that values the success of every student.

It has been found that 2e students consider their teachers' effective emotional engagement with them a key factor for their academic achievements and success [35]. But, since 2e students "may experience difficulties that impact their behavioral and academic engagement or how they demonstrate engagement teachers may not have the resources to meet the needs of these students or interpret non-typical signs of engagement" [14]. Thus, educating 2e students has been suggested, by Lee and Ritchotte [2], to require school personnel to be trained in recognizing the characteristics of these unique learners.

Similarly, Baum et al. [36] suggest three major aspects of an educational program for 2e students. The first is the comprehensive identification of students' strengths, interests, and talents. The second key is to address student weaknesses contextually within an enriched curriculum so students can apply and transfer skills in authentic ways. Finally, they recommend assessing progress by evaluating specific growth over time instead of measuring 2e students by grade-level expectations, since their development patterns might oftentimes differ from what is typically expected.

1.8. Aim and Research Questions

At the background of the extensive international research that was briefly described above about 2e students and their educational provision, the apparent utility of such research for both students and teachers, and the lack of research relating to twice exceptionality in Sweden, it is relevant to start conducting research about the educational conditions for 2e students. The research described above shows that the educational provision for 2e students needs improvement, and this study contributes to this by providing detailed insights into educational challenges and possible improvements in the educational situation of a 2e student. Conducting exploratory studies about the experiences and educational needs of 2e students and their guardians is a way to pave the way for theories about educational experiences and successful and less successful education. Such theories can in later studies be tested on a large scale in Sweden and in the longer run may also affect the international field of research. Thus, the aim of this study was to conduct an exploratory single-case study about educational experiences and needs from the perspectives of a 2e student and the student's guardians. Our research questions were:

- How do the 2e student and her guardians experience her educational environment in school?
- What wishes do the 2e student and her guardians have relating to her educational environment in school?

2. Materials and Methods

2.1. Overview and Participants

This study is an exploratory single-case study about the educational situation of a 2e female student in school year 7 based on repeated semi-structured and individual interviews with the student and her two guardians. The broad array of ways to define and identify 2e students that we described earlier means that the research field lacks conclusive arguments for one single set of sampling criteria and leaves the sampling methods open for contextual adaption. The sampling in the present study was affected by the increased attention that schools, higher education, and political debate during the last decades have paid to neurodevelopmental disorders in Sweden. The sampling was also inspired by the intricate educational and social complexity surrounding a neurodevelopmental disorder or diagnosis. The student met the inclusion criteria of being classified as 2e since she was (i) considered gifted based on IQ > 120 according to WISC-V and (ii) diagnosed with a neurodevelopmental disorder (ADHD) based on diagnostic criteria. Both (i) and (ii) were established by a psychologist long before our study started. High IQ is considered one out of several commonly used giftedness identifiers [16], and ADHD is considered one out of several described disabilities included in twice exceptionality definitions [13,15,20]. In the terms of Cornoldi et al. [22], the student in our study would be called '2e-ADHD'. As noted earlier, the diversity within the group of 2e students implies difficulties in drawing true generalizations about the entire group. Rather, this single-case study aimed to provide rich data about this particular student's educational situation from the perspective of the participants and thereby give insights that may guide future research in the area.

We conducted a single-case study with emphasis on real-life context and which relies on qualitative interview data and triangulation, that is, "using more than one method or data source during the study of social phenomenon" [37] (p. 468, our translation). According to Merriam [38], most case studies in education are exploratory and incorporate qualitative data to acquire an in-depth understanding of a case by getting close to the research participants and receiving rich information about their interpretations of the educational situation under consideration. Such qualitative and rich data are often collected using interviews with research participants [38]. We conducted in-depth interviews with the three research participants, allowing us to acquire rich data about the same educational situation from different perspectives using triangulation of sources. Our interview data were inductively coded using thematic analysis [39], and later, we performed a consensus interrater reliability check using Stemler's [40] threshold value as a guideline.

According to Braun and Clarke [39], thematic analysis "provides a flexible and useful research tool" that "can be applied across a range of theoretical and epistemological approaches" (p. 78). We rest this study upon a non-skeptical realist foundation. Non-skeptical realism is adopted by around 80% of the graduated philosophers in two large-scale studies by Bourget and Chalmers [41,42]. The dispute between realists and non-realists concerns "[t]he standard opposition between those who affirm, and those who deny, the real existence of some kind of thing, or some kind of fact or state of affairs" [43] (p. 308). This realist metaphysical theory does not imply any naive epistemological idea about reaching correct worldviews in simple ways. While a non-skeptical epistemology presupposes that it is possible to reach true beliefs about an external world, it does not presuppose that such beliefs are easily reached. Our methodological decisions, such as triangulation between sources and consensus interrater reliability check, are in line with our theoretical assumptions and were made partly to lower the risk of misinterpretations and reach valid conclusions.

Application for ethical vetting, in accordance with the Swedish Act concerning the Ethical Review of Research Involving Humans (Dnr: 2022-01444-01), was sent to the Swedish Ethical Review Authority, which approved this project before the start of data collection. The student and her two guardians gave their informed consent and were given information that they were at all times free to terminate participation without giving any reason and that confidentiality would be respected.

2.2. Data Collection

We conducted several semi-structured interviews with the three research participants about the educational and social situation of the student and sampled the six interviews that had a clear emphasis on present educational challenges and opportunities. The data set in this study thus comprises six data items, in Braun and Clarkes [39] terms, and contains two interviews with each interviewee. The interviews lasted 20–60 min each and were carried out by two of the researchers. One researcher conducted all interviews with the child and the child's father, and another conducted all interviews with the child's mother. All interviews were sound-recorded, and written notes were taken during the interviews. The interviews were based on an interview guide containing questions about the participants' experiences, approaches, and preferences in relation to the student's educational environment. In the following, we provide a few examples of interview questions from the interview guides for the student interviews:

- Can you tell me about your ADHD diagnosis?
- Do you think that you are gifted? Why? Why not?
- What do you think of your lessons in the classroom?
- Are there moments when it gets boring for you in school? Give examples. What do you usually do then?
- Are there moments when it gets difficult for you in school? Give examples. What do you usually do then?
- How could school become better for you?

Below we give a few examples of interview questions from the interview guides for the guardian interviews:

- Can you tell me about your child's disability?
- Can you tell me what you think about your child's giftedness?
- What do you think of your child's lessons in the classroom?
- Is there any area/subject in which it works particularly well for your child? What is it that makes it work well?
- Is there any area/subject in which it does not work well for your child? What is it that makes it problematic?
- How could school become better for your child?

Throughout, our interview guides contained open questions to avoid "leading questions that may solicit a desired response, but not necessarily an accurate response" [44] (p. 8). They also contained follow-up questions to allow for the interviewees to elaborate on their responses and thereby "ensure the collection of thick, rich data" [44] (p. 8), which has been recommended for increasing research worker reliability [44].

2.3. Data Processing

The interview data were transcribed by two authors. Three authors then conducted an inductive thematic analysis. According to Braun and Clarke [39], thematic analysis is a method for "identifying, analysing and reporting patterns (themes) within data" (p. 79), which is a way to organize and describe the data set in detail. By 'inductive', we mean that we conducted this part of the data processing 'bottom-up' or 'data-driven', without "trying to fit it into a pre-existing coding frame" [39] (p. 83). We followed Braun and Clarke's [39] (p. 87) step-by-step guide for inductive thematic analysis, except for step 2 below, which was added by us and is similar to the inductive analysis of interview data by Reznitskaya and Glina [45]. According to Braun and Clarke [39], the analysis "involves a constant moving back and forward between the entire data set, the coded extracts of data that you are analysing, and the analysis of the data that you are producing" (p. 86), a description that reflects our process. Hence, the six steps below only reflect the approximate order during the process because we, for instance, sometimes moved from step 4 to step 5 and then back again to step 4.

1. Familiarizing yourself with your data.
2. Producing a record of idea units/propositions for each transcribed interview.
3. Generating initial codes.
4. Searching for themes.
5. Reviewing themes.
6. Defining and naming themes.

In Reznitskaya and Glina [45], the expression 'idea unit' (here used in step 2 above) corresponds approximately to a single verb clause. In our data processing, we instead used the word 'proposition'. The idea is to produce a record of autonomous propositions for all quotes in each interview to allow for subsequent initial coding. In our data, it was common that several propositions were extracted from one quote. An example of this is provided in Table 1.

Table 1. Examples of idea units/propositions for an extract of a transcribed interview with the child.

Quote	Propositions
C: . . . then it can be adapted to how good you are in different subjects and so, i.e., to what extent you are at the same level. Because if I would sit with the guy who disturbs . . . I would have hit him if he teased, because he teases a lot. . . . It would have been, it would have been kind of the best ever, to have it that way instead, because then the teacher does not have to do as much, because then you can ask a friend first, then teachers, and . . . If I ask a friend first—I always do it. The girl sitting next to me, she's, we're about the same level, I'm a little bit sharper. But I very often just ask her "Is it like this?" but then she says "But, like, C, it's just like this" and then I come up with it pretty quickly—it goes much faster. She asks me too. . . .	I think that placement in the classroom should be adapted to how good you are.
	I can't handle sitting with someone who disturbs me.
	If I'm sitting with someone who is on the same level as I am, I can ask her about school assignments.
	It makes it easier for the teacher if I sit with someone who is on the same level as I am.
	If I had been sitting with the guy who was disturbing and he had teased, I would have hit him.

In step 2, we acquired hundreds of propositions, some of which were then deleted as they were considered not relevant to our research questions. Overall, 476 propositions remained, which all comprised data for the coding in steps 3–5. Out of the 476 propositions, the two interviews with the student comprised 279 propositions, the two interviews with the father (called Guardian 1 or 'G1′) comprised 71 propositions, and the two interviews with the mother (called Guardian 2 or 'G2′) comprised 126 propositions. In our analysis in steps 3–5, we made use of a few coding principles inspired by ideas in Braun and Clarke [39], Bryman [37], Reznitskaya and Glina [45], and Stemler [40]. These principles were that (A) the themes shall exhaust the data set so that there is no relevant data left out from the final thematic structure, (B) the themes shall be distinct (not overlapping), and (C) the main themes shall contain both the child's and the guardian's views to allow for triangulation, that is, for "using more than one method or data source during the study of social phenomenon" [37] (p. 468, our translation). Moreover, as emphasized by Lewis [44], we continuously considered "[n]egative cases, discrepant data, or disconfirming evidence" in our "search for data that would disprove the established themes or does not fit into one of the categories" (p. 11). This led to several changes in preliminary versions of the thematic structure.

According to Lewis [44], to fully assess research worker reliability, one must ensure that interviews are interpreted the same by different researchers. In other terms, this regards the assessment of interrater reliability, which refers to "the level of agreement between a particular set of judges on a particular instrument at a particular time" [40] (p. 1). In our study, after the main phases of the inductive analysis 1–6, one researcher randomly sampled and ordered 30% of the 476 propositions (30% from each of the six interviews) to allow for a consensus interrater reliability check, similar to the procedures in Author et al. [31] and Reznitskaya and Glina [45]. The researcher not involved in the prior data processing ('the blind rater') thereafter used the preliminary thematic structure and coding manual to independently code the 30% data sample. Some overlap between preliminary themes was thereby discovered, which led to a final smaller revision of the thematic structure.

Thereafter, a distinct set of propositions were randomly sampled and ordered (again equaling 30% of the 476 propositions). These new propositions were coded by the blind rater deductively using the coding manual including the final thematic structure, thereby conducting a consensus interrater reliability check [40]. According to Stemler [40], percent agreement is a measure usable when written data are supposed to be sorted into "possible thematic categories" (p. 2) and is "calculated by adding up the number of cases that received the same rating by both judges and dividing that number by the total number of cases rated by the two judges". In our study, we reached >85% percent agreement and thus exceeded the typical 70% threshold value for percent agreement.

3. Results

Our inductive thematic analysis resulted in the following three main themes: (1) multiplex perspectives on academic outcomes and expectations, (2) the intersection between twice exceptionality and academic work, and (3) information and perceptions about twice exceptionality. Each main theme is divided into three to four subthemes. An overview of all main themes and subthemes is provided in Table 2, which also depicts the coding manual (created during the inductive phase of the data processing) that was later used for deductive coding for interrater reliability control purposes. All main themes contain interview data from the child (C) and both guardians (G1 and G2).

3.1. Multiplex Perspectives on Academic Outcomes and Expectations (1)

This first main theme includes descriptions of the child's concrete academic outcomes as well as her and her guardians' expectations of these outcomes. It also includes descriptions of the classmates' perceptions of and approach to the child's academic outcomes and how the child conceptualizes the social rules surrounding how you should talk with your classmates about goals, outcomes, and emotional responses related to academic performance. We present the three subthemes in the following order: (1a) *the child's academic outcomes and her expectations of herself*, (1b) *the guardians' expectations of the child's academic outcomes*, and (1c) *the classmates' perceptions of the child's academic outcomes*.

3.1.1. The Child's Academic Outcomes and Her Expectations of Herself (1a)

The child gave many examples of her high academic achievement in school. She spoke about different subjects such as English and Math and argued that she outperforms her classmates in English. She said that she is one out of a few in the class who finishes her school tasks on time. Both the child and G1 described her abilities as being especially good when it comes to verbal areas, but worse in writing. Both the child and G1 talked about the child's high expectations of her academic outcomes. The child talked about how her goal was to have the highest grades in her school class, and she stated that her grades are very important to her. She also acknowledged that she experiences a lot of satisfaction when she reaches top grades:

> C: . . . I think it was in the first week [in the new] school that I said "I'll have an A in math when I finish sixth grade". She just "No . . . I've given out two A's and I've been a teacher for 15 years". And then I said "No, I'm going to have A's, I'm going to be your third" . . . And the day I finish school . . . when she gave me my grades . . . she said "You will be happy with your grades". And then I knew that then I had got an A in math. . . . And then I was really happy. Then I was happy all over the world.

On the other hand, the child experienced a high level of frustration when the teachers did not deliver clear information about what grade she had received, and she also talked about her extensive disappointment when she did not reach top grades:

> C: . . . if I will get a D then I will really cry . . . I am not exaggerating. I kind of cried yesterday when we got our math tests back because I had 2 errors . . . I'm just frustrated that I did badly, so annoyed that I made mistakes. . . . then I can seem

really grumpy . . . when I get angry with myself. . . . I care quite a lot, because I want to [be able to] get into any high school [that I] want.

Table 2. Overview of all main themes and sub-themes.

Number	Theme	Theme Description		Sub-Theme Title	Sub-Theme Description	Source	Propositions
1	Multiplex perspectives on academic outcomes and expectations	Included are descriptions about the child's concrete academic outcomes and expectations on them. Included are also descriptions about the classmates' approach to the child's academic outcomes and her adaptions to the classmates' approaches.	**1a**	The child's academic outcomes and her expectations on herself	The child's concrete academic outcomes (grades, test results, etc.) and her expectations on herself.	Child and guardians	C: When I received a B, I got disappointed with myself. G1: C wants to be good in school.
			1b	The guardians' expectations on the child's academic outcomes	The guardians' expectations on the child's academic outcomes.	Child and guardians	C: Mom wants me to be good. G1: If C does her best in school, then she can later choose what she wants to do in life. G2: C will be able to do what she wants in her life.
			1c	The classmates' perceptions about the child's academic outcomes	The child's view on, and adaptions to, the classmates' approaches to the child's academic outcomes.	Child	C: When I made two mistakes on my math test and got disappointed, then everyone think that I am bragging. C: If one is good in school, then one shall not talk about it with ones classmates.
2	In the intersection between twice exceptionality and academic work	Included is reasoning about how the child experiences and copes with academic work in school and at home. Included are concrete consequences arising in the intersection between academic work in classroom situations and the child's characteristics and behavior. Excluded are descriptions of personal traits that are not directly related to academic work. Included are descriptions about teacher approaches, actual or preferred teacher strategies and organisation of the learning environment.	**2a**	Experiencing and coping with academic work	How the child experiences or copes with concrete academic work in school or at home, as well as concrete consequences arising in the intersection between academic work in classroom situations and the child's traits and behavior.	Child and guardians	C: When it gets boring in school, I talk to the one sitting behind me. C: When the school-work gets too easy, I think too complicated and then it gets wrong. C: When I do homework at home, then I must repeat it many times, because I can't focus. G1: C puts up her own goals. G2: C gets bored if she has already learnt everything in all lessons.
			2b	Teachers' classroom strategies	Actual or preferred teacher strategies and approaches.	Child and guardians	C: Many tasks are just to read, respond, and then send the tasks to the teacher. C: If I were to decide, then I would have been allowed to make a verbal completion together with the teacher after I had made my test. G1: The teacher must often re-evaluate the students' knowledges. G2: In school, the norm is that everything is to be adapted to the group.
			2c	Organisational preconditions for learning in school	Actual or preferred organisation of the learning environment on a structural level, beyond teachers' classroom organisation and influence.	Guardians	G1: The school shall seek help from parents even if it is the school that owns the problem, steers, and exerts responsibility for the organisation. G2: The school class has 16 children.

Table 2. *Cont.*

Number	Theme	Theme Description		Sub-Theme Title	Sub-Theme Description	Source	Propositions
3	Information and perceptions about twice exceptionality	Included is information and direct talk about ADHD diagnoses or giftedness as well as general personal traits or explanations related to characteristics typically associated with ADHD diagnoses (such as hyperactivity, attention difficulties, or impulsivity) or giftedness (such as being high achiever, being smart, thinking a lot, thinking fast, high level of intellectual integrity, or being a besserwisser). Included is also general talk about being different. Excluded are descriptions of teacher classroom strategies and the ways that the child approaches academic work inside and outside the classroom, even if these are apparently linked to behavior typically associated with an ADHD diagnosis or giftedness.	**3a**	The child's diagnosis and exceptional traits	The child being different, her ADHD diagnosis or giftedness, her general personal traits or explanations related to general characteristics typically associated with ADHD or giftedness, and about how the child and the guardians relate to all this.	Child and guardians	C: When one has ADHD, one is either hyperactive in the brain or one is hyperactive in the body. I am both. C: I get frustrated or sad if something does not work out the way I thought it would. C: I am like everyone else, but I may have difficulties in some situations. G1: I have never experienced unease when it comes to talking about the diagnosis. G2: C constantly wants to learn.
			3b	Peers' views on twice exceptionality	Classmates' perceptions about being different, being diagnosed with ADHD, or being gifted, including talk related to characteristics typically associated with ADHD or giftedness.	Child and guardians	C: The classmates don't believe that I am very smart. C: My classmates think that I must change, but it is pretty difficult. G2: When a person who has difficulties in a group leaves, it gets apparent for the group that the person is different.
			3c	The teachers' knowledge about twice exceptionality	The teachers' information and knowledge about, or perceptions of, the child being different, diagnosed with ADHD, or gifted.	Child and guardians	C: My tutors are good, because they see no difference between me and the others in the class. C: I find it bad that it is only my tutors who know that I am gifted. G1: Teachers need to see and understand the individual's difficulties. G2: The teacher read literature to reach a higher level of knowledge about C:s problems.
			3	Normality and exceptionality in a societal perspective	The Swedish society's or general views on ADHD, giftedness, or being different.	Child and guardians	C: I believe that most people find it difficult to feel that one is not normal. G1: In Sweden, it is frowned upon to be good. G2: In Sweden, we sometimes forget that we aren't allowed to be at the top or to be bad, but that we rather should all be baseline.

That the child wanted to be high-achieving in school was underlined also by G1, who stated that the child has "found a motivation on her own; yes I want to be good in school". However, the child talked about how she had lowered her grades in the seventh school year and considered different explanations for this. G2 indicated that the school focuses too much on test results and that more resources should be devoted to supporting the everyday schoolwork. The child gave examples of antecedents such that her earlier schoolwork has been too easy so that she has lost relevant knowledge or ability to do it properly now, or that she does not have enough concentration or motivation to finish some school tasks:

> It hasn't gone well, because . . . it's been too easy for me because I have thought that it should be harder, but it's become too easy and then I've kind of forgotten, like, how to do it. So, I've lowered myself a lot and the teachers notice that, and kind of everyone tells me that when [there are verbal exercises then I can achieve high results] . . . but as soon as it comes to writing, then it becomes very difficult. Then I miss a lot of things that I, because . . . I don't have the energy to finish . . .

3.1.2. The Guardians' Expectations of the Child's Academic Outcomes (1b)

The guardians' expectations were discussed by the child and both guardians. G2 expressed that she just required her children in general, and thus also the child involved in our study, to be able to graduate from school. G2 argued that it is not important that C outperforms her classmates or gets top grades. G2 rather emphasized that C should only do what is necessary in school, to avoid stress and to rather pay attention to handling her social difficulties. G2 expressed a firm belief that the child will handle school to a satisfactory level. However, from the child's point of view, G2 is experienced to have high expectations of C's school performance:

> C: . . . My mom is quite a lot like, that I should perform well, because she knows that I can. She knows that if I come home and say "I got a C", then she knows I'm disappointed . . . then she just says, well, but you have to study more and then . . . I get kind of angry and start crying and then she knows that I am disappointed in myself for not get higher marks . . .

It may appear as if there are contradictions in what has been stated above about G2′s perspective, but the following quote sheds light on a distinction that G2 made between expectations of high academic outcomes and expectations of not being lazy when it comes to academic work: "She doesn't have to show that she has a thousand A's in school, or, like: "I have an A in all subjects!". Not for me. However, I do not accept laziness, but that is something completely different". Both G2 and G1 justified their expectations of C's academic performance via the importance the outcomes had on her ability to enter higher education. According to G1: "I said . . . "But don't you know what you want to study in high school?" . . . do the best you can in elementary school because then you can choose what you want . . . if you have done your best then you cannot do any more . . ."

3.1.3. The Classmates' Perceptions of the Child's Academic Outcomes (1c)

The child talked about how she experienced her classmates' responses to her academic performance, how she conceptualized the underlying social rules, and how she frequently broke such rules. The rules could concern that one should not voice one's academic goals, school grades, or test results when they are vastly beyond the classmates' and that one should not be disappointed about tiny mistakes on tests when having overall test results much better than others. She stated that one is not allowed to express anything "if one is disappointed if one is good". She described how her outstanding performance automatically led to classmates' experiencing her as bragging:

> C: . . . If you think of the social [aspects], then I am horse lengths behind my friends. But when it comes to . . . things that you should know . . . then I have no problem. Then I am plenty of horse lengths ahead. And then they can often take me as if I am bragging. That I am a 'besserwisser' [know-it-all], I am able to do anything, know everything and so on. Because I've always been told that. . . . Not that I've thought about it. Because I don't care (about it). . . . It's like your classmates, when you have a special talent, then . . . they just think you're boastful, because you have the abilities/potential.

The child talked about problems that arose when she voiced her emotions about her school grades to her classmates:

> C: Once we got our grades at the end of school, we went home. So then I talked to my friends and . . . they thought I was bragging because I said . . . that I was proud that I had got my A's and my B's and that I was disappointed that I had gotten that C. I couldn't do anything about it because everyone had gotten C or lower.

She talked about how she once in school year 6 told her classmates that she became really disappointed with herself because she had read one of the questions in the test sloppily and as a result received a B rather than an A on the test. The classmates thought that it was "absolutely pathetic" and that it was just a matter of feeling sorry for herself when she became disappointed over making one or two mistakes on an A-question.

3.2. In the Intersection between Twice Exceptionality and Academic Work (2)

In this second main theme (2), the child's and the guardians' experiences of and preferences for academic work and the school environment are discussed. The main theme includes reasoning about how the child experiences and copes with academic work in school and while doing homework, and consequences arising in the intersection between academic work in the classroom and the child's characteristics and behavior. We also give an account of the child's and guardians' reasoning about teacher approaches, actual or preferred teacher strategies, and organization of the learning environment on a structural level. The three subthemes are presented in the following order: (2a) *experiencing and coping with academic work*, (2b) *teachers' classroom strategies*, and (2c) *organizational preconditions for learning in school*.

3.2.1. Experiencing and Coping with Academic Work (2a)

The child gave a complex picture of how she experiences and copes with schoolwork in the classroom and while doing her homework. Often, the school tasks were experienced as too easy for her, resulting in boredom and difficulty concentrating, whereas she described that her classmates were unable to reply correctly to the teachers' questions. However, the child found writing more difficult than speaking, which was also consistent with comments by G1, who noted that C's overall fast and easy learning processes made it possible for her to use more time for the more difficult writing process. However, the easy school tasks were experienced as problematic for the child:

> I: But is there any time when you feel that it is difficult in school then?
>
> C: That's when it gets too easy. Then I think it is very difficult. . . .
>
> I: Interesting, because I think if it gets too easy . . .
>
> C: It's almost harder than if it were to be too hard. . . . if it becomes too easy, then I will just think that it is far too complicated and then it will just go wrong. It happens a lot of times that . . . I think it's too difficult . . . it's too easy and then it just gets harder so that I kind of won't come up with anything. . . .
>
> I: What you're saying is that it's almost harder when it's too easy?
>
> C: Yes, I find it harder when it's too easy than if it's hard. Thus it's easier when it's too hard.

That the child prioritizes more challenging school tasks before easier ones was also visible in her descriptions of individual or group tasks in school, in which she preferred to work alone so that she could adapt the content to a higher level:

> C: . . . I'm always the one who has worked alone. Because otherwise I get like this, "But my god how unsmart can one be?" and then I just get so impatient in the end and then I just get angry and grumpy. Because I want it my way . . . and I think most people are like that, too.

The child gave several more examples that revealed her intellectual autonomy and integrity, and G1 added that C works autonomously with her schoolwork without any "scolding" from teachers. Furthermore, G1 stated that C independently puts up her own goals and that she does not need clear goals. G2 described more experiences of the child's behavior that show clear signs of intellectual autonomy in relation to teachers. According to G2, the child only respects teachers who know their job, does not give in to teachers until she is proven wrong, and forever discredits teachers who do not have the right argumentation.

The child described that when the teachers ask questions, C's responses are either immediate or very slow. She sometimes experienced high levels of attention and concentration, and sometimes boredom and concentration difficulties. In the following quote, the child gives an example of considerable variations in levels of attention and concentration:

> C: . . . It is like this, [the teacher] has not even had time to finish the question and I already have the answer to the question. And it's kind of like that, either I do it or I don't do anything at all. Then I don't even raise my hand either. Because either it's really fast or I'm slow as syrup . . . I'm not great at holding up my hand and then waiting to get to talk, because then I know that they will ask someone who is not attentive. And then the answer will not come out correctly and I am quite fast, because when they have pointed at someone and they are not fast enough, then I say it. Because I think it takes too long. I'm pretty bad at waiting and things like that . . .

The child described different negative consequences of boredom in school, such as giving up, talking to persons near to her in the classroom, spinning with her chair, walking away to do something else, just sitting on her chair, or talking to the teacher. She acknowledged that, if she does not find the school content "fun", she sometimes talks or spins with her chair because she has a "bad day". She also experienced what she called "super focus" or "super attention", which makes her able to pay full attention for a long time to some school tasks that she finds interesting. This mode was experienced as positive when she was taking tests in school. However, she also stated that, "When I have my super focus turned on, I get really tired afterwards, because I have focused so much". She exemplified several ways for promoting her concentration decline, such as having interesting school tasks:

> C: We have had a trial in the classroom, because it has been in Social Science, and . . . then I was a prosecutor. And then I would get my counsel. Then if [the teacher] has not said that we have this time . . . I might have been sitting there for 2 h and I could still have something to say because I wanted it my way. I want my case, my plaintiff would get money from them and they should get that penalty etc.

Another example of a concentration-promoting method was multitasking in the sense that she held her body busy in some way, such as drawing on her desk:

> C: Unfortunately, I start drawing on my bench and it may not be so good. But . . . I can't sit and draw on paper. It doesn't work. It's not the same, so there's something about kind of just drawing at the same time . . . but not on a piece of paper. Paper doesn't work. I have to draw on the, like, bench. . . . because otherwise, then a whole lecture might have passed and I have not listened at all. Because I've . . . looked straight ahead and just stared. Then I have not been involved at all.

Other similar examples of ways to improve concentration were leaning her chair against the wall or listening and reading at the same time. She argued that she did not learn very much while doing homework at home, but that she at least worked better with it if she focused intensively for a very short period, using "5 focused minutes instead of 20 unfocused". She preferred to work on her own and particularly to not sit with anyone who bothers or disturbs her, because she would then start behaving physically badly against that person. Walking away to a separate room where she could work alone was described by her as promoting her productivity.

3.2.2. Teachers' Classroom Strategies (2b)

Several areas that concerned actual and preferred teacher strategies, approaches, and behaviors were discussed by the interviewees, such as having a growth mindset when approaching students, building safe and caring teacher–student relationships, promoting differentiation and acceleration, preventing stigma, and developing firm and fair social rules in the classroom to prevent disturbing behavior.

According to G1, it is important that teachers approach students with the belief that they are open to development:

> G1: [Teachers] should never [put] this person is in this category, the green category and [believe that this] person will always be in the green category and never move away from it—then you don't think that people develop. ... And as a teacher, you have to believe that the students will develop. I guess that's why the teacher is there.

The child argued that the teachers should attempt to be friendly and not become angry if a student breaks the rules by, for instance, leaving the classroom without the teacher's permission. G2 also talked about the importance of teachers getting to know their students but added that it is very relevant to set and maintain routines and rules of conduct in the classroom. According to G2, the teachers and the school lack authority over the students and do not to a sufficient degree succeed in teaching the students to show respect in school. G2 stated that, "The school has no authority, and definitely no fostering about respect. They talk a lot about it but they don't have it, unfortunately". G2 advocated a few ways to reach a more respectful state in school:

> G2: ... It shouldn't be so darn fuzzy at school. ... they should have rules, they should have order and they should understand that they will be punished. If they make a mistake, there should be a consequence. And it should not be a consequence that affects the group, but it should be individualized.

The child gave voice to similar ideas and stated that, "Mom agrees with me about this; me and mom think much alike each other about school". C argued that the rules of conduct should apply equally to all students and that there should be rewards for not disturbing the classroom. Such rewards were, by the child, expressed in terms of leaving 10 min earlier, which, according to C, would make the disturbing students in the long term understand that they should stop their disturbing behavior. Students not following the rules should, according to the child, immediately be sent out of the classroom, to not disturb the students that follow the rules. According to G2, the very same should apply to her own daughter, something that C also agreed with:

> C: ... if I had been a teacher and I would have had myself as a student, I would have ... made home calls because sometimes, I can be really damn annoying, that is. ... I'm not, I wouldn't say I'm the [most well-behaved student]. So I do this stuff myself and that's what makes me relatable.

However, the child, at other times, exposes her belief that it is important for teachers to adapt to students with ADHD in the way that they should not always push them to do exactly the same things as other students and sometimes "let them get away with some things" when they cannot handle some particular situations. Both the child and G2 underline the importance of making individual solutions for students based on knowledge about the individual students. G2 argues that the school must, and has the resources to, adapt the education to different students' needs and knowledge levels. According to the child, it is important that the teacher tries to sense if there is anyone who wants more difficult schoolwork, and then to give it to those who want it. G1 agrees that the school should analyze and adapt education to different student needs:

> G1: ... the range, the outcome, is always from minus [lower academic outcomes] to plus [higher academic outcomes] and then you have to think about what you do with these over here at the edges. And sometimes I've experienced that you don't have a plan for it, but you just work on. The focus is on this group here in the middle. And that's probably where the problem may lie; that you don't analyze or try.

G2 described that there have been times when teachers have tried to hold the child back and not let her work in her own pace, while at other times, there have been teachers who have developed their competencies to provide her with more advanced school tasks. According to G2, the teachers have lately made appropriate adaptions:

> G2: She has always received support and help to move forward from the teachers now in recent years. [L1] here in [X] has been fantastic, and also [L2] so . . . then she has received support and help at the level she is at, and then . . . [L1] may feel that now she is letting her go too far—"I have to catch up here myself"—[L1] maybe put her here in a teaching role and said: "Why can't you join [another child] today because she has a little problem with this and this"? Yes, but then C may have gone, sat like that and worked with [the other child] and explained to that child. So that then [L1] has to find another role for her.

Whereas G2 prefers several forms of acceleration or enrichment options, as can be noted in the quote above, G2 is very clear that she does not want her daughter to be pointed out as best in class or an exemplary student. G2 prefers that the child stays in class, that she does not have to experience more stress or pressure than necessary, and that teachers' emphasis on cutting-edge competencies can wait until she reaches upper secondary school. According to G2, it is important to avoid stigmatization, and that there should thus not be too much fuzz around her so that "she shall, like, get a large hat that reads 'I have ADHD'". However, G1 argued that the teachers should try to develop a safe atmosphere that induces a belief in the teachers' competencies in handling C's disability and that prevents taboos surrounding the diagnosis.

3.2.3. Organizational Preconditions for Learning in School (2c)

The child and the guardians discussed organizational preconditions for a positive learning environment in school, such as having more than one teacher per school class, having small school classes, and having a calming physical environment. Most of these factors were described as being better now that she had changed to another school, but when it came to the teacher ratio, both the child and G2 stated that they had still only one teacher per school class. The child expressed that she would have preferred to have more than one teacher, to enable verbal tests rather than written tests:

> C: But it will be difficult, it's seventh grade . . . It takes extra time for the teacher. After all, we only have one teacher. . . . It is not possible, because then the teacher has to leave the classroom with the student. Because I can't sit in there [in the classroom], and then there will be chaos in there [in the classroom].

However, there were few children in the class, and this was the main reason for the choice of school, according to G2, "So, why we chose this school is because it has few students. I think that everyone benefits from that". G2 expressed that it would work better when going to the lunchroom and make it easier to maintain order in the school with fewer children. According to G2:

> G2: . . . here at [the school] it works largely because you have small classes, you have small rooms for group work and you have a small schoolyard. . . . The school building has different floors; maybe that makes it calmer in the corridors? I don't know. In some miraculous way they have succeeded, at least.

Other physical factors that were considered positive for the learning environment were that the school had a small schoolyard, several building levels that were believed to cause calm in the corridors, and furniture that was sound-absorbing or construed to not make noise.

3.3. Information and Perceptions about Twice Exceptionality (3)

The third main theme (3) includes the interviewees' reasoning about being different, ADHD diagnoses, or giftedness, as well as general personal traits or explanations related to characteristics typically associated with ADHD diagnoses or giftedness. It contains four subthemes which are presented in the following order: (3a) *the child's diagnosis and exceptional traits*, (3b) *peers' views on twice exceptionality*, (3c) *the teachers' knowledge about twice exceptionality*, and (3d) *normality and exceptionality in a societal perspective*.

3.3.1. The Child's Diagnosis and Exceptional Traits (3a)

The child's ADHD diagnosis and different traits and behaviors commonly associated with giftedness and talent were discussed by the child and her guardians from a wide range of perspectives. This subtheme includes the interviewees' reasoning about how to understand and approach the diagnosis and to be normal or abnormal and about the child's intellectual integrity, fast learning skills, boredom, hyperactivity, impulsivity, acting out behavior, and emotional and cognitive instability.

G1 talked about the scientific basis of the ADHD diagnosis and that he never experienced any unease when talking about the diagnosis. The child noted that it often happens that others do not understand her because of her ADHD and that she usually answers and talks about the diagnosis if someone asks about it. The interviewees' understanding of the diagnosis has varied over time, and G1 expressed that it was important to receive the information that not all people with an ADHD diagnosis are exactly the same:

> G1: But that's what one forgot to tell about in the beginning, it's not pluses and minuses or 1–100, but there is so much more that comes into play. And that's exactly what this psychologist was so amazingly good at explaining. To, like, picture how the world for a person with ADHD might be and how many spectrums there are . . . and it is also good for those who have a diagnosis to understand, just because there are two of us in my class who have ADHD does not mean that we have the same problems. We can have completely different problems.

The child described both positive and negative consequences stemming from her ADHD. She said that she believes that it makes her good at many things, but that there have also been plenty of problems, especially when she was younger. She considered her disability to be comparable to a sickness that it is difficult to do something about: "It's quite difficult [to change behavior] because it's something that I am, it's a sickness, or how should I put it, that I have and then you can't just make it magically go away; just hide it in your back pocket".

When it came to the combination of giftedness and a neurodevelopmental disorder, the expressions "twice exceptional" and "2e" were unknown to the child, but she spoke about both her "intelligence" and her "ADHD", and G1 asserted that C knew about both her giftedness and her ADHD diagnosis. G2 stated that the combination of high intelligence and ADHD becomes demanding. Overall, the interviewees talked more about ADHD than giftedness, and the child was more prone to attribute explanatory power to ADHD than to giftedness. However, there were a few exceptions to this, and several traits typically associated with giftedness were brought forward by the interviewees. G2 talked about C's intellectual autonomy and integrity, both guardians emphasized that she is a fast learner, and the child talked about her extensive knowledge in comparison with others. According to G2, the child is highly intelligent, and together with social difficulties, this was believed to cause social problems: ". . . Then you can imagine that when she sits there, going: "Ha! You answered wrong! Ha! You did this! Ha! You did that!" And she becomes an annoying . . ." The child argued that her intelligence could cause internal harm, too: ". . . It can be quite uncomfortable and kind of feel very . . . almost so that you are a little ashamed that you are smarter than everyone else. . .". The combination of giftedness and ADHD was considered problematic in some ways by the child:

> I: . . . If you can tell me what you think about intelligence, or your particular talent . . . How does it affect you?
>
> C: . . . if I would not have had my ADHD but just a higher intelligence than everyone else, then I would be able to avoid situations where someone comes up to me and says something that according to me is not . . . If you are a little smart, you know that you can do better than others, then I could have avoided it. Then they could have believed whatever they believe and so on, but now if someone says something that is incorrect, then . . . I cannot stop myself from commenting on it. . . .

Both G2 and the child talked about C's social difficulties, and G2 emphasized the importance of learning to not point out others' mistakes in a rude manner. Moreover, C talked about how she is impulsive, easily gets bored, and has poor patience, which make her unwilling to wait for her turn:

> C: . . . because I am gifted and have ADHD, my brain spins so fast all the time . . . . . . I have always had problems, one always raises one's hand, but . . . I have never become good at that, so I have always just spoken immediately, because I don't have the energy to wait for the others since it takes a while . . .

The child described a lack of internal emotional understanding and emotional control. She said that, ". . . it is due to my ADHD also, that I am impulsive". According to C, she sometimes just feels a strong urge to do something and immediately follows that urge. For instance:

> C: . . . then I only get impulses, like: now I have to do this . . . and I don't even have time to think about it, I've already done it . . . I have to say this, no one asks, no one even agrees with what I'm talking about. And so, I just say it. It's very often like that, I say things straight out.

The child ascribes this impulsivity to her ADHD and also asserts that ADHD affects her so that she becomes a 'besserwisser'/'know-it-all': "I'm a 'besserwisser, but it's just . . . I take my impulses very quickly . . . I'm impulse-driven . . . But it's also because of my ADHD that I'm impulsive". The child talked about how her impulsivity and lack of emotional control make her hurt her friends when she becomes angry:

> C: Do first, think later. Say first, think later. . . . If I get angry, I can "conjure up" 1000 sentences about why this person should hate themselves. It can go on indefinitely . . . when my boss in the brain takes over. It's kind of one of my best friends, but it's my worst enemy too. I can say so many things that I know this person takes offense too, and if this person has told me that something is a pain for them, then . . . Once I get into an arguing state and just raise and raise my voice to be heard—that's when this boss kind of dies. He takes a little nap and then I just conjure up all the words I know and everything I can about this person that I know can make them sad. And—they haven't quite grasped that yet—I don't mean anything when I'm angry, and then [afterwards] I can get really angry with myself, too.

However, the child also argued that she is, in fact, pretty good at keeping her emotions inside, but she also stated that when it gets too much, it becomes like an unforeseen emotional "explosion". These kinds of extreme variations are visible also in the child's ability to focus and concentrate. She names her extreme concentration skill "super focus", which she said can be followed by a high level of tiredness. Variations in attention were also described by the child as follows ". . . either I absolutely can't focus on anything, or . . . I don't even hear what anyone is saying. But it's really either or. There is no in-between". She said that it is her weakness that she "never knows what mood her brain is in". The child's brain was described by herself to be hyperactive, which she explained with references to both her ADHD and giftedness. She found both her brain and her body extremely active, which she thought made her different from others: ". . . either you're hyperactive in the head, in the brain that is, or you're hyperactive in the body. But I wouldn't say I'm either/or, I'm rather both hyperactive in my body and in my head". Even though the child argued that there were differences between her and her classmates, such as the above, she also said that she is very much similar to others, just that she has other difficulties. According to C, she did not want to feel strange and abnormal:

> . . . One doesn't want to feel this different. . . . like: "now [C] must be special". . . At least I've found that really hard. That . . . everyone else has been able to think that they are like everyone else. That is, that one is different from everyone else. That one is not normal . . . I think most people find that quite difficult.

According to G2, her child is special and should be allowed to be different, but she can now focus mainly on developing social skills and "just be like everyone else and learning the social 'game'". G2 also concluded, based on how the society and school context works, that her task as a parent becomes to teach her kids that they shall not be too good in school.

3.3.2. Peers' Views on Twice Exceptionality (3b)

The child gave an account of how she thinks that others understand her and her diagnosis. According to C, her classmates perceive her as a 'besserwisser'/'know-it-all' who knows everything, and she tends to be considered emotionally sturdy by others, which is evident in the following quote:

> C: . . . many people just think . . . that I'm so patient, that I don't care . . . but then, even if it's not meant for me, I can get angry out of nowhere. I don't even know why I get angry . . . that's just because I've been so angry, annoyed, for quite some time and then I just get like that.

She talked about how she feels misunderstood by her classmates, who she said believe she does a lot of things on purpose. According to the child, the classmates do not understand what ADHD is, and especially not that it may be combined with being smart:

> I: . . . are there times when . . . others around you, don't understand you, and you think that this is because of your ADHD?
>
> C: Yes, that's kind of almost every day. . . . Not many people in my class now understand that certain things I do happen because of my ADHD. . . . hardly anyone really knows in there [the classroom] what it [ADHD] is, too. Everyone then thinks: "Ah you have ADHD, then you can't sit still and . . . You're not that smart". Because they think I'm so smart.

Another example where the child talked about how her classmates do not understand her behavior as a result of lacking knowledge about ADHD and giftedness is the following: ". . . others think, what the hell is she doing? Many who do not understand, many think that I am just stupid, or . . . that I'm doing something wrong". The child said that she has only described her behavior in more detail to her best friend and that this resulted in it being much easier for her friend to understand why C behaves the way she does.

3.3.3. The Teachers' Knowledge about Twice Exceptionality (3c)

The interviewees discussed the teachers' present knowledge about giftedness and ADHD and that there is a need for teachers, in general, to increase their knowledge in these areas to be able to meet individual students properly and to orchestrate education effectively. According to the child, only the so-called "class mentors" (Swedish: "mentorer"—i.e., two teachers with special responsibility for the class, beyond teaching, which, for instance, includes administrative and social responsibility, keeping extra contact with the students and their guardians, and so on—perhaps comparable to what is sometimes called "form teachers" or "form tutors") know about the child's giftedness, and the child described how she had informed one of her mentors about this: "then I told him I'm not low-intelligent: 'I'm a notch higher than the normal level,' and he said that he understood that, because he'd noticed . . . because I was able . . ." The child talked about the class mentors knowing that she learned new things easily and that the teachers had noticed that she listens well (even if it sometimes seems as if she is not listening). However, she experienced it negatively that only the class mentors and no other teachers knew about her giftedness: ". . . No teacher except my mentors knows about it [i.e., the giftedness] and I think that's pretty bad behavior from a school".

According to G1, the teachers can take part in the diagnostic information if they want, in order to make the best out of the situation. The child emphasized that the knowledge about her preconditions helps the class mentors to provide appropriate support: ". . . she is . . . really nice to me and just tries. She knows that I am able, and she knows that I get stuck . . ." G2 talked about how both G2 and C had informed the teachers about her ADHD diagnosis and giftedness. G2 also explained teachers who then started to read to increase their own knowledge in relevant areas to be able to provide suitable educational provisions for C. According to G1, some teachers know how to handle the situation in a good way, and they do not always need to have some special title to be role models. G1 argued that teachers should be open and interested in analyzing different student needs and strengths, to be able to meet the students' needs with their teaching.

3.3.4. Normality and Exceptionality in a Societal Perspective (3d)

The guardians discussed societal perspectives on being outstanding and abnormal. G1 argued that it is considered bad to be good in Sweden and contrasted this with another attitude said to be prevalent in the US:

> G1: ... there has been a discussion in the media about ... "Shall the school adapt to the individual or to the broad middle lane?" And it is like that within everything, really, in our society. ... In Sweden, it is frowned upon to be good, I would like to argue, at least in comparison with other countries, the US, where it is always about the result and nothing else.

G2 agreed with this and stated that Swedes: "... aren't allowed to be at the top, and we aren't allowed to be bad, but we should all be, like, baseline ..." Similarly, the child expressed that she believes that most people find it hard to feel that one is not normal.

4. Discussion

4.1. Focus on Strengths, Not Only Weaknesses

As noted in the background, several researchers suggest that an effective educational approach towards 2e students should take into consideration their strengths and special abilities, not only their weaknesses and difficulties (e.g., [32,34,36]). Several studies have also found that this is oftentimes not the case, but that schools instead tend to focus on the weaknesses or disabilities of 2e students, such as difficulties associated with an ADHD diagnosis, etc. (e.g., [6,36]). The result of the present study is interesting in relation to this.

Firstly, it can be noted that the experiences of both the guardians and the child in our case study are in line with prior studies (e.g., [32,34]) that have suggested that schools tend to focus less on the strengths and abilities of 2e students. Although there are some examples in our study of descriptions of situations where the school has understood particular strengths, there are very few examples of how the school has made systematic endeavors to base an educational strategy on her special strengths, abilities, and interests. If it indeed was a fact that only two of her teachers even knew about her giftedness, as stated by the child herself, it would seem impossible that there would be any far-reaching educational attempts to provide her with an educational environment adapted to her giftedness. It might be, of course, that more teachers know about it than what the child herself is aware of. However, if that was the case, and they did not inform her that they were aware of her situation, it can be questioned whether there were any systematic adaptations to meet her needs. A rather solid conclusion, therefore, is that this study adds to the body of research suggesting a lack of attention from schools to the strengths and abilities of 2e students relating to their giftedness. This is in line with findings discussed by, for instance, Dare and Nowicki [6] and Gierczyk and Hornby [32].

Secondly, it can be especially noted that the child herself also desires and requests that her school should do more in this respect. She explicitly stated that she wishes that more of her teachers knew about her giftedness, and she talked about how the school could be better at catering to her strengths. This echoes suggestions made by prior research (e.g., [32]), which also highlights that 2e students are oftentimes good at identifying the educational needs of both themselves and other 2e students, which has also been reported in prior studies (e.g., [32]). The guardians also made some statements in this general direction. For example, G2 described how her new school is now supporting the child better than her last school, and giving her special tasks like helping other children, which G2 seems to regard as a positive thing.

On the other hand, both the child and G2 expressed sentiments that it is good not to be seen as different from what is considered normal, and this might speak heavily against informing other people, both teachers and students, about her giftedness. If the social environment is not ready to meet such differences in a positive and supporting way, it is not very remarkable that exceptional students keep to themselves. We return to this matter later.

The general tendency of the data from the present study suggests that the participants in this study—in particular the child herself—align with the suggestions made by many researchers, that an effective and fair educational strategy toward 2e students ought to be based upon, and center around, an informed picture of the students' giftedness, strengths, and abilities.

4.2. The Need for More Knowledge

In order to focus on strengths and not only weaknesses in the educational provision, parents likely play an important role, as advocates for their child's rights and needs [cf. 28]. To be able to accomplish this, parents "need the resources [necessary] to fulfill this role" [6], (p. 216), which includes access to research specifically about 2e students. Since there is a lack of research in Sweden about 2e students, as well as a general lack of knowledge about, and attention and focus spent on talking and thinking about, twice exceptionality in the public and professional educational conversation, it is not surprising that the guardians focus on their child's disability rather than their giftedness.

Thus, in order for teachers and educators, as well as parents, to adequately support 2e students, there may be a need for effective practices for the identification of 2e students (cf. [20]), and there is a need for more studies on how to provide proper support. In order for any of these things to happen effectively and reliably, there is also a need for adequate definitions of twice exceptionality. As of now, there is a lack of both theoretical and empirical research dedicated to 2e students, not the least in the Swedish context.

On the other hand, according to the Swedish Education Act [10], teachers shall identify and provide support to meet students' needs, regardless of whether or not there are any diagnoses or special identifications involved. Thus, it might be argued that there is, after all, no need to explicitly identify a certain student as 2e, as long as the specific needs of that student are being identified and met. That said, one might think that the likelihood that a specific student will have their needs identified and met without explicit use of twice exceptionality terminology is less likely. In particular, prior research suggests that the strengths and giftedness of a student are especially less likely to be given as much attention if no explicit identification of twice exceptionality is undertaken.

4.3. Peers

Some interesting differences between the results of the present study and some of the prior research on 2e students and their relationships with peers are of interest to discuss further. As noted in the background, prior research has found that peers of 2e students recognize both the strengths and weaknesses of their 2e friends [25]. Moreover, peers appreciate and admire these strengths displayed by their 2e friends, and they even express that they take pride in their 2e friends' strengths, successes, and special abilities [25].

This is a description that differs from the picture that arises from the data in the present study. The child interviewed in this study, on the contrary, expressed the feeling that her peers perhaps do not appropriately recognize her strengths, but more importantly, that they are not particularly supportive, happy, or admiring toward her in this regard. For example, she said that she feels that being gifted or intelligent is not looked favorably upon by her peers. In fact, all our participants state that it is frowned upon to do well in school in Sweden or to be highly able.

A few interpretations of this picture are possible. Firstly, it might be that the child is right that there is a general tendency by her peers, and students in Sweden in general, to frown upon giftedness and to not express admiration toward gifted students or pride in the high abilities and achievements of one's gifted peers and friends. There is, unfortunately, other evidence that supports such a view.

Secondly, it might be that the situation in part results from a lack of knowledge among her peers about her situation and condition, caused (at least in part) by a lack of information. She stated herself that she does not speak much to her peers about her giftedness, and, moreover, that only two of her teachers know about it. From this information, we may assume that the information given to others than those most closely concerned is quite limited. But while this might be part of an explanation of the alleged unsupportiveness of her peers, it raises further questions. Why has she not communicated more openly to her peers and teachers about her giftedness? Perhaps even more importantly, why have her teachers not communicated more clearly with both their colleagues and the students in her class? It is not difficult to assume that this is because there are underlying norms and traditions that still make giftedness difficult to handle topic within the Swedish educational domain.

Thirdly, it might be that her peers actually do not mean to frown upon her academic successes and her strengths and special abilities, contrary to what she seems to believe. It is possible that her peers, in telling her off when she is sad about a few mistakes on a test, actually mean to encourage her for having done well. Maybe they meant to shift her focus from the negative to the positive aspects, wanting to help her see that she should actually be quite happy about her good result. This might be an attempt at being supportive, and might also be a way of expressing admiration, as if they were trying to say "you shouldn't be sad about your performance. I'm not sad about your performance, in fact I think you did great. I would be thrilled to have as good a test result as you did. Well done! Be proud of yourself!" It should be noted, of course, that this is different from what she recalls them saying. However, it might be that they did not manage to express themselves perfectly clearly or that she did not manage to perfectly do them justice in her recollection of the events, perhaps in part due to the fact that she has formed the opinion that her peers are not supportive of her.

While our data do not provide enough ground to conclusively settle these matters, the mere possibility that one, or both, of the first alleged explanations are valid is reason enough to be concerned. It is possible that the experiences that the student in this case study is giving voice to are due to systematic shortcomings in the Swedish educational system with regard to supporting 2e students. More research is needed in order both to find out whether there are systematic errors relating to how 2e students are treated in school and, if there are, then how to effectively start correcting these errors in order for 2e students to receive the equal opportunities that they have been promised by the educational system.

4.4. Limitations and Prospects

The study design allowed us to acquire an in-depth understanding of the interviewees' experiences and reasoning, in accordance with Merriam [38]. However, our design and small sample limits external validity. As an exploratory single-case study, we aimed to provide data that may be used to formulate new hypotheses about the educational situation, challenges, and opportunities for a group of students that have not previously been devoted many research resources in Sweden. Through our findings, we pave the way for further qualitative research in the area to determine if similar results are found for other 2e students nationally and for further large-scale research to test hypotheses built on the results of our study. Swedish experimental research to test the effectiveness of some of the suggested teacher strategies would be of educational value for both teachers and 2e students. Retrospective studies that illuminate 2e students' educational journeys from early childhood education and onward would also be of value, as would studies of 2e children in other domains than the educational, to reach a holistic understanding of the group. However, as earlier noted, such a holistic approach is complicated by the diversity of, for instance, the disabilities [6,13], and more national research is therefore needed with samples based on different preconditions.

Author Contributions: Conceptualization, A.-C.H., V.G., Y.B. and Å.G.; methodology, Y.B., V.G., A.-C.H. and Å.G.; software, V.G. and Y.B.; validation, V.G. and Y.B.; formal analysis, A.-C.H., Å.G., Y.B. and V.G.; investigation, A.-C.H. and Å.G.; resources, A.-C.H., Y.B., Å.G. and V.G.; data curation, Y.B., V.G., A.-C.H. and Å.G.; writing—original draft preparation, Y.B. and V.G.; writing—review and editing, V.G., Y.B., A.-C.H. and Å.G.; visualization, Y.B. and V.G.; supervision, Y.B. and V.G..; project administration, Y.B., A.-C.H., Å.G. and V.G.; funding acquisition, V.G. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: This study was approved by the National Review Board Etikprövningsmyndigheten in Sweden (protocol code 2022-01444-01 and date of approval 2022-06-02).

Informed Consent Statement: Informed consent was obtained from all subjects involved in this study.

Data Availability Statement: Data is unavailable due to privacy or ethical restrictions.

Acknowledgments: The authors wish to thank Valerie Margrain for language-checking this article. After that, some further changes to the text were made, so any remaining errors are our own. The authors would also like to thank the participants of this study, who devoted time and energy to this project, providing us with valuable data.

Conflicts of Interest: The authors declare no conflict of interest.

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ISBN 978-3-7258-0115-2