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# Cognitive and Emotional Aspects of Academic Performance

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Edited by  
Yosi Yaffe and Gal Harpaz

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# **Cognitive and Emotional Aspects of Academic Performance**



# Cognitive and Emotional Aspects of Academic Performance

Editors

**Yosi Yaffe**

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# Contents

<b>About the Editors</b> . . . . .	<b>vii</b>
<b>Maria Tzachrista, Evgenia Gkintoni and Constantinos Halkiopoulos</b> Neurocognitive Profile of Creativity in Improving Academic Performance—A Scoping Review Reprinted from: <i>Educ. Sci.</i> <b>2023</b> , <i>13</i> , 1127, doi:10.3390/educsci13111127 . . . . .	<b>1</b>
<b>Niek Sebastiaan Kooren, Christine Van Nooijen and Fred Paas</b> The Influence of Active and Passive Procrastination on Academic Performance: A Meta-Analysis Reprinted from: <i>Educ. Sci.</i> <b>2024</b> , <i>14</i> , 323, doi:10.3390/educsci14030323 . . . . .	<b>29</b>
<b>Yael Grinshtain, Gal Harpaz and Yosi Yaffe</b> Parental Help-Giving Orientations Scale (PHGOs) in Children’s Learning: Construction and Validation Reprinted from: <i>Educ. Sci.</i> <b>2023</b> , <i>13</i> , 363, doi:10.3390/educsci13040363 . . . . .	<b>54</b>
<b>Gal Harpaz, Yael Grinshtain and Yosi Yaffe</b> “Who’s the Student at Home?”: Parental Help-Giving Orientation in Learning at Home Predicted Using a Parent’s Personal Characteristics Reprinted from: <i>Educ. Sci.</i> <b>2024</b> , <i>14</i> , 246, doi:10.3390/educsci14030246 . . . . .	<b>68</b>
<b>Dominique-Esther Seroussi, Yehuda Peled, Rakefet Sharon, Nathan Rothschild, Osnat Halperin Barlev, Eyal Weissblueth and Gal Harpaz</b> ‘A Different Voice’ in Peer Feedback: Gender Specificity in Students’ Willingness to Provide Peer Feedback Reprinted from: <i>Educ. Sci.</i> <b>2023</b> , <i>13</i> , 654, doi:10.3390/educsci13070654 . . . . .	<b>81</b>
<b>LaTasha R. Holden and Bear Goldstein</b> Brief Mindset Intervention Changes Attitudes but Does Not Improve Working Memory Capacity or Standardized Test Performance Reprinted from: <i>Educ. Sci.</i> <b>2024</b> , <i>14</i> , 227, doi:10.3390/educsci14030227 . . . . .	<b>98</b>
<b>Moran Farhi, Yarden Gliksman and Lilach Shalev</b> Cognitive Control among Primary- and Middle-School Students and Their Associations with Math Achievement Reprinted from: <i>Educ. Sci.</i> <b>2024</b> , <i>14</i> , 159, doi:10.3390/educsci14020159 . . . . .	<b>116</b>
<b>María Teresa Costado Dios and José Carlos Piñero Charlo</b> Mathematical Anxiety among Primary Education Degree Students in the Post-Pandemic Era: A Case Study Reprinted from: <i>Educ. Sci.</i> <b>2024</b> , <i>14</i> , 171, doi:10.3390/educsci14020171 . . . . .	<b>132</b>
<b>Eitan Simon and Yonit Nissim</b> The Role and Motivation of Pre-Service Teacher (PST) Mentors from Pro-Social to Cognitive-Effective Perspectives Reprinted from: <i>Educ. Sci.</i> <b>2023</b> , <i>13</i> , 930, doi:10.3390/educsci13090930 . . . . .	<b>147</b>
<b>Sawsan Awwad-Tabry, Inbar Levkovich, Timothy Pressley and Shiri Shinan-Altman</b> Arab Teachers’ Well-Being upon School Reopening during COVID-19: Applying the Job Demands–Resources Model Reprinted from: <i>Educ. Sci.</i> <b>2023</b> , <i>13</i> , 418, doi:10.3390/educsci13040418 . . . . .	<b>162</b>

<b>Liat Eyal, Eyal Rabin and Tamar Meirovitz</b>	
Pre-Service Teachers' Attitudes toward Integrating Digital Games in Learning as Cognitive Tools for Developing Higher-Order Thinking and Lifelong Learning	
Reprinted from: <i>Educ. Sci.</i> <b>2023</b> , <i>13</i> , 1165, doi:10.3390/educsci13121165 . . . . .	<b>176</b>
<b>Orr Levental, Dalit Lev-Arey and Ilan Tamir</b>	
Parents' Involvement in Choosing Extracurricular Sports Activities: A Gendered Perspective from Israel	
Reprinted from: <i>Educ. Sci.</i> <b>2024</b> , <i>14</i> , 99, doi:10.3390/educsci14010099 . . . . .	<b>188</b>
<b>Dalit Lev Arey and Orr Levental</b>	
Beyond the Game: The Influence of Varying Degrees of Sports Involvement on College Students' Self-Perceptions and Institutional Affiliation	
Reprinted from: <i>Educ. Sci.</i> <b>2024</b> , <i>14</i> , 332, doi:10.3390/educsci14030332 . . . . .	<b>200</b>

# About the Editors

## **Yosi Yaffe**

Yosi Yaffe holds a senior lecturer position in the Department of Special Education and Educational Psychology at Tel-Hai Academic College. His area of expertise lies in the assessment of families, with a particular interest in parent–child relationships across various contexts relating to the emotional wellbeing and educational performance of adolescents and emerging adults with and without special needs.

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Review

# Neurocognitive Profile of Creativity in Improving Academic Performance—A Scoping Review

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**Abstract:** The present study provides an in-depth review of the neurocognitive aspects of creativity and its association with academic achievement in children. The outcomes of this study indicate a considerable positive relationship between creativity and academic ability, namely in reading, comprehension, and written tasks. Neurocognitive processes, including associative thinking, divergent thinking, executive functions, and predictive representations, play a significant role in shaping the characteristics associated with creativity. Although creativity may lead to potential adverse outcomes, extensive study has firmly established its significance in academic accomplishment. This systematic review includes studies conducted between the years 2016 and 2022. The primary selection criteria employed for the inclusion of articles in the research encompassed the following aspects: articles written in the English language, articles directly relevant to the subject matter of the study, articles featuring a sample population comprising students, displaying regular and typical developmental patterns, articles adopting a descriptive, exploratory, or longitudinal study design. The research promotes the cultivation of creativity within educational settings, emphasizing the utilization of cultural resources, the alignment of teachers' attitudes with the promotion of creativity, and the comprehension of neurocognitive factors influencing creative processes. There is a significant focus on the necessity for more investigation into the correlation between creativity and academic achievement. Further research is needed to gain a comprehensive understanding of how creativity is incorporated within educational settings to achieve academic performance.

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**Keywords:** creativity; academic performance; neurocognition; learning; academic skills

## 1. Introduction

Creativity is a cognitively complex process that generates novel and valuable ideas, solutions, and products. It is essential in numerous facets of human life, including academic performance and education. Creativity as a means of enhancing academic performance is gaining increasing attention in research and education.

Several brain regions, including the prefrontal cortex, anterior cingulate cortex, and default mode network, have been linked to creative thought in neurocognitive studies of the brain processes underlying creativity. These regions are associated with various cognitive functions, such as ideation, cognitive flexibility, and problem-solving.

The relationship between creativity and academic achievement is complex and can vary depending on the context and the specific measures of creativity and academic achievement employed in the studies. Here are some potential influences of creativity on academic performance:

*Enhanced Problem-Solving:* Through creative thinking, students can approach problems in novel ways and generate inventive solutions. This can be especially beneficial in subjects that require solving complex problems, such as mathematics and science.

*Enhanced Learning and Memory Consolidation:* Creative activities can improve learning and memory consolidation. When students actively engage in creative tasks related to

the topic, they may better comprehend and retain the information. Incorporating creative elements into the instructional process can increase student motivation and engagement. Students become more invested in their studies when encouraged to explore and express their ideas creatively.

*Communication and Expression:* Creativity can improve both written and verbal communication skills. Students who can express themselves creatively may excel in subjects that require effective communication, such as literature, writing, and the arts.

Engaging in creative activities can aid in reducing stress and anxiety, which can positively affect academic performance.

Recognizing that the connection between creativity and academic performance can be complex is essential. Creativity can have positive effects, but an imbalanced emphasis on creative activities at the expense of traditional academic subjects can have negative consequences.

According to [1], creativity is a complex and multifaceted process that involves identifying information gaps, formulating hypotheses about them, analyzing and testing them, and communicating the results to solve problems and promote environmental changes. According to research findings, creativity is also associated with school performance and academic accomplishments, such as arithmetic, writing, and reading [2–4]. In addition, juvenile creativity undergoes various developmental changes, including a decline during elementary school [5]. Characteristics such as acquired knowledge, methods of thinking, verbal and language skills, types of stimulation, and motivation are also responsible for a child's creativity performance throughout his or her development [6]. It also appears to be associated with reading, critical thinking, reasoning, creativity, and freedom of expression [7]. Lastly, thinking and creating original products and new ideas are among the skills that distinguish humans from other species and have brought them to their current position. According to this meta-analysis, creative ability is a component of the school experience and the development of cognitive skills and a factor that promotes excellent academic performance [8].

According to several researchers, creativity and learning entailed change and had fundamental parallels [2,9–11]. Specifically, creativity is associated with novel and significant modifications to ideas, goods, and behaviors. Similarly, learning is characterized by relatively stable changes in comprehension and conduct [9,10,12,13]. It seems reasonable to presume a positive relationship between creativity and academic success, which is viewed as the result of learning.

An earlier study [14] revealed that sixth-graders' creative abilities were more closely related to reading than mathematics. Another German study examining the relationship between student creativity and academic achievement (teacher-determined grades) reached similar conclusions, namely that creativity is most strongly associated with academic achievement in social studies (e.g., history and political science) and less so with academic achievements in language learning (German and English) or mathematics and natural sciences [15,16]. Some researchers [17] discovered positive correlations between students' creativity and academic performance in earth sciences, geography, Spanish, and chemistry.

In addition, the neurocognitive profile of creativity can be studied beyond education and the enhancement of academic performance and within the psychology of individual differences, as it can be related to the parameter of leadership [18–22], clinical psychology, as it can be studied in the context of therapy and psychopathology [23], as well as in special minority groups [24]. All the parameters mentioned above are evaluated in the subsequent.

Moreover, the neurocognitive profile of leadership creativity refers to the underlying brain processes and cognitive mechanisms that contribute to the creative thinking and problem-solving abilities of influential leaders [18,20]. Creativity plays a vital role in enabling leaders to navigate complex challenges, innovate, and inspire others, despite the fact that leadership is a multifaceted concept involving various traits and skills [21,22]. The neurocognitive profile of leadership creativity is comprised of cognitive skills, emotional intelligence, and the capacity to foster a creative and collaborative environment. These

characteristics enable leaders to think critically, adapt to changing conditions, and motivate their teams to produce innovative solutions and superior results. Consequently, creativity is central to effective leadership across a variety of domains and industries.

Another aspect in which creativity is applied in education is gamification. The neurocognitive profile of creativity in gamification refers to the cognitive processes and brain mechanisms engaged when individuals engage in creative activities in the context of gamified experiences. Gamification incorporates game elements and mechanics into non-game contexts to improve user engagement, motivation, decision-making, and overall experience [25]. Gamification can cultivate an environment that encourages innovative thought and problem-solving when combined with creativity [26].

Understanding the neurocognitive aspects of creativity in gamification enables designers and educators to create more engaging and effective gamified experiences that harness the power of creativity to improve learning, problem-solving, and overall user satisfaction [27]. By tapping into the brain's cognitive processes associated with creativity, gamification can become a potent instrument for stimulating innovative thought and fostering an enjoyable learning or interactive environment [28].

Additionally, the neurocognitive profile of creativity in therapy refers to the underlying brain processes and cognitive mechanisms at play when people engage in creative activities as part of the therapeutic process. Clinical psychology frequently employs creative approaches to therapy, which can provide clients with unique advantages and opportunities to investigate and express themselves in novel and imaginative ways. Incorporating creativity into therapy can enhance the therapeutic process by engaging various brain regions and fostering emotional expression, insight, and personal development. Recognizing the diverse ways creativity can contribute to the healing and transformational process, therapists who use creative approaches customize interventions to each client's needs and preferences [29].

While creativity is typically associated with improved academic performance, the relationship between creativity and academic performance in people with psychopathology can be influenced by several factors. It is essential to recognize that despite their difficulties, individuals with psychosis can exhibit remarkable resilience and fortitude. Integrating supportive interventions, cognitive remediation, and creative therapies into academic programs may improve this population's cognitive performance, creative expression, and academic performance.

Due to the complexity of psychosis and its varied effects on individuals, research in this field is constantly evolving. Further research is required to comprehend the neurocognitive mechanisms underlying creativity in people with psychosis and how creative interventions can be effectively integrated into educational settings to enhance academic outcomes. In addition, the treatment and support of individuals with psychosis should be comprehensive, considering their unique strengths, obstacles, and personal objectives [30]. In both correctional facilities and special population settings, it is essential to embrace a holistic approach that recognizes each individual's unique needs and challenges [31]. Trauma, psychological health, and social support are essential to their cognitive and academic abilities [32,33]. Individualized interventions, such as creative therapies, educational programs, and vocational training, can positively affect cognitive abilities, creative expression, and academic performance as a whole [34].

This systematic review aims to investigate whether there is a correlation between creativity and academic capabilities and with which of these capabilities this correlation is usually found. The research sample includes published scientific articles in valid and recognized scientific journals investigating the relationship between creativity and academic skills in different countries and cultures. In addition, the central objective of this paper is to examine and provide answers to the following research questions:

[RQ1] What are the cognitive processes associated with creative thinking?

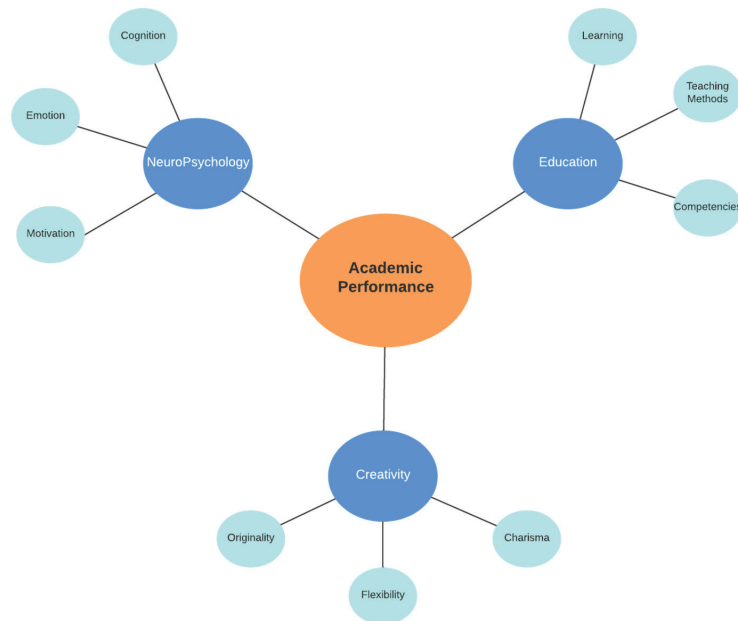
[RQ2] How does creativity affect academic performance?

[RQ3] What are the differences in the neurocognitive profiles of creative and non-creative students?

[RQ4] How can creativity be fostered in the classroom?

[RQ5] How does creativity interact with other cognitive processes to affect academic performance?

The figure below presents the theoretical framework underlying the current systematic review, wherein academic performance is the central focus. Surrounding this central hub are the key factors that play a crucial role in enhancing academic performance: neuropsychology, education, and creativity. Additionally, these factors are further elaborated upon, highlighting their interconnectedness and interdependence. Neuropsychology focuses on assessing and examining various core components: cognition, emotion, motivation, education through learning, teaching methods and skills, creativity with originality, flexibility, and giftedness. These components are enhanced through specialized training and the utilization of tools specific to the field of neuropsychology. The goal is to foster students' cognitive and psycho-emotional development within an educational setting (Figure 1).



**Figure 1.** Flowchart of Conceptual Framework.

## 2. Literature Review

### 2.1. Neurocognitive Aspects of Creativity in Academic Performance

A neurocognitive framework for human creative thought is proposed by researchers [35]. The authors propose that creative thinking encompasses the dynamic interaction of several cognitive processes, such as associative thinking, divergent thinking, and executive functions. Associative thinking pertains to the cognitive capacity to establish associations between thoughts or ideas that may appear unrelated, facilitating the creation of innovative and unique ideas. Divergent thinking encompasses developing many answers or options, fostering cognitive flexibility, and the ability to produce many ideas. The creative process involves using executive processes, including cognitive control and working memory, to sustain attention, suppress extraneous stimuli, and manipulate mental representations.

Moreover, the significance of predictive representations in creative thinking is underscored by recent research [36]. Predictive representations encompass the cognitive process of building mental simulations or models that enable humans to foresee the likely impli-

cations of their thoughts and subsequently make adjustments based on these anticipated consequences. This technique enables the assessment and enhancement of innovative concepts. In [37], the correlation between cognitive knowledge and creative thinking abilities is investigated, explicitly focusing on the Big Five personality traits. The authors propose that creative thinking is both an outcome and a potential catalyst for developing other cognitive processes, including cognitive thinking. Cognitive thinking encompasses the processes of analysis, evaluation, and synthesis of information, which play a pivotal role in generating and cultivating innovative ideas. In another scholarly work [38], the notion of active imaginative listening, which entails active participation in imaginative and creative cognitive processes during music listening, was explored. This cognitive process enables humans to engage in the exploration of alternate perspectives, the generation of mental imagery, and the establishment of links between various sensory modalities. Engaging in active imaginative listening has the potential to augment creative thinking through the stimulation of the imagination and the facilitation of novel idea development.

In conclusion, another study [39] investigates the impact of creativity and intelligence on academic achievement. The study posits that individuals who demonstrate exceptional abilities in creativity and intelligence tend to attain superior levels of scholastic achievement. This discovery underscores the significance of incorporating creative thinking capabilities alongside cognitive talents inside educational environments to augment academic performance. In brief, the neurocognitive characteristics associated with enhanced academic performance through creativity encompass a range of cognitive processes such as associative thinking, divergent thinking, executive functions, predictive representations, cognitive thinking, active imaginative listening, and the integration of creativity and intelligence. These cognitive processes play a role in the generation of original ideas, the ability to think flexibly, the evaluation and improvement of ideas, and the enhancement of academic achievement.

Several research studies have provided insights into the impact of creativity on academic achievement based on the neuropsychological profile of creativity. In one scholarly work [40], the researchers delved into the nuanced aspects of creativity, shedding light on the potential negative implications. Specifically, they emphasized that individuals with a propensity for unique thinking may be more inclined toward dishonest behavior. Although the cited source did not explicitly examine the correlation between creativity and academic achievement, it posited that creativity might engender adverse outcomes that could indirectly influence one's academic performance. Additionally, one other study [41] investigated the potential causal relationships among processing speed, intellect, creativity, and school success. Their research findings indicated that the speed at which information is processed can directly influence cognitive abilities, such as academic achievement. Additionally, the impact of processing speed on real-world performance may be mediated indirectly through intelligence and creativity. Another study [42] examined the correlations among protracted psychosis phenotypes, socio-emotional adjustment, academic outcomes, and neurocognitive ability. This study primarily examined psychosis phenotypes, but it also offers valuable insights into the potential influence of neurocognitive characteristics on academic ability. These findings could be pertinent to comprehending the relationship between creativity and academic success.

One study [43] investigated the correlation between ethical saliency and deviant behavior among persons with creative inclinations. While this study did not specifically investigate the impact on academic performance, it provides insight into the potential correlation between creativity and deviant conduct, which could have implications for academic achievements. Furthermore, another study [44] examined the impact of virtual reality apps on cognitive load-mediated creativity components and creative performance within the context of engineering design. This study primarily examined the field of engineering design. However, it offered valuable insights into the cognitive processes associated with creativity and their potential influence on creative performance, which could be applicable in academic contexts.

Another study [45] investigated the influence of creativity on functional outcomes among individuals diagnosed with schizophrenia. The primary focus of this study pertains to schizophrenia, although it emphasizes the potential mediating influence of creativity concerning neurocognition and functional results. This implies that the presence of creativity could have a notable impact on academic achievement through its involvement in moderating the connection between cognitive talents and practical results. In another study [46], the intricate relationship between creativity, imagination, personality attributes, and academic success was investigated. Their research findings indicated an indirect relationship between flexibility, conscientiousness, and academic achievement mediated by creativity. This observation underscores the potential impact of creativity on academic performance. The study by [47] examined the correlation between creative thinking and academic achievement, specifically emphasizing English language and mathematics. Their research findings indicated a statistically significant correlation between creativity and academic achievement, wherein higher levels of creativity are linked to improved academic performance. In [37], researchers investigated the correlation between creative thinking capacity, cognitive knowledge, and the Big Five personality traits. Their study's findings indicated variability in creative thinking abilities among students and further revealed that individual personality features influence this variability. This observation underscores the potential impact of creativity on academic achievement, as individual variations influence it.

In [48], the researchers examined the Montessori model and its influence on the development of creativity. Although this citation does not explicitly discuss academic performance, it underscores the significance of educational environments in cultivating creativity, which can potentially impact academic outcomes. In [49], the researchers investigated the cognitive processes involved in students' creative problem-solving, specifically focusing on applying Wallas' theory in the context of mathematical problem-solving. This study primarily examined the field of mathematics, although it offered valuable perspectives on the cognitive mechanisms underlying creative thinking and problem-solving. These insights can potentially apply to academic achievement across other subject areas. The study conducted by [50] explored the correlation between creativity and academic performance, focusing on analyzing potential variations based on gender. The findings of this study indicate a positive correlation between creativity and higher-level accomplishment, particularly in the context of diverse linguistic actions. This observation underscores the potential impact of creativity on academic achievement, particularly in areas related to language and communication. In [39], the author investigated the impact of creativity and intelligence on academic achievement. The study posited that individuals who demonstrate exceptional aptitude in creativity and intelligence are more likely to attain elevated levels of academic achievement. This highlights the significance of incorporating creative thinking talents alongside cognitive ability to augment academic performance.

In summary, drawing from the neurocognitive profile of creativity, it can be inferred that creativity can positively and negatively impact academic achievement. Indirectly, academic success can be influenced by processing speed, IQ, socio-emotional adjustment, and ethical saliency. The potential influence of creativity on the association between cognitive ability and functional results, particularly in connection to academic accomplishment, is a subject of interest. The impact of individual characteristics, namely personality factors, on creative thinking capacity and its correlation with academic performance is noteworthy. The promotion of creativity within educational environments, along with the examination of the cognitive mechanisms behind creative thought, has the potential to enhance academic achievement.

## 2.2. Neurocognitive Profile Differentiation of Creative and Non-Creative Students

Variations in neuropsychological profiles exist between students classified as creative and those classified as non-creative, encompassing multiple dimensions. According to [51], a suggested relationship exists between creativity and several outcomes, such

as academic success, career potential, and employment performance. This suggests that kids who possess creative abilities may have higher academic accomplishment levels than students who lack creative abilities. The study described in [52] investigated the correlation between creativity and performance in several geometrical problem-solving tasks. The results of their study indicate that students with higher levels of creativity may exhibit superior problem-solving skills and achieve higher performance outcomes when faced with non-routine and open-ended tasks compared to students with lower levels of creativity. The study by Pettersen et al. (2019) examined the progression of creative work engagement among engineering students, focusing on their inclination and proficiency. The findings of their study indicated that children with a higher level of creativity may have a greater inclination and capability to participate in creative endeavors compared to students with lower levels of creativity. A recent study [53] investigated the relationship between perceived creativity and the Big Five personality qualities. The findings of their study suggested that individuals with elevated levels of creativity may manifest distinct personality characteristic profiles compared to others lacking creative tendencies.

In other research, the researchers [54] discussed the values across creative fields. According to their research findings, persons with creative inclinations may exhibit distinct value systems compared to those without creative tendencies, implying potential variations in their neurocognitive profiles. In another study, the researchers [55] examined the variations in creative performance among individuals in the interior design field. The study conducted by the researchers emphasized the possible impact of cognitive styles on creative performance, indicating that individuals with creative abilities may demonstrate distinct cognitive styles compared to those without creative abilities. In a recent study [56], a comparison was made between the viewpoints on creative thinking exhibited by students in art school and those in non-art education. The research indicated that individuals enrolled in art education programs may exhibit distinct neuropsychological profiles compared to their counterparts who are not pursuing art education, implying potential variations in their capacities for creative thinking. Another study [57] investigated the discriminant validity of implicit ideas about intelligence and creativity. The study's findings indicated that individuals with distinct implicit conceptions regarding intelligence and creativity may display varying neurocognitive profiles, suggesting possible distinctions between students who are deemed creative and those who are not.

Another study [58] examined the correlation between sleep patterns, academic success, and performance on neurocognitive tests. The results of the study indicated that there may be variations in sleep quality and neurocognitive function between individuals who possess creative abilities and those who do not, which could potentially impact their academic success. Additionally, in another study, the researchers [48] investigated the Montessori paradigm and its influence on creativity. The findings of their study indicate that students enrolled in Montessori programs may demonstrate elevated levels of creativity compared to students in non-Montessori schools, suggesting potential variations in their neurocognitive profiles. A previous study [46] investigated a complex relationship between creativity, imagination, personality attributes, and academic success. The findings of their research indicated that there may be a correlation between creativity, imagination, and personality qualities, which could have an impact on academic achievement. This shows that there might be variations in the neurocognitive characteristics of individuals who possess creative abilities compared to those who do not.

Another study [59] examined the creativity profiles of students in the development of independent learning activities. The results of their study indicated that students with varying creativity profiles may demonstrate distinct neurocognitive profiles, hence suggesting potential disparities between individuals classified as creative and those classified as non-creative. The study described in [60] examined the utilization of creative cognition and positive affect in academic research. According to their study, it was proposed that kids with a propensity for creativity may demonstrate distinct cognitive and affective mechanisms compared to their non-creative counterparts, potentially impacting their aca-



demographic achievements. In the work of another researcher [61], the utilization of creativity to mitigate ethnic bias within the context of college admissions was examined. According to the study's findings, individuals from diverse ethnic backgrounds may demonstrate varying degrees of creativity, implying potential variations in their neurocognitive profiles.

Another researcher [32] investigated the psychological aspects of the inclination towards novelty-seeking, creativity, and innovation. The available evidence indicated that individuals with varying levels of novelty-seeking, creativity, and invention may display distinct neurocognitive profiles, implying possible distinctions between students with creative abilities and those without. Another study [39] focused on examining the impact of creativity and intelligence on academic achievement. The study implied that individuals who thrive in creativity and intellect may exhibit different neurocognitive profiles than those who excel in only one category, highlighting potential disparities between creative and non-creative students. In brief, variations in neurocognitive profiles exist between creative and non-creative students across multiple dimensions. These dimensions encompass problem-solving aptitude, inclination, capacity for creative endeavors, personality characteristics, cognitive approaches, values, sleep quality, and cognitive and affective functioning patterns. The distinctions mentioned above may potentially influence disparities in scholastic achievement among those classified as creative and non-creative students.

### *2.3. Promotion of Creativity in the Classroom*

An increasing scholarly focus is on examining how creativity might be cultivated within educational settings. In another study, the researchers [62] examined a pedagogical framework that effectively leveraged cultural resources to cultivate creative thinking within educational settings. This study offers valuable insights into integrating cultural viewpoints and considerations within teaching techniques, aiming to enhance creativity in the classroom. In another study [63], an examination was undertaken on incorporating creativity within STEAM (Science, Technology, Engineering, Arts, and Mathematics) education. This paper examined the significance of creating an environment that fosters creative thinking and problem-solving within educational settings. In the work of other researchers [32], an examination was conducted on the neurocognitive dimensions related to novelty-seeking, creativity, and innovation. This study offered valuable insights into how comprehending the cognitive processes associated with creativity can enhance teaching methodologies to cultivate creativity within educational settings. A study conducted by other researchers [64] investigated the utilization of neuroscience discoveries in creativity training. This paper examined the implications of comprehending the neurological mechanisms underlying creativity to develop impactful treatments and instructional strategies to cultivate creativity in educational settings. In another study, the researchers [65] investigated the beliefs and actions of teachers concerning their efforts to promote student creativity. This study offers valuable insights into the pivotal role of teachers in establishing a nurturing and intellectually engaging atmosphere that fosters the development of creative thinking and self-expression development. Through the synthesis of the studies mentioned above, it can be deduced that the cultivation of creativity within educational settings necessitates the integration of cultural resources, the provision of opportunities for creative cognition, a comprehension of the neurocognitive dimensions of creativity, the application of neuroscience discoveries to pedagogical approaches, and the alignment of educators' beliefs and practices with the promotion of creativity in students. These strategies facilitate the establishment of a conducive learning environment that fosters and amplifies students' creative thinking abilities and problem-solving aptitudes.

### *2.4. Creativity and Cognition Interaction*

The neurocognitive characteristics associated with creativity are dynamic with other cognitive processes, resulting in diverse impacts on academic achievement. According to research [52], creativity emerges as a notable determinant of students' academic achievement across many categories of geometrical problems, with particular emphasis on open-ended,

non-routine problem-solving tasks. This finding suggests that the relationship between creative thinking and problem-solving skills shapes academic performance in geometry. In one study, the researchers [46] emphasized the interconnectedness of creativity, imagination, personality attributes, and academic success. The study's findings indicated that flexibility exhibits the most significant indirect impact on academic achievement, with conscientiousness, initiating imagination, changing imagination, and extroversion following suit regarding their respective effects. This study examined the relationship between personality qualities and creative thinking concerning their impact on academic results. In another study, the researchers [66] investigated the progression of creative task performance among engineering students. The results indicated that promoting creativity among students has the potential to improve their capacity to participate in and excel at creative endeavors, leading to significant effects on their academic achievements. In another study [67], an examination was undertaken to investigate the correlation between individuals' perceived creativity and the Big Five personality qualities. The study's findings indicated that creativity has a crucial role in problem-solving and cognitive aptitude as adults' vocational and overall life achievements. This finding suggests that variations in individual personality traits can shape how creativity is manifested and its subsequent effects on academic achievement.

In another study [68], the researcher investigated the impact of several interventions on creativity and academic performance. The findings suggest that the utilization of various creative applications can have a beneficial impact on academic performance. The neurocognitive characteristics associated with creativity are reciprocal with several cognitive functions, including problem-solving aptitude, personality traits, and imaginative thinking, thereby impacting academic achievement. Implementing diverse interventions and approaches in the classroom can facilitate the development of creativity among students, augmenting their cognitive processes and yielding favorable outcomes in terms of academic accomplishment.

### 3. Materials and Methods

This is a systematic review of the literature carried out using the search terms "creativity, intelligence, academic achievement, learning, students, reading, understanding" in bibliographic databases (PubMed, Scopus, and HEAL-link) and their synonyms and combinations.

For an article to be included in the study, it had to meet the following criteria: (1) it had to be a scientific article; (2) it had to be written in English; (3) be germane to the topic of the study; (4) its sample had to include students aged 5 to 16 with normal, typical development; (5) published between 2016 and 2022; (6) published in a reputable scientific journal; (7) the article had to be a research or longitudinal study, (8) be in the field of psychology, (9) be exhaustive; and (10) be freely accessible.

The PICOS (Population, Interventions, Controls, Outcomes, Study design) method was utilized as a criterion for including articles in this study. Articles were included in the search if their country had a population of students up to 16 with standard, typical development and no diagnosed developmental disorders who attended public schools. Children's creativity should have been evaluated using a recognized creativity assessment test, such as the Torrance Creative Thinking Test modified for each country's population, the Dimension Change Card Sort, the Consensual Assessment Technique, or the Aurora battery.

After searching the databases for the articles and implementing the filters, 550 articles were retrieved. After evaluating these, seven articles emerged. After acquiring the bibliography and evaluating the articles based on criteria, duplicate articles were identified and removed from all search results from the three databases. Then, the titles of the articles were evaluated, and those incompatible with the purpose of the systematic review were excluded. The abstracts of the remaining studies were subsequently read, and those that did not satisfy the inclusion criteria were discarded. The full texts of the studies that were

discovered as a result of the previous search were examined, and those that needed to provide the necessary information regarding the subject and purpose of the review were eliminated. The methodology and quality of the studies were evaluated, and those that met the eligibility requirements were chosen (Figure 2).



**Figure 2.** Flowchart of literature review steps.

#### 4. Results

Researchers from various nations and cultural origins published the articles (n = 21). The studies were published in English-language scientific journals. Six research projects were funded—two longitudinal, one cohort, two descriptive, and two explorative studies (Table 1).

**Table 1.** Main Results and Study Characteristics.

Authors	Population	Purpose	Tools	Results
Bezerra et al., 2022 [69]	75 children (7–9 years old)	Characterizing creativity, intelligence, phonological awareness, and reading decoding and verifying potential relationships between creativity and these skills	Brazilian Figural Creativity Test (TCFI) Wechsler Abbreviated Scale of Intelligence (WASI) Phonological Awareness—Sequential Assessment Tool (CONFIAS) Reading Assessment of Words and Pseudowords Isolated (LPI)	Correlations between creativity with intelligence and reading skills were found for all three grades, with Year 3 having the strongest correlations.
Bayley, 2022 [70]	306 children (7–11 years old)	Exploration of cognitive flexibility based on adaptive skills such as problem-solving and creativity	Dimension Change Card Sort (DCCS) Flexible Item Selection Task (FIST) Object-based Pattern Reasoning Assessment (OPRA)	Cognitive flexibility predicts nonverbal reasoning, and there is limited evidence of a relationship between cognitive flexibility and reading abilities.
Rubenstein et al., 2022 [71]	141 children (5–6 years old)	Examining the relationship between learning and creativity in first graders using static and developmental achievement scores in reading and mathematics	Torrance Tests of Creative Thinking-Figural (TTCT-F) Northwest Evaluation Association-Measure of Academic Progress-Growth (NWEA-MAP-Growth)	Significant positive relationships were found between student creativity and static academic achievement scores in both reading and mathematics.
Sur & Ates, 2022 [72]	380 children (11 years old)	Determining the relationship between reading, listening comprehension and creative thinking levels of 7th grade students	Reading Comprehension Achievement Test Listening Comprehension Achievement Test Torrance Creative Thinking Test Verbal A Form	A positive, statistically significant relationship was found between listening comprehension and reading comprehension scores with creative thinking ability.
Toivainen et al., 2021 [73]	1306 children (9–16 years old)	An investigation of creativity in children’s written work at the age of 9 and its association with educational achievement	Consensual Assessment Technique (CAT) WISC-III Cognitive Abilities Test 3	Creative expressiveness, as a measure of creativity, explained variance in English scores independently of children’s intelligence and motivation over time.
Zhang et al., 2020 [74]	1082 children (8–15 years old)	Exploring gender differences in the relationship between creativity and academic achievement	Torrance Test of Creative Thinking Figural Form A Self-reported personal data	Creativity and academic achievement and gender differences in which aspects of creativity were related to academic achievement.

Table 1. Cont.

Authors	Population	Purpose	Tools	Results
Mourgues et al., 2016 [75]	1165 children (10–16 years old)	Assessing the specific contribution of creativity to future academic performance	Key Stage 2 (KS2) test Aurora General Certificate Secondary education	The general form of creativity was found to contribute to future academic performance independently of other academic skills.
Lamichhane et al., 2020 [76]	Undergraduate and graduate students from engineering, management, and science backgrounds at Kathmandu University, Nepal in Finland and Nepal	Fostering creativity in the classroom is possible through lab-based teaching-learning methods that focus on problem-solving and design thinking. [RQ4]	A lab-based teaching-learning method focused on problem-solving and design thinking was used as an intervention	Results validated the efficacy of lab-based teaching-learning in addressing the need for critical and creative thinking skills among learners.
Bollimbala et al., 2020 [77]	92 MBA students	[RQ4] [RQ2]	A 20-min Hatha yoga intervention session was administered as a short case study	Hatha yoga improves divergent thinking, but the control group worsens it. No effect on convergent thinking. These findings support the executive function hypothesis. The study also finds that encouraging creativity in a routine academic task may not improve it.
Ruiz-Ariza et al., 2017 [78]	184 participants	Creativity Emotional Intelligence (Measured Through 4 Factors: Well-being, Self Control, Emotionality, And Sociability) [RQ4] [RQ3] [RQ2]	A 12-week cooperative high-intensity interval training (C HIIT) intervention	Teens aged 12–16 showed increased creativity and emotional intelligence (EI) with cooperative high-intensity interval training (C-HIIT). Inactive adolescents in the experimental group (EG) improved more in creativity, well-being, and sociability than the control group (CG). Starting PE classes with 16 min of C-HIIT may be recommended, regardless of other activities.

Table 1. Cont.

Authors	Population	Purpose	Tools	Results
Nejad, N.S. (2017) [79]	60 participants	Effectiveness Of Children's Educational Model Based On The Criteria Of Creativity [RQ4]	Experimental and Control Groups of preschool children	A clinical trial examined how a child-centered teaching model affected preschoolers' creativity. Results indicated the model significantly impacts children's creativity ( $p < 0.05$ ). This study may affect childhood disorder prevention and treatment
Sadeghi et al., 2020 [80]	30 participants	Mental simulation training can boost architecture students' creativity and academic performance [RQ4]	Teaching mental simulation strategies for 5 sessions of 3 h	Mental stimulation can boost architecture students' creativity and academic performance
Colzato et al., 2018 [81]	80 healthy young volunteers with active tVNS and sham stimulation	Creativity interacts with other cognitive processes to affect academic performance because the vagus nerve is causally involved in creative performance, and GABA (likely to be increased in active tVNS condition) supports the ability to select among competing options in high selection demand (divergent thinking) but not in low selection demand	Transcutaneous vagus nerve stimulation (tVNS) and placebo/sham stimulation	Vagus nerve stimulation (tVNS) boosts divergent thinking. Compared to sham stimulation, active tVNS increased divergent thinking. Results indicated that GABA (likely to be increased in active tVNS condition) aids divergent thinking but not convergent thinking.
Peña et al., 2022 [82]	66 people with 3 characteristics	[RQ5] [RQ1]	20 min of transcranial direct current stimulation (tDCS), transcranial random noise stimulation (tRNS), and sham dose	Divergent and convergent thinking were significantly affected by tDCS and tRNS over the left dorsolateral prefrontal cortex (DLPFC) and left inferior frontal gyrus (IFG). Compared to sham, tRNS performed better in PC fluency and originality. The stimulation groups had no significant effect on cognitive flexibility.

Table 1. Cont.

Authors	Population	Purpose	Tools	Results
Bóo et al., 2019 [83]	6 undergraduate students	[RQ3] [RQ2]	A mindfulness intervention was conducted	All students found mindfulness improved self-awareness and self-regulation of thoughts, feelings, and actions. Students' psychological distress and study habits may affect the initial impact of mindfulness on academic performance.
Lifshitz-Ben-Basat, A., and Mashal, N. 2021 [84]	This study was a randomized, double-blind, sham-controlled, crossover study	Transcranial direct current stimulation (tDCS) can alter the left angular gyrus (AG) of the frontotemporal network, motivation traits, and the control network, which are involved in creative thinking. [RQ1]	tDCS (transcranial direct current stimulation) intervention with tDCS (transcranial direct current stimulation) dose	Cathodal tDCS over the left AG significantly increased novel metaphor generation, while anodal stimulation increased conventional metaphors. In the sham condition, higher motivation (behavioral approach system "fun-seeking") was associated with metaphor creativity, while lower fun-seeking was associated with more conventional metaphors. Motivation traits no longer influenced creative metaphor generation after active stimulation.
Akpur, U. 2020 [85]	227 students	Academic Achievement [RQ1]	The Critical Thinking Scale, The Reflective Thinking Scale, and The Marmara Creative Thinking Dispositions Scale were administered	Critical, reflective, and creative thinking were positively and significantly correlated. All three variables significantly predicted academic success.
Peña et al., 2019 [86]	30 people divided into an active tRNS group and a sham group	The Remote Associates Test (RAT), the Torrance Tests of Creative Thinking's Unusual Uses and Picture Completion subtests, and general creativity measure verbal convergent, divergent, and general creativity. No improvement was seen in visual divergent thinking. [RQ1]	A 20-min intervention of transcranial random noise stimulation (tRNS) and sham stimulation	Left tRNS DLPFC improves verbal divergent and convergent thinking. RAT scores, unusual uses fluency and originality, and general creativity differed significantly between the active tRNS and sham groups in mean change scores. No improvement was seen in visual divergent thinking.

Table 1. Cont.

Authors	Population	Purpose	Tools	Results
Brown, S. and Kim, E. 2021 [87]	Humans	Creative production is, at least in part, an enhancement of sensorimotor brain areas involved in non-creative production, and the motoric meta-analysis showed that high-level motor areas like the pre-supplementary motor area and inferior frontal gyrus that interface motor planning and executive control were the most concordant. [RQ3]	This study was a meta-analysis	In a meta-analysis of creative production in five domains (verbalizing, music, movement, writing, and drawing), the pre-supplementary motor area and inferior frontal gyrus were activated. The Alternate Uses meta-analysis showed a distinct activation profile, suggesting creative production domain-specificity. Creative production may enhance sensorimotor brain areas involved in non-creative production, according to the activation profiles of the two meta-analyses.
Sunavsky, A. and Poppenk, J.L. 2020 [88]	Humans	In the inferior frontal gyrus (IFG) and inferior parietal lobe (IPL), creative and non-creative students have different neurocognitive profiles, including local grey matter and white matter predictors, the superior longitudinal fasciculus that connects them, and IFG IPL functional connectivity. The anterior lobe of the cerebellum and parahippocampal gyrus predicted creativity across neuroimaging modalities in exploratory analyses. Creativeness was also predicted by basal ganglia white matter integrity. [RQ3]	This study was a pre-registered conceptual replication and extension study	In the inferior frontal gyrus (IFG) and inferior parietal lobe (IPL), local grey matter and white matter predictors in the IFG, the superior longitudinal fasciculus that connects them, and IFG-IPL functional connectivity predicted greater creativity. Creativeness was also predicted by basal ganglia white matter integrity. Experimental analyses showed that the anterior lobe of the cerebellum and the parahippocampal gyrus predict creativity across neuroimaging modalities.



Table 1. Cont.

Authors	Population	Purpose	Tools	Results
Saggar et al., 2019 [89]	48 children, 26 children	Creative students have higher externalizing behavior, right lateral frontal segregation, and functional specialization, which tracks creative thinking development. [RQ3]	This study was longitudinal cohort sequential experimental design	Data-driven methods showed that middle childhood creative thinking ability varied, with some children declining and others increasing. These trajectories were linked to developmentally relevant constructs like increased externalizing behavior, not intelligence, age, or sex. Increased right lateral frontal segregation or functional specialization accompanied creative thinking development.
Batey, M. and Hughes, D.J. 2017 [90]	Humans	Cognitive ability measures rarely relate to creative self-perceptions. [RQ3]	This study was a systematic review	Creative self-perceptions rarely correlate with cognitive ability. Openness to Experience and Extraversion positively affect creative self-perceptions. Neuroticism, Agreeableness, and Conscientiousness vary by self-perception, domain, and culture.
Hay et al., 2019 [91]	29 professional engineering designers	Creative and innovative design tasks recruit similar brain regions in professional designers, and creative and non-creative students have greater left cingulate and right superior temporal gyrus activity than a design manipulation control task. [RQ3]	This study was fMRI study	Left cingulate and right superior temporal gyrus activity was linked to creative and innovative design performance. Creative and innovative tasks did not differ in pre-frontal brain activity. Professional designers use similar brain regions for creative and innovative design.
Yang, J. and Zhao, X. 2021 [92]	2355 students from a high school in China	Academic Performance [RQ2]	This study was observational	Creativity boosts academic performance. Convergent thinking affects academic performance more than divergent thinking. Students' self-esteem and internal locus of control affect academic performance through creative thinking.

Table 1. Cont.

Authors	Population	Purpose	Tools	Results
Doleck et al., 2017 [93]	104 students	Academic Performance [RQ2]	This study was a structural model employing a partial least squares approach	Except for cooperativity, computational thinking skills did not affect academic performance. Teaching and learning 21st-century skills requires curriculum-mandated higher-order thinking instruction. Successful teaching and learning of 21st-century skills requires curriculum alignment between instructional objectives and evaluation methods.

In all studies, evaluations were conducted on children attending public institutions with the consent of both parents and school personnel. Year of publication, country of origin of researchers, year/duration of implementation, funding, research design, purpose, sample, instruments, results, and conclusions were extracted from each study.

Regardless of children's previous academic performance, Sitorus et al. published a longitudinal study [37] that evaluated the contribution of creativity to future academic performance. The research sample consisted of 1165 seventh-grade students from six schools in England. The researchers used the five "Aurora battery" subtests to evaluate creative and practical abilities to conduct their research. In particular, subtests were administered to evaluate verbal (conversations and figurative language), numeracy (animated numbers), and figurative creativity (book covers and multiple uses). In addition, the Key Stage (KS2) tests were administered to evaluate pupil achievement after completion of certain educational stages.

Furthermore, at age 16, the English, mathematics, and science ratings from the general secondary school certificate were considered. Regarding the procedure, KS2 scores were collected in 2006, the Aurora tests were conducted two years later in 2008, and the scores were examined in conjunction with GCSE scores four years later in 2012. Multiple (domain-specific) creativity factors represented the Aurora subtest scores less accurately than a single (general) creativity factor. Thus, it was determined that the subtests assessed a standard set of general creativity skills but independently evaluated a distinct set of creative skills. In addition, creativity could be used to predict GCE scores independently of KS2 scores. According to the researchers, this result was based on the fact that the creative skills assessed by Aurora are distinct from the academic skills measured by KS2 and may have contributed more to the long-term prediction of GCSE performance four years later. Independent of other academic abilities, the researchers discovered that a general form of creativity contributes to future academic performance.

In 2020, researchers [41] examined the relationship between creativity and academic achievement, as well as gender differences in this relationship, among Beijing, China's upper primary school students. Children aged 8 to 15 years old in Beijing, i.e., fourth, fifth, and sixth-graders from four primary public institutions, participated in the survey. Children's creativity was evaluated using the Chinese variant of the Torrance Test of Creative Thinking (TTCT). In addition, the researchers created a survey to capture the students' personal information. The students' academic achievement was determined by their final semester grades, which professors or a faculty commission evaluated. The correlation between

student creativity and academic achievement was found to range from weak to moderate in the study's findings. The five creativity subtest scores (originality, fluency, elaboration, abstract titles, and resistance to premature closure) were significantly and positively related to students' Chinese performance, whereas only four of the subtest scores (fluency, originality, resistance to premature closure, and abstract titles) were significantly related to students' mathematics achievement. In addition, boys and girls performed notably differently on assessments of creativity. Specifically, boys outperformed girls in originality, whereas girls outperformed boys in abstract title usage. Furthermore, processing and using abstract title scores were considerably correlated with girls' Chinese and mathematics academic achievement.

In contrast, for boys, resistance to early closure was associated with their academic performance in Chinese and mathematics. In contrast, originality and use of abstract titles were only associated with their academic performance in Chinese. The researchers concluded that students' creativity was significantly and positively correlated with their academic achievement and that females' creativity tended to be adaptive. Simultaneously, males demonstrated both innovative and adaptive creativity.

Other researchers [40] conducted a longitudinal study to examine the relationship between nine-year-old children's creativity and educational achievement, regardless of the student's intellect or motivation. The sample consisted of 1306 twin children from Welsh and English institutions. The inclusion criterion for the study was data from children's written accounts between the ages of nine and sixteen. The Consensual Assessment Technique (CAT) was used to code the creativity and nine other dimensions of nine-year-old children's home-written stories under the supervision of their parents and guardians. The CAT measures creativity in shared creative products like children's written stories. On a seven-point scale with ten criteria, children's stories were evaluated: creativity, likeability, novelty, imagination, logic, emotion, grammar, detail, vocabulary, and straightforwardness. Verbal and non-verbal tests were used to assess intelligence at age nine, such as the Vocabulary and General Knowledge tests from the WISC-III and the Figure Classification and Shapes tests from the Cognitive Abilities Test 3. The motivation to write at age nine was assessed with two questions to parents/guardians and children. Teachers assessed educational attainment at ages nine and twelve by recording current achievement in grammar, spelling, and writing, and educational attainment at ages nine and thirteen was assessed by teachers by recording current achievement. According to the research, creative expression and writing motivation at age nine were not significant predictors of academic achievement.

In contrast, logic, intellect, and ninth-grade English writing grade were significant predictors for all children. However, in the second half of the sample, the finding that logic at age 9 is a statistically significant predictor of English writing at age 12 was not replicated. In addition, creative expressiveness, as a measure of creativity, explained variance in English scores across time independent of children's intellect and motivation. In addition, the study revealed moderate genetic and environmental influences on writing creativity at age nine. This study also revealed some intriguing gender distinctions. At nine, females scored higher than boys on tests of creative expression and reasoning, writing motivation, and English writing grades. Even in adolescence, the researchers concluded that creativity in children's writing is associated with academic achievement.

In a 2022 descriptive study, researchers [39] examined the relationship between creative thinking and Turkish students' reading and listening comprehension levels, thereby attempting to demonstrate a connection between language and thought. The research sample comprised 380 seventh-graders from eight public schools in the Ikonium Province of Turkey. The only baseline for the study was the seventh grade because the researchers wanted to examine the development of abstract processing and creative thinking abilities, which develop by age 11. Students' reading comprehension skills were evaluated with the Reading Comprehension Achievement Test (RCAT), their auditory comprehension skills with the Auditory Comprehension Achievement Test (LCAT), and their creative thinking with the Torrance Tests of Creative Thinking (TTCT). Pearson correlation analysis was

utilized for the data analysis. The survey results indicated that secondary school students' reading and listening comprehension levels are average. The correlation between reading comprehension and auditory comprehension was statistically significant, while the correlation between reading comprehension and fluency, a subdimension of creativity, was the least significant. In addition, there was a positive and statistically significant correlation between listening comprehension and creative thinking scores. There was also a positive and significant correlation between reading and auditory comprehension. Finally, a correlation between reading comprehension and creative thinking abilities appeared. All association trends were statistically significant, according to the researchers' findings. Therefore, they believe it necessary to encourage students to develop a positive attitude toward reading, listening, and writing and exercise reading and writing to foster and develop their creative thinking.

In 2022, other researchers [38] studied the relationship between first-grade students in the Midwestern United States and their creativity. The survey included 141 students, with a mean age of 6.19 years, from two schools with comparable demographic characteristics in the Midwestern United States. The research was conducted using the Torrance Tests of Creative Thinking-Figurative (TTCT-F) to measure the students' creativity and the Northwest Evaluation Association-Measure of Academic Progress-development (NWEA-MAP-Growth) to evaluate students' achievement development in math and reading over time. To conduct the research, permission was sought from the student's parents, who were notified via electronic newsletter and regular mail and gave their assent. The research revealed a correlation between all TTCT-F scores and academic achievement, including math and literacy. This suggests that even kindergarten and first-grade students exhibit the exact relationships between creativity and academic achievement as older students. In addition, students who can better comprehend stimuli or generate original ideas are more likely to demonstrate academic success. However, no significant correlations between academic development and TTCT-F scores were discovered. However, grade level substantially influenced the relationship between creative thinking processes and academic growth in reading and mathematics, with kindergarteners exhibiting significantly more significant growth than first graders. Inferred from the foregoing, the study demonstrates significant positive relationships between TTCT-F performance and static academic achievement scores in reading and mathematics. However, the correlation with academic growth scores could have been more precise.

In 2022, researchers [35] conducted a cohort study with measurements in grades one and four on cognitive flexibility based on adaptive skills, such as problem-solving and creativity, in low-resource school-attending Rwandan students. Three hundred and six children aged 7–8 and 10–11 from primary institutions in Kigali, Rwanda, as well as informal settlements and villages, participated in the study to determine the population's poverty index. The Dimension Change Card Sort (DCCS), which assesses the classification of primarily colors and shapes, and the Flexible Item Selection Task (FIST), which measures flexibility in selection and object matching, were used to evaluate children's cognitive flexibility. The Object-based Pattern Reasoning Assessment (OPRA), which assesses non-verbal reasoning through the recognition of patterns in sequences, four literacy activities were used to assess reading, which was selected from validated context-adapted reading assessment tools and in the Rwandan language, and self-made questionnaires were used to assess the student's personal and socioeconomic characteristics. Several factors demonstrated significant correlations with students' cognitive flexibility, as demonstrated by the research findings. In measures of cognitive flexibility, literacy, and nonverbal reasoning, Grade 4 students scored substantially higher than grade one students. This was true for both literacy and nonverbal reasoning assessments.

Even after controlling for background variables, significant differences were found in the cognitive flexibility of Rwandan students across schools. In addition, the family structure appeared to significantly affect cognitive flexibility, as children from single-parent families performed better than students from nuclear families despite living in more

modest homes and consuming fewer protein-rich foods. The most significant finding of this study is the correlation between cognitive flexibility and other learning outcomes among Rwandan children, as cognitive flexibility predicts non-verbal reasoning. In addition, limited evidence of a correlation between cognitive flexibility was discovered. Due to their limited exposure to print and written materials before entering the classroom, seven- and eight-year-olds need help with adaptability and literacy skills. The correlations between cognitive flexibility and reading and language skills appeared more stable and dependable among fourth-graders. The researcher concludes that curricula based on fostering abilities that enhance creativity and problem-solving are the foundation for enhancing academic accomplishments and developing skills to adapt to changing conditions.

Additionally, researchers [36] conducted an exploratory study on the relationship between creativity and reading, phonological awareness, and decoding skills. The sample consisted of 75 children of both sexes in grades one (6–7 years), two (7–8 years), and three (8–9 years) from public elementary institutions in Natal, Brazil. The method's selection criteria required candidates to be in grades one to three at a primary school in Natal. In contrast, exclusion criteria included a history or diagnosis of neurodevelopmental disorder and hearing, vision, and movement disorders. The Brazilian Figural Creativity Test (TCFI), which measures creativity through numbers, was used to evaluate the abovementioned abilities. The Wechsler Abbreviated Scale of Intelligence (WASI), adapted for the Brazilian territory, the Phonological Awareness—Sequential Assessment Tool (CONFIAS), which measures phonological awareness, and the Reading Assessment of Words and Pseudowords Isolated (LPI), which measures children's reading of words and pseudowords. All parents and guardians were informed and provided written consent for their children's participation. The children were withdrawn individually from the classroom for three 40 min assessment sessions in a room with minimal distractions. The results indicated that creativity did not appear to develop, as expected by the researchers based on the available literature, and that there were no significant differences between school years. No significant distinctions existed between the first and second grades regarding phonological awareness performance. On the LPI, all divisions had relatively low performance. However, their performance improved as the number of students in a class increased. Furthermore, significant all-grade correlations were found between verbal tests, executive functions (intelligence assessment), and creativity, and these correlations increased over time, even when intelligence and creativity indices were below average.

Regarding the relationship between creativity, reading, and phonological awareness, it was observed that correlations between creativity, phonological awareness, and reader decoding were weak regarding significance and effect size in the first and second years. In contrast, the correlations in the third year ranged from moderate to robust. These disparities are likely the result of the first- and second-graders immature development. It was discovered that creativity in reading allowed for the development of cognitive skills, including language, imagination, freedom of expression, and cognitive and linguistic abilities. The researchers determined that creativity was related to skills such as literacy and intelligence in all three grades, with the strongest correlations occurring in third grade.

## 5. Discussion

Creative thinking is linked to various cognitive processes. According to a study [81], it was discovered that transcutaneous vagus nerve stimulation (tVNS) can promote divergent thinking, which refers to the cognitive skill of generating various solutions to a given problem. The study conducted by Peña in 2022 demonstrated that the application of transcranial random noise stimulation (tRNS) on the left dorsolateral prefrontal cortex (DLPFC) resulted in enhanced performance on a picture completion test. This task is commonly used to assess fluency and originality in divergent thinking. The study conducted by a researcher in 2021 [84] revealed that the application of cathodal transcranial direct current stimulation (tDCS) on the left angular gyrus (AG) enhanced the production of unique metaphors. Conversely, anodal tDCS was found to facilitate the formation of traditional

metaphors. In another study [86], it was determined that transcranial random noise stimulation (tRNS) administered over the left dorsolateral prefrontal cortex (DLPFC) yielded enhancements in verbal convergent and divergent thinking abilities. The studies mentioned above suggest that creative thinking encompasses various cognitive mechanisms, namely divergent thinking, cognitive flexibility, and metaphor formation. Furthermore, these cognitive processes can be influenced by the application of brain stimulation techniques such as transcutaneous vagus nerve stimulation (tvNS), transcranial random noise stimulation (tRNS), and transcranial direct current stimulation (tDCS) [RQ1].

Moreover, implementing physical and mental activities, such as Hatha yoga and cooperative high-intensity interval training, can enhance students' creativity. The study conducted by a researcher in 2020 [77] revealed that engaging in a 20 min Hatha yoga session significantly enhanced divergent thinking abilities among MBA students. In a study conducted by another researcher in 2017 [78], it was discovered that the implementation of cooperative high-intensity interval training positively impacted the enhancement of creativity and emotional intelligence among a group of physically unfit adolescents. However, the study conducted by a researcher in 2020 [83] yielded varied outcomes regarding the influence of mindfulness on academic achievement. Some students indicated a good correlation between mindfulness and academic performance, whereas others claimed an initial negative association. In general, the literature indicates that engaging in physical and mental workouts can enhance creativity and, conceivably, scholastic achievement. Further investigation is required in order to gain a comprehensive understanding of the interplay between these variables [RQ2].

Concerning the differentiation of neurocognitive abilities between pupils classified as creative and non-creative pupils, notable distinctions exist in the neurocognitive profiles exhibited by individuals falling into these categories. In one study [94], it was observed that individuals recognized as prominent creators exhibited discernible activity patterns in brain regions associated with default mode and executive functioning when engaged in creative thinking, as opposed to individuals not recognized as eminent thinkers. In another study [95], it was observed that individuals with high levels of creative achievement exhibited discernible structural variations in their brains, particularly within the parietal cortex, compared to individuals with average levels of creative achievement.

According to one researcher [74], the cognitive process of creativity encompasses both divergent and convergent thinking, which are influenced by metacontrol states that may be observed through distinct patterns of cortical brain activation. In general, the publications mentioned above indicated variations in brain activity patterns and brain morphometry that are linked to creative performance. Furthermore, these variations may correlate with an individual's creative eminence or accomplishment level.

Furthermore, one study [96] revealed that engaging in creative production positively impacts the sensorimotor brain regions that are often associated with non-creative production. According to another study [89], it was observed that enhanced levels of creativity were generally associated with specific characteristics of the inferior frontal gyrus (IFG) and inferior parietal lobe (IPL). These characteristics encompassed local grey matter and white matter predictors within the IFG, the superior longitudinal fasciculus that connects these regions, and the functional connectivity between the IFG and IPL. According to the study [97], there were identifiable patterns in the development of children's creative thinking ability during middle childhood. The research also revealed that enhanced segregation or functional specialization in the right lateral frontal region of the brain corresponded with increases in creative thinking capacity over time. In a study conducted by a researcher in 2017 [90], it was discovered that a consistent and positive correlation exists between individuals' self-perceptions of creativity and their levels of Openness to Experience and Extraversion. Nevertheless, the associations between Neuroticism, Agreeableness, and Conscientiousness exhibit a greater level of complexity and differ depending on the specific form of self-perception (such as trait, process, or product), the particular domain of self-perception (such as arts or science), or the cultural context [RQ3].

Moreover, the cultivation of creativity within the educational setting can be facilitated by a range of interventions. According to another study [76], the implementation of laboratory-based learning had a positive impact on the enhancement of critical thinking and creativity among both undergraduate and graduate students. The study [77] revealed that engaging in a 20 min Hatha yoga session enhanced divergent thinking abilities among MBA students. In a study conducted by Ruiz-Ariza in 2017, it was discovered that implementing cooperative high-intensity interval training yielded positive effects on physically inactive adolescents' creative abilities and emotional intelligence. In the study [79], it was determined that implementing a child-centered teaching model, which was designed according to specific creativity criteria, significantly enhanced preschool children's creative abilities. The results of this study indicated that many interventions, including laboratory-based learning, Hatha yoga, cooperative high-intensity interval training, and child-centered teaching approaches, can enhance creativity in the classroom [RQ4].

Moreover, the interplay between creative and cognitive processes influences academic achievement. In a study [81], it was discovered that the application of transcutaneous vagus nerve stimulation (tVNS) improved divergent thinking, a crucial aspect of creativity. The study [82] demonstrated that applying transcranial random noise stimulation (tRNS) on the left dorsolateral prefrontal cortex and left inferior frontal gyrus enhanced performance on a picture completion test. This task is commonly used as an indicator of divergent thinking abilities. Nevertheless, the study conducted by Peña in 2022 did not yield any statistically significant results about the impact on convergent thinking or cognitive flexibility. The results of this study indicated that the augmentation of creativity through activating targeted cerebral areas could potentially lead to an enhancement in scholastic achievement [RQ5].

Additionally, this research presents empirical support for the correlation between creativity and performance. Based on the empirical findings of the conducted research, it was observed that creativity significantly impacted academic achievement, irrespective of other academic abilities. Furthermore, research findings have indicated that cultivating adaptive creativity positively influences the academic performance of females. Conversely, both inventive and adaptive creativity have been identified as significant contributors to academic success for males. The presence of creativity can be observed in children's written work, and it can be considered an indicator of their potential for achieving scholastic achievement in the future. Ultimately, a significant association has been shown between individuals' reading and listening abilities and their creativity and mathematical proficiency levels.

Specifically, this study offers many insights into the correlations between creative cognitive processes and achievement in academic settings. Nevertheless, numerous constraints will exert an influence on future research endeavors. The research investigations may have benefited from a larger sample size, which would have allowed for more generalizability of the results to a diverse population of students from other nations. Furthermore, much research has indicated a moderate association between creativity and educational attainment—the evaluation process needed to comprehensively assess diverse academic disciplines and competencies. The scope of the research articles, however, was constrained to particular skills associated with creativity, including reading, writing, and mathematics.

Based on the constraints mentioned above, it is advisable to undertake further investigation to assess the impact of creativity on improving abilities within an educational setting. The necessity of conducting systematic reviews is widely acknowledged, wherein the inclusion of research incorporating additional variables, such as children's personality traits, the socio-economic setting of their development, and the characteristics of their families, is deemed essential for investigating this association. Furthermore, it is recommended that future studies aim to comprehensively understand the role of creativity in the learning process, considering many aspects at the classroom level. Ultimately, examining the potential ramifications of a lack of creativity within educational settings on scholastic achievement is imperative.

The impact of creativity on future academic performance is both predictive and cumulative. Hence, it is imperative to acknowledge and foster creativity within education

while facilitating avenues for the manifestation and cultivation of creative abilities. This, in turn, can engender novel prospects for educational and vocational growth among students.

The concept of creativity is a complex and multidimensional construct that has had a profound influence on scholastic achievement. Numerous scholarly investigations have examined the correlation between creativity and academic attainment, focusing on elucidating the neurocognitive aspects of creativity and its impact on bolstering scholastic accomplishment. Another study [46] discovered that creativity can serve as a compensatory mechanism for those with lower levels of intellect, positively influencing their academic achievement. The researchers concluded that a statistically significant positive relationship exists between creativity and academic accomplishment. Furthermore, they found that higher levels of creativity among students are associated with increased academic achievement. A further investigation [47] provided evidence of the correlation between creativity and academic performance. The study revealed a statistically significant correlation between creativity and academic performance, as evidenced by a confidence level of 99 percent.

Additionally, some researchers [96] conducted a study in which they formulated a theoretical framework suggesting that self-perceived intelligence and creativity, in conjunction with the Big Five personality traits, are predictors of psychometric intelligence and creativity. These factors, in turn, are posited to influence academic achievement. The investigation of creativity from a neuroscientific perspective has provided valuable insights into the neurocognitive mechanisms that underlie creative thinking and its influence on academic achievement. According to [36], neuroscientific research on creativity is currently lacking in theoretical development. Nevertheless, it exhibits potential for elucidating the brain systems implicated in creative cognition. In conjunction with the neurocognitive characteristics associated with creativity, there are additional elements, namely personality traits and emotional intelligence, which have been observed to impact one's scholastic achievements. According to [89], a positive correlation exists between self-reported conscientiousness and academic success. Nevertheless, when conducting cross-country evaluations, it has been observed that nations exhibiting higher levels of conscientiousness tend to exhibit poorer performance on assessments measuring mathematical and reading abilities.

Furthermore, another study [98] revealed that emotional intelligence, in conjunction with creativity, exerts a noteworthy influence on academic achievement among youngsters. This implies that the interplay between cognitive and emotional elements plays a role in determining academic success. The correlation between creativity and academic achievement is a topic that has generated considerable debate. In the scholarly discourse, a study [97] draws attention to divergent findings in the existing literature concerning the correlation between creativity and academic attainment. Nevertheless, most of the studies examined in this study substantiate the existence of a favorable correlation between creativity and academic performance.

In summary, the neurocognitive characteristics associated with creativity have a significant impact on improving academic achievement. The presence of creativity can serve as a means to offset a deficiency in intellectual capacity and augment one's academic performance. Examining creativity from a neuroscientific perspective provides valuable insights into the neurological processes underlying innovative and imaginative ideas. Various elements, such as personality traits and emotional intelligence, are known to exert influence on academic achievement. In educational environments, the cultivation of creativity can have beneficial outcomes for students' academic performance.

## **6. Conclusions**

The neurocognitive profile of creativity influences academic performance positively through multiple cognitive, emotional, and motivational mechanisms. Integrating creative approaches into educational practices may improve students' problem-solving skills, motivation, and engagement and reduce their stress levels. However, the precise nature of these effects may vary based on the situation and the individual. As neuroscience and education



continue to develop, additional research is required to understand the relationship between creativity and academic achievement.

The results of this research illustrate a significant and positive correlation between creativity and educational competence, specifically in the domains of reading, comprehension, and written assignments. Neurocognitive processes, such as predictive representations, executive functions, associative and divergent thinking, and predictive thinking, significantly influence the attributes associated with creativity. The study advocates for enhancing creativity in academic environments by examining the correlation between the utilization of cultural resources, the congruence between instructors' attitudes and the encouragement of creativity, and the understanding of neurocognitive factors that impact creative processes.

Although creativity has the potential to affect academic performance positively, it is crucial to acknowledge and analyze the limitations and potential confounding factors that could influence the neurocognitive aspects of creativity concerning its impact on academic performance. Various factors, including neurocognitive deficits, sleep patterns, emotional parameters (anxiety), gender differences, individual traits, and educational attainment, can significantly influence the association between creativity and academic achievement [99]. To overcome these limitations, it is imperative to adopt a multidisciplinary approach that integrates perspectives from various disciplines such as neuroscience, psychology, education, and related fields.

Further research into the neurocognitive aspects of creativity concerning enhancing academic performance may delve into diverse avenues, thereby expanding our comprehension of this association. An area that warrants exploration is examining the influence of social media on academic achievement and creative abilities. In addition, future longitudinal studies have the potential to offer further insights into the predictive capacity of neurocognition and its influence on academic achievement. Further exploration is warranted in examining the role of creativity within the realm of academic entrepreneurship. Furthermore, researching the correlation between emotional intelligence and creative performance can yield significant insights. Subsequent research endeavors may delve into the examination of the influence exerted by emotional intelligence on the creative output of individuals, thereby elucidating its potential ramifications on scholastic attainment. Moreover, it is suggested that future studies investigate the correlation between curiosity, creativity, and motivation concerning academic achievement. Furthermore, future research endeavors may delve into the examination of various components of the educational setting, such as pedagogical approaches and physical classroom arrangements, in order to ascertain their effects on the cultivation of creativity and its subsequent implications for scholastic achievement.

Lastly, Virtual Reality (VR) and Augmented Reality (AR), along with the utilization of Artificial Intelligence (AI) algorithms and recommender systems mainly applied in education, health, or other research fields, have the potential to analyze and comprehend patterns in creative thinking [100]. This analysis can illuminate the correlation between creative thinking and academic achievements. Furthermore, investigating the impact of immersive creative experiences on brain function represents another significant avenue for future research.

Moreover, future investigations about the role of creativity in educational environments could explore the inclusion of special populations, such as gifted individuals, by analyzing their neurocognitive profile. Researching the examination of creativity within populations characterized by attention deficit hyperactivity disorder (ADHD), autism, dyslexia, and other neurodivergent conditions holds significant potential for advancing scholarly investigations in this domain. With the progression of technology and the increasing knowledge about the brain, there is a growing potential to explore the neurocognitive characteristics of creativity and its impact on academic achievement. The findings of this study have the potential to significantly influence educational methodologies, pedagogical strategies, and societal perspectives regarding creativity and intelligence.

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Review

# The Influence of Active and Passive Procrastination on Academic Performance: A Meta-Analysis

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**Abstract:** The relationship between academic performance and procrastination has been well documented over the last twenty years. The current research aggregates existing research on this topic. Most of the studies either find no result or a small negative result. However, recent studies suggest that procrastination can have a positive influence on academic performance if the procrastination is active instead of passive. To analyse the effect of active procrastination on academic performance, a meta-analysis was conducted. The analysis includes 96 articles with 176 coefficients including a combined average of 55,477 participants related to the correlation between academic performance and procrastination. The analysis uncovered a modest negative correlation between academic performance and procrastination overall. Importantly, the type of procrastination exerted a substantial impact on the strength of this correlation: active procrastination demonstrated a small positive effect size, whereas passive procrastination registered a small negative effect size. Additionally, participant-specific characteristics and indicators further modulated the magnitude of the correlation. The implications of this research extend to underscoring a potential beneficial aspect of procrastination, specifically elucidating how certain types of procrastination can positively influence academic performance.

**Keywords:** procrastination; academic performance; meta-analysis; active procrastination; passive procrastination

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## 1. Introduction

While academic performance is relatively straightforward to define as the extent to which someone has achieved their academic goals, such as sufficient grades and diplomas [1], the definition of procrastination proves more complex due to its multifaceted nature and various types. A common method employed to classify these types of procrastination is to distinguish between trait (or general) procrastination and state (or situational) procrastination. Trait procrastination refers to a general tendency to procrastinate, while situational procrastination is triggered by a specific context [2]. One of the most pressing forms of situational procrastination occurs in academic contexts. Academic procrastination is defined as the delay of completion or initiation of academic tasks to the point where the delay can be described as irrational [3]. A study conducted by Sirin [4] revealed a moderate correlation between situational and academic procrastination. Within academic procrastination, one can distinguish between behavioural or avoidant procrastination, defined as the postponement of action, and decisional procrastination, defined as the postponement of decisions [5].

Over the past four decades, research has consistently indicated a high prevalence of procrastination. An early study reported that 46% of students exhibited signs of academic procrastination [6]. Another study by Harriot and Ferrari [7] reported that chronic procrastination affects 20% of adults. A recent study by Popova and Pronenko [8], based on

self-reported data, indicated that up to 60% of college students exhibit significant levels of academic procrastination. So, the prevalence rates of procrastination vary considerably across studies and specific types of procrastination.

Unfortunately, academic procrastination can come at a serious cost to well-being, self-efficacy, and academic performance, while increasing test anxiety and academic stress [9]. Other research has linked procrastination to anxiety, lack of self-esteem, and depression [10]. Multiple meta-analyses have consistently found a negative correlation between procrastination and academic performance, with effects ranging from minor to moderate in severity [11–16].

The decline in academic performance associated with procrastination can be attributed to both direct causes and a multitude of indirect effects. A direct influence of procrastination is the delay of academic tasks, reducing the time available for studying or project work, which in turn diminishes performance due to time constraints. This behaviour may hinder the utilisation of distributed practice, a technique known to enhance memory retention when applied effectively [17]. This typically leads to cramming, often compromising sleep quality [18]. Indirectly, procrastination may influence academic performance through various factors including lack of motivation, suboptimal learning approaches [19], increased anxiety, aversiveness, loss of productivity, sense of social disapproval, stress [20], and poor self-regulation [21]. The many indirect effects complicate the assessment of procrastination's direct impact on academic performance. Moreover, most studies report correlational data, which do not clarify the causal relationships between these variables. It is possible that there is no direct causal link, and that the observed low academic performance and procrastination are both outcomes of other underlying factors. This complexity contributes to ongoing debates regarding the relationship between procrastination and academic performance [22].

While the existing literature has predominantly concentrated on the negative aspects of procrastination, some types may lead to benefits. Chu and Choi [23] argue for a differentiation between passive and active procrastination. Passive procrastination is characterised by indecision to act, whereas active procrastination is marked by a preference and deliberate decision to work under pressure. Alternative terminologies for these procrastination types have been proposed, such as structured and unstructured procrastination [24], or strategic delay and procrastination [25], serving similar conceptual roles as active and passive procrastination, respectively. According to Kim et al. [26], active and passive procrastination differ in their correlation with personality and academic performance. They report that passive procrastination is negatively related to the ability to meet deadlines, extraversion, agreeableness, conscientiousness, and Grade Point Average (GPA), but positively related to neuroticism, which is the inclination to experience adverse emotions. Conversely, active procrastination has positive low to high correlations with a preference for pressure, ability to meet deadlines, outcome satisfaction, extraversion, and a negative correlation with neuroticism. Although active procrastination has no significant correlation with GPA, it is preferable relative to passive procrastination, which has a medium negative correlation with GPA.

Knowing this distinction between active and passive procrastination, one can divide the different procrastination measurement tools into those that measure active and passive procrastination (see Appendix A for a comprehensive summary of different procrastination indicators). The summary was compiled by applying the snowball technique to existing literature [27]. This means that an initial pool of articles was searched using the keyword "procrastination assessment", from which each reference list was examined to find further references, and this repeated until no new procrastination indicators were found. The summary in Appendix A lists the most common procrastination indicator tools, including how they assess both procrastination itself and procrastination type. The list does not include workplace-related procrastination, but mostly general, behavioural, avoidant, decisional, and academic procrastination.

Of all the different measurement tools, the Procrastination Assessment Scale for Students (PASS) [6] is the most known and established assessment tool. The PASS assesses procrastination using 12 self-reported items using two subscales related to the frequency and problem of procrastination. Similarly, most other procrastination indicators use self-assessment questionnaires, with the only exception being the Procrastination Checklist Study tasks (PCS) [28], which offer a measurement based on study-related behaviours including time of initiation intention and time of completion. To our knowledge, the only procrastination indicators that look at both passive and active procrastination are the Academic Procrastination Scale (APSM) [24] and the Metacognitive Beliefs about Procrastination scale (MaP) [29]. The APSM assesses both active and passive procrastination by assessing the common characteristics of both types of procrastination in a self-assessment questionnaire. The MaP assesses metacognitive beliefs about procrastination using 16 self-assessment items that result in an indication of passive, active, or non-procrastinator. There is one indicator that looks at active procrastination only, named the Active Procrastination Scale (APSCM) [30]. The APSCM is a 16-item self-assessment questionnaire that assesses four characteristics of procrastination: satisfaction with an outcome, ability to meet deadlines, intention to procrastinate, and preference for time pressure. The rest of the procrastination indicators focus on the negative aspects of procrastination, and will therefore be classified as measurements for passive procrastination.

When reviewing works on procrastination in relationship with academic performance, the following performance indicators are prevalent: Grade Point Average (GPA), midterm and final examination score, assignment grade, quiz, course grade, homework, and American College Test (ACT) [12].

This study will focus on the relationship between procrastination and academic performance. The relationship will be assessed using the research questions: (a) What is the relationship between academic performance and procrastination? (b) Does the type of procrastination, active or passive, influence the relationship with academic performance? (c) Is the relation between academic performance and procrastination influenced by the variables age, type of measurement, academic performance indicators, and procrastination indicators?

In this study, we hypothesise a negative correlation between procrastination and academic performance, consistent with the extant literature [9,11–16,31]. Building on Chu and Choi's [23] framework, we anticipate distinct relationships between types of procrastination and academic performance: a negative correlation for passive procrastination and a positive correlation for active procrastination. We expect that younger students will exhibit stronger correlations between academic performance and procrastination than older students, aligning with the findings of Kim and Seo [12]. With respect to measurement, we expect self-reported data to yield smaller correlations due to inherent variability and reliability issues. For academic performance indicators, we anticipate uniform correlations, contrasting the varied correlations expected from different forms and types of procrastination measures.

This study aims to bring clarity to the mixed findings concerning the relationship between procrastination and academic performance. Various studies have depicted this relationship in contrasting lights: as negative [9], neutral [32], and even positive [23]. With our results we intend to provide more definitive insights into this complex association. A meta-analysis by Kim and Seo [12] found a negative correlation between academic performance and procrastination. However, they found a high variation in the correlation sizes and between different subgroups, such as geographical region, self-reported data, performance indicators, procrastination indicators, and age. Using the newly published data, this study contributes to the scientific knowledge base by extending this research with more published data. This study's findings will equip educators with the critical understanding of when procrastination might negatively or positively influence academic performance.



The research questions will be addressed by synthesising results from previous studies on the topic of procrastination and academic performance. The method used in this study is a meta-analysis, which is used to provide an overview of already published articles in a structured fashion [33] (pp. 3–13).

## 2. Method

Data were sourced from the Web of Science database and accessed through various platforms: Erasmus University Rotterdam Library (EUR Library), free databases via Google Scholar, and Unpaywall [34]. The sample was compiled using a targeted search query incorporating the keywords “procrastination” and “academic performance”. The keyword search query included synonyms and terms identified in prior meta-analyses [11–16]. The exact keyword search query stated the following: “procrastination” (Topic) AND “academic performance” OR “performance” OR “accomplishment” OR “academic achievement” OR “GPA” OR “grade” OR “school performance” OR “examination score” OR “ACT” OR “academic success” OR “missing deadline” OR “task completion time” OR “task delay” OR “task preparation time” OR “grade point average” (Topic) and Proceeding Paper or Article (Document Types).

Data research was limited to the year 1975, the earliest year of publication Web of Science can access, until the 13th of May 2023, the date of data extraction. Studies included in the analysis had to meet the criteria listed in Table 1.

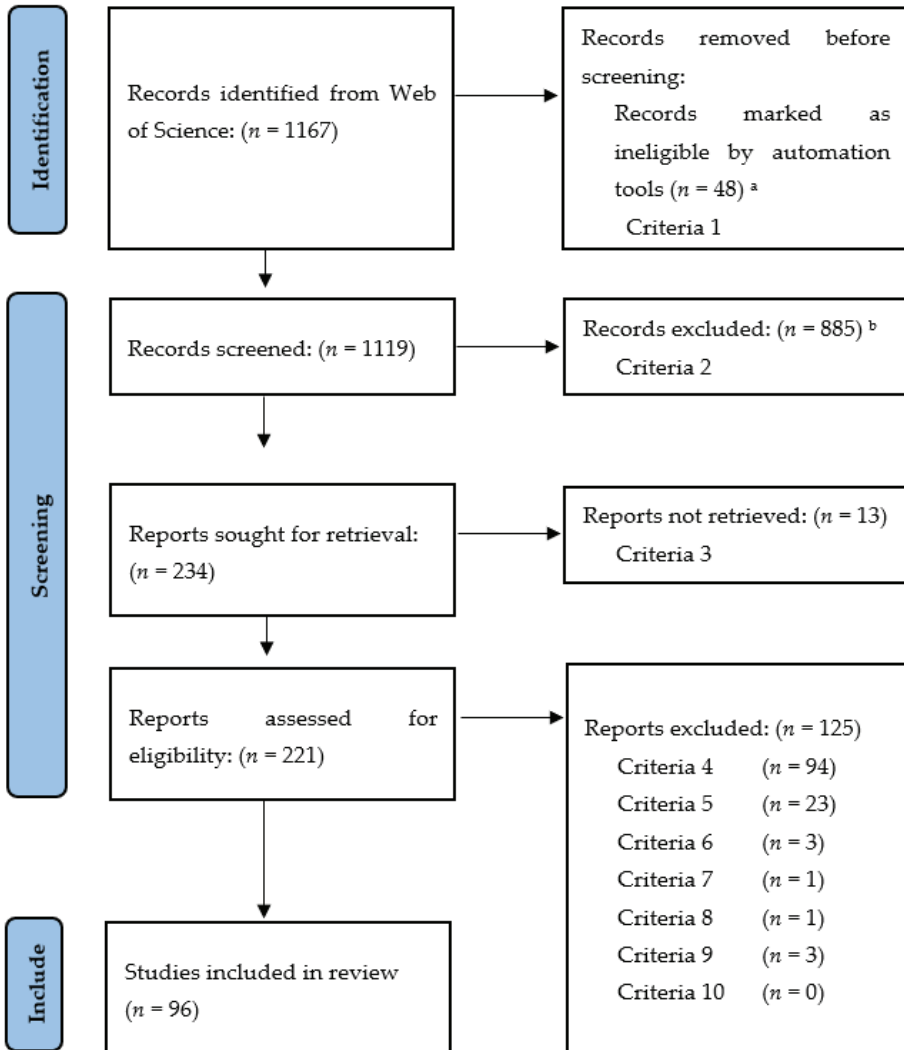
**Table 1.** Inclusion and exclusion criteria.

Number	Inclusion Criteria	Exclusion Criteria
1	The study is empirical in nature.	The study is a review.
2	The article is on the topic of procrastination and academic procrastination.	The article is not on the topic of procrastination and academic procrastination.
3	The article is accessible through open databases or via EUR Library.	The article is not accessible through open databases or via EUR Library.
4	Reported Pearson correlation coefficients between academic performance and procrastination, along with sample sizes.	The article did not report the correct correlation coefficient as per inclusion
5	Articles are available in English.	Articles are not available in English.
6	The sample size of the article was less than 10,000	The sample size of the article was over 10,000.
7	The sample represents a population with normal learning capabilities.	The study has a sample size consisting of only academically challenged participants.
8	The study was not retracted.	The study was retracted.
9	The studies are unique in individual participants, procrastination measures, or academic performance measures.	The studies are not unique in individual participants, procrastination measures, or academic performance measures (copy of article excluded).
10	The study does not attempt to influence the procrastination of the participants.	The study is on procrastination interventions.

The studies found through the keyword search were first scanned using the title and abstract to assess their relevance to the topic of procrastination and academic performance. Studies that did not mention the topic of procrastination and academic performance in the title or abstract were excluded from further analysis. Then the studies were scanned with a focus on the inclusion and exclusion criteria, particularly in the Sections 2 and 3. If a study met all criteria, the entire article was assessed, and data were extracted. The following data were extracted: the author(s) name(s), publication year, sample size (N), sample age range (pre-primary, primary school, secondary education, college, adults), geographic location, procrastination indicator (see Appendix A), academic achievement indicator, correlation coefficient(s), type of procrastination (active or passive procrastination), and

type of measurement (self-assessment or external assessment). If a study had altered an existing measure of procrastination and academic performance to an extent where the measure became unique or the study had a unique measurement tool, then the indicator was noted as research specific.

The retrieved studies and excluded studies were visualised using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 flow [35] and can be found in Figure 1. The PRISMA flow diagram was used to note the records that were identified, removed, screened, excluded, retrieved, not retrieved, assessed, excluded after assessment, and included.



**Figure 1.** PRISMA flow diagram including the number of articles per meta-analytic phase identification, screening, and included. Note. This flow diagram denotes the specific number of articles in every step of the meta-analysis process and how the number of articles was reduced to just those included into the meta-analytic review. <sup>a</sup> Recognized by Web of Science as review articles and excluded by exclusion criteria two. <sup>b</sup> Records are excluded from eligibility assessment as the research topic is irrelevant to the topic of the current research.

When an article reported multiple coefficients, all relevant coefficients were extracted. If an article reported multiple similarly tested procrastination scores over a period of time, then only the score closest to the time that the academic performance score was obtained was noted. If an article used multiple procrastination indicators and academic performance indicators, all variations were extracted. However, for analysis, these results were averaged and weighted to ensure that each study contributed proportionally to its sample size. Coefficients derived from the same participant pool were weighted based on sample size and the total number of relevant coefficients using the formula:  $((\text{sample size}/\text{number of relevant coefficients})/\text{total number of participants in the meta-analysis}) \times \text{Pearson correlation coefficients}$ . In cases where studies reported correlation coefficients for differing sample sizes drawn from the same participant pool, an average sample size for each study was calculated to determine the total number of participants.

The extracted data were organised using Excel version 2304 and analysed using IBM SPSS Statistics 29. The data were weighted according to the sample size of the individual study. The correlation coefficients  $r$  were transformed into a  $z$  statistic using Fisher's  $z$  transformation, before an average was calculated to make the average  $r$  less biased [36] when transformed back from an average  $z$  to an average  $r$  [37]. Fisher's  $z$  was also used to calculate significant differences between effect sizes. Effect sizes were characterised as small ( $r < 0.2$ ), small to medium ( $r = 0.2\text{--}0.5$ ), medium to large ( $r = 0.5\text{--}0.8$ ), and large ( $r > 0.8$ ) [38].  $p$  values would indicate decisive evidence ( $p < 0.001$ ), substantive evidence ( $p = 0.001\text{--}0.01$ ), positive evidence ( $p = 0.01\text{--}0.05$ ), or no evidence ( $p > 0.05$ ) [38].

A meta-analysis was planned using either a random-effects model or fixed-effects model, pending the results of the heterogeneity tests. Given that the included studies employed diverse indicators to measure various facets of procrastination, it was anticipated that a random-effects model would be more appropriate. The studies also varied in terms of geographic location, year of publication, time between measurements, sample age, type of procrastination, and performance indicators. These variations likely violate the assumption of identical empirical settings needed to perform a fixed-effects model [39]. A random-effects model approach is in line with most meta-analytic approaches [40]. The estimator used for the meta-analysis was the Restricted Maximum Likelihood (REML) [41].

Apart from the weighted  $r$ , all test statistics were gathered using the meta-analysis function included in the IBM SPSS 29th edition. The meta-analysis on continuous effect size reported an effect size estimate, homogeneity test statistics, heterogeneity test statistics, Egger's regression-based test, Trim-and-Fill analysis [42], and a Forrest plot. Using the average  $z$ , a 95 per cent confidence interval [43] was computed separately for the extraction variables where applicable. The average  $z$  was also used to compute a  $p$ -value to examine the statistical significance of the correlation coefficients. To perform the weighted  $r$  analysis, a standard error was calculated using the formula  $(1 - r^2)/\sqrt{N - 3}$  to minimise potential bias. This formula was, compared to other formulas, one of the most unbiased methods available to calculate the standard error, only becoming slightly negatively biased for correlations larger than  $r = 0.60$  [44].

The data were analysed on homogeneity using the homogeneity statistic  $Q$  and the heterogeneity statistic  $I^2$ . The  $Q$  statistic was used to assess the presence of heterogeneity [45]. This meant that a significant  $Q$  statistic would result in the use of a random-effects model, as the data were not homogenous, and a non-significant  $Q$  statistic would result in a fixed-effects model, as the data were homogenous [46]. The  $I^2$  was interpreted to quantify the extent of heterogeneity, where  $I^2 \approx 25\%$  was defined as low heterogeneity,  $I^2 \approx 50\%$  was defined as medium heterogeneity, and  $I^2 \approx 75\%$  was defined as high heterogeneity [47].

The potential for publication bias was analysed using the Trim-and-Fill method [48]. A small study bias was assessed using Egger's regression test [49]. These tests are most accurate in detecting publication bias and small study bias when compared to the Tang's regression test and Begg's regression test [50].

The data were analysed for outliers using the interquartile range technique. This technique entails that an outlier must be at least 1.5 times the length of the interquartile

range away from the mean to be identified as a mild outlier. If the outlier is three lengths of the interquartile range away from the mean it was classified as an extreme outlier [51]. However, based on the research by Hansen et al. [39], outliers were not removed due to the variation in procrastination indicators, performance indicators, procrastination factors, and performance facets, which likely resulted in very different effect sizes. This variation in effect sizes was desired for this study as we were interested in overall effect size.

### 3. Results

The search query on procrastination and academic performance resulted in 1167 articles. From those articles, 48 articles were removed as they were identified as reviews by Web of Science. This resulted in 1119 records that were screened based on the title, keywords, and abstract. This screening process deemed 885 articles irrelevant to the current research and excluded them from the full article assessment. This led to the identification of 234 articles, which were subsequently accessed using open databases and resources available through EUR Library. All but 13 articles were successfully retrieved for full assessment. The full assessment identified 96 articles that fit the inclusion and exclusion criteria and basic guidelines. This meant that 125 articles did not meet these requirements. A full rundown of the article selection process is available in Figure 1 and the list of included studies ( $n$ ) is available in Appendix B Table A2.

Articles included in the analysis ( $n = 96$ ) reported a combined number of coefficients ( $k = 176$ ). The articles had a combined average number of participants ( $N = 55,477$ ) and a unique pool of participants ( $N_{un} = 55,555$ ) based on the unique number of participants per study, excluding the study by Seo [52], as this study used the same participant data as in a study by Seo [18]. The articles show a positive trend towards the year of publication, with more recent years having more published articles.

Before examining the correlation sizes, the heterogeneity was assessed using the  $Q$  statistic ( $Q = 5354.761$ ,  $p < 0.001$ ) and resulted in a significant statistic, meaning a random-effects model is most appropriate for our data analysis. The high  $I^2$  statistic ( $I^2 = 95.7\%$ ) suggests the data are highly heterogenous, confirming this choice.

The Trim-and-Fill analysis for publication bias resulted in zero imputed and this suggests that the data do not suffer from publication bias. The Egger's regression test resulted in a significantly low negative intercept ( $a = -0.225$ ,  $t = -6.049$ ,  $p < 0.001$ ), which indicates that studies with smaller sample sizes show larger effects in our data. A visual inspection confirms this test result with hardly noticeable asymmetry in the data, as shown in the funnel plot in Appendix C Figure A1.

However, what is noticeable is the asymmetry in the standard error, with most studies having a standard error smaller than 0.10 and only one study having a standard error larger than 0.20.

The interquartile range technique identified four mild outliers, two positives ( $r = 0.42$ ,  $r = 0.34$ ) and two negatives ( $r = -0.87$ ,  $r = -0.71$ ). These outliers were confirmed by visually inspecting the Forest plot. Together, these outliers are responsible for the sum of 1247 participants, which is about 2.2% of the overall sample size. The outliers have a slightly negative influence on the overall correlation coefficients, with an averaged correlation slightly lower than the overall correlation ( $r = -0.21$ ). These outliers are identified for discussion purposes but not removed due to the allowed variance in methods.

The weighted mean for the correlation between procrastination and academic performance was significant ( $r = -0.18$ ). The weighted means of the correlations for the type of procrastination were all significant, including active ( $r = 0.15$ ), passive ( $r = -0.17$ ), and not provided ( $r = -0.43$ ). All mentioned indicators for academic performance were significant for weighted  $r$ : average grade ( $r = -0.28$ ), course grade ( $r = -0.17$ ), exam ( $r = -0.22$ ), and GPA ( $r = -0.20$ ). The listed indicator API ( $r = -0.03$ ) had a non-significant weighted  $r$ , while the rest were significant: APSCM ( $r = 0.16$ ), dilatory behaviour ( $r = -0.24$ ), GPS ( $r = -0.22$ ), PASS ( $r = -0.17$ ), and TPS ( $r = -0.22$ ). The sample age ranges resulted in correlations that were marginally significant and varied across groups, including adults

( $r = -0.39$ ), college ( $r = -0.22$ ), and secondary education ( $r = -0.11$ ). The type of reported academic performance resulted in two significant weighted correlations for externally gathered ( $r = -0.18$ ) and self-reported ( $r = -0.22$ ) performance, but an insignificant result when performance was not provided ( $r = 0.00$ ). The type of reported procrastination resulted in two significant weighted correlations for externally gathered ( $r = -0.49$ ) and self-reported ( $r = -0.16$ ) procrastination data.

The unweighted correlations (estimated  $r$ ) and relevant statistics for all collected variables can be viewed in Table 2 and Appendix D Tables A3 and A4.

**Table 2.** The correlations between academic performance and procrastination and other variables.

Total	<i>k</i>	Sample Average N	Weighted <i>r</i>	Estimated <i>r</i>	Confidence Interval (95%)	Q-Value	<i>I</i> <sup>2</sup> (%)
Procrastination-performance	176	55,477	-0.18	-0.19	[-0.223, -0.163]	5354.761	95.7
Type of Procrastination and Performance							
Active	14	2377	0.15	0.13 *	[0.035, 0.266]	125.450	89.3
Passive	137	53,398	-0.17	-0.20	[-0.230, -0.174]	3160.315	94.0
Not provided	25	2868	-0.43	-0.33	[0.411, -0.245]	537.908	94.5
Indicator of Performance							
Average grade	23	7252	-0.28	-0.27	[-0.332, -0.217]	134.398	86.5
Course grade	25	14,915.5	-0.17	-0.28	[-0.396, -0.168]	2927.722	98.9
Exam	39	7176	-0.22	-0.16	[-0.220, -0.106]	554.141	91.7
GPA	60	16,743.5	-0.20	-0.18	[-0.224, -0.138]	589.932	91.0
Indicator of Procrastination							
API	13	2999	-0.34	-0.27	[-0.343, -0.189]	87.730	87.0
APSCM	22	2377	0.16	0.07 **	[0.003, 0.143]	169.589	87.5
Dilatory behaviour	10	772	-0.23	-0.24	[-0.297, -0.181]	19.377 **	49.9
GPS	11	2993	-0.22	-0.31	[-0.431, -0.190]	81.074	90.4
PASS	21	5424	-0.17	-0.14	[-0.217, -0.068]	335.113	94.5
TPS	20	8479	-0.22	-0.24	[-0.286, -0.190]	109.431	82.5
Sample Age Range							
Adults	1	83	-0.39	-0.39	[-0.576, -0.204]	SR	SR
College	158	33,048.5	-0.22	-0.19	[-0.221, -0.155]	4380.464	94.7
Secondary education	17	22,345.5	-0.11	-0.23	[-0.297, -0.153]	624.412	97.4
Reported Performance							
Externally gathered	98	24,864	-0.18	-0.21	[-0.259, -0.169]	3813.492	96.2
Self-reported	76	25,190	-0.22	-0.17	[-0.206, -0.163]	1124.649	93.6
Not provided	2	6540	0.00 ***	-0.14 ***	[-0.439, 0.162]	27.871	96.4
Reported Procrastination							
Externally gathered	24	2256	-0.49	-0.38	[-0.467, -0.289]	720.136	96.0
Self-reported	152	53,676	-0.16	-0.16	[-0.194, -0.135]	2329.641	94.7

Note. Variables weighted  $r$ , estimated  $r$ , and Q-value are significant at  $p < 0.001$  unless marked with an asterisk. SR = statistics cannot be computed because this subgroup contains a single record. The abbreviations found in the 'Indicator of Procrastination' section are explained in Appendix A. \*  $p < 0.01$ , \*\*  $p < 0.05$ , \*\*\*  $p > 0.05$ .

#### 4. Discussion

The present study was undertaken to aggregate existing research on the relationship between procrastination and academic performance. Our findings suggest a small negative correlation between the two variables. This could imply that those who procrastinate may either have lower academic aptitude, underperform due to procrastination, or develop procrastination tendencies due to poor academic performance. Notably, the data exhibited significant heterogeneity, indicating that the included studies may have focused on disparate aspects or types of procrastination. This was partially confirmed by analysing the most popular procrastination measures (see Appendix A, which mentions a variety of measurement techniques, aspects of procrastination, and types of procrastination that likely contribute to the observed heterogeneity). However, additional factors such as participant

characteristics, geographical location, performance metrics, data collection methods, and temporal aspects of the study further contributed to the observed heterogeneity.

This result is very similar to an earlier meta-analysis by Kim and Seo [12], but their study reported a slightly lower effect size. The result is also comparable to those of van Eerde [16] and Steel [15], with some comparable effect sizes, some slightly larger and some slightly smaller. However, the result did differ significantly from the average effect size reported by Setayeshi Azhari [14], which reported a small to medium overall effect size compared to the small effect size found in this study. Overall, our results mostly align with those of previous studies.

Of interest were the results related to the type of procrastination. Active procrastination showed a small positive relationship with academic performance, while passive procrastination had a small negative relationship with academic performance. Noticeable is that the studies wherein the type of procrastination was not specified showed a small to medium negative correlation with academic performance. The results of the type of procrastination closely matched the accompanying procrastination indicators, as most passive indicators reported similar correlations to the correlation between passive procrastination and academic performance. Active procrastination and academic performance showed similar effect sizes compared to APSCM and academic performance. The externally gathered procrastination data aligned closely with the non-specified type of procrastination. The effect sizes of the externally gathered procrastination data were significantly higher compared to previous meta-analyses on this type of data [12,53].

Another interesting variable is the sample age range, as adults appear to have the highest effect size for the relationship between procrastination and academic performance, followed by college students with about half the effect size, and then followed by students in secondary education with half the effect size of the college students. This being said, only one study in this dataset used adults as their participant population, so this phenomenon is not strongly supported. It is, however, interesting to consider, as this finding directly opposes the results found by Kim and Seo [12].

Due to the correlational nature of the extracted coefficients, a causal relationship cannot be confirmed. It could be the case that procrastination causes poor academic performance, or that people with low academic performance tend to procrastinate more compared to those with high academic performance. These relationships may also exist simultaneously.

These results can be used to answer the research questions. The first research question on the relationship between academic performance and procrastination can be answered by the overall correlation statistic, stating that there is a bivariate small negative correlation between academic performance and procrastination. This is in line with the hypothesis and previous research. The second research question was on the influence of the type of procrastination on the correlation with academic performance. Passive procrastination was found to have a small negative correlation with academic performance, and active procrastination had a small positive correlation with academic performance. These results confirm the hypothesis that active procrastination is positively correlated with academic performance and passive procrastination is negatively correlated with academic performance. Contrary to our hypothesis, the impact of age on effect sizes was inversely related, leading us to reject this aspect of our hypothesis. As for the influence of measurement type, our findings partially corroborate and contradict our initial expectations. Specifically, self-reported data for academic performance yielded larger effect sizes compared to externally collected data. Conversely, for procrastination, self-reported data produced smaller effect sizes relative to externally sourced data. The results of the performance indicators were in line with the hypothesis, with all indicators having the same directionality in correlation, all hovering around a small to medium correlation. The hypothesis related to the procrastination indicators was also confirmed, as procrastination indicators appear to correlate with the type of procrastination that they are intended to measure.

This study has several limitations. One such factor is the possibility of publication bias. Even though the Trim-and-Fill analysis concluded there was no publication bias, the

test is known to perform poorly in the presence of high heterogeneity [48,54], which is the case for this dataset. The second bias test, Egger's regression test, resulted in a negative small study bias, meaning that small studies show more extreme effect sizes compared to larger studies. This could be negligible for a number of reasons: most studies in the dataset have a relatively high sample size, the weighted  $r$  makes these studies less impactful, and the reported bias was relatively small. Knowing this does not rule out the possibility of publication bias.

The weighted  $r$  also has limitations. Using a weighted correlational approach means that large studies have more of an impact on the overall correlation statistic. However, one could argue that it is not fair to assign more weight to large studies, as they might have less controlled methods compared to smaller studies, where the study process can be more easily controlled. This method makes the overall correlation coefficient more biased towards the facets of procrastination and academic performance that are measured by larger studies. To combat this limitation, both the weighted  $r$  and the unweighted estimated  $r$  have been reported for comparison. The difference between the weighted  $r$  and the unweighted  $r$  was very small for most variables.

Self-reported data can influence the objectivity of the correlation. Self-reported data on academic performance such as GPA generally correlate well with objective GPA, but the correlation can vary depending on many of the participants' characteristics [55]. The objective measures of procrastination might also be questionable as they generally tend to focus on measures such as delay, absence, and time, which do not cover the full extent of procrastination and cannot distinguish between active and passive delay related to the types of procrastination [56].

Articles used in this study span a wide timeframe in which the academic setting has changed. Particularly during the years 2020 to 2022, online education became more prevalent due to the pandemic [57]. This could have influenced the relationship between procrastination and academic performance. It could be that the correlation between the variables has decreased as the gap in academic performance has declined due to COVID-19. It could also have increased the correlation, as COVID-19 could have impacted procrastinators more than others in terms of academic performance.

Results on active procrastination and the comparison with passive procrastination should be interpreted more critically compared to the rest of the results. The definitions of procrastination and active procrastination differ substantially, as one is considered irrational and the other deliberate and intentional. A review study by Klingsieck [25] compared popular definitions of procrastination and strategic delay, which is similar to active procrastination, and found that strategic delay differs in facets such as irrationality, awareness, and discomfort. It might not be fair to compare active and passive procrastination as they analyse different facets. This difference is visible in the effects sizes, as they differ significantly. This difference in definition might limit the comparison strength between the two procrastination types.

The review process of this study also has some limitations. Due to the method of screening, if the appropriate variables were not mentioned in the title, abstract, or keywords, the study was not included in the full article review. This method allowed us to find many articles, but may have caused some relevant publications to go unnoticed.

The selection and screening of articles were done by the first author using one database, and are therefore prone to more mistakes in data assessment and extraction compared to the use of multiple assessors. Potentially overlooked articles could have provided different or more definitive results. The results of this study could be biased towards the journals that are supported by Web of Science.

The procrastination indicators and academic performance indicators were selected due to their broad nature, to allow for summative results after analysis. However, most articles used these indicators in line with their own needs, and adapted them accordingly. The meta-analysis prioritizes quantitative data at the expense of qualitative precision. Put differently, the result is statistically extremely robust, but compromises the conditions under

which the results are attained. A more stringent data collection process would introduce a greater variety of indicators, thereby reducing the certainty of the conclusions due to a smaller number of studies for each specific indicator.

To address these limitations, future research should implement the following strategies: employ multiple assessors for data selection and extraction to reach consensus and establish inter-rater reliability; incorporate additional tests for publication bias; expand database searches and integrate data from existing meta-analyses on the subject; establish more precise criteria for indicators to preserve their interpretive value; and include grey literature in the search parameters to ensure a comprehensive review.

The implications of this research are mainly related to academic settings, as the correlation is primarily focused on academic performance. The direct implications of this research are the following: procrastination among students should be monitored to identify students that could suffer in terms of academic performance; not all procrastination should be viewed as negative as active procrastination is positively related to academic performance; procrastination should be given more attention the older people get, as there seems to be a positive correlation between age and effect size.

The implications of this research enrich the existing body of knowledge regarding the interrelationship between procrastination and academic performance. It also provides an overview of the different procrastination indicators and their relationship with academic performance. The results of the subgroup analysis on the type of procrastination are also of interest for researchers in this field; researchers should account for different types of procrastination when using or developing an indicator for procrastination. The type of procrastination can greatly influence the correlation with academic performance.

Procrastination as a concept should be well defined, as the results of this research show that procrastination can refer to a variety of behaviours. These behaviours generally follow the line of delay of tasks, but with different intentions and surrounding behaviours that lead to different performance results. The example provided in this study relates to academic performance correlating differently with active and passive procrastination; however, future research may distinguish many more differences between types of procrastination.

The results of this study can also be used to theorise about the direct and indirect influences of procrastination on academic performance. The distinction between passive and active procrastination can serve as a comparison between procrastination associated with negative performance and procrastination associated with positive performance. Both forms of procrastination contain dilatory behaviour within their definition; however, active is regarded as more positive compared to passive. One can theorise that if both forms of procrastination delay tasks to the same extent, then the only difference between the two is the traits associated with them. If this statement is true, then one can assume that the indirect effects of procrastination determine the direction and strength of the relationship. However, further research needs to be conducted to verify that both forms of procrastination cause task delay to the same extent, and determine whether the definitions are related enough to compare.

## **5. Conclusions**

The overall relationship between procrastination and academic performance is negative and small. The type of procrastination does matter when compared with academic performance, as active procrastination is positively related to academic performance, while passive procrastination is negatively related to academic performance. When measuring procrastination, one should consider that external measurements of procrastination correlate more with academic performance compared to participant-reported data, keeping in mind that these forms of data collection differ in procrastination facets. It can be inferred that the correlation between academic performance and procrastination is more pronounced among college students compared to those in secondary education.



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## Appendix A. A Summary of Measurement Tools Used to Assess Procrastination

**Table A1.** A comprehensive summary of procrastination indicators.

Measurement	Abbreviation	Active or Passive Procrastination	How Procrastination Is Assessed	Test–Retest Reliability
Academic Delay Scale [58]	EDA	Passive, it reports the tendency to delay tasks considering the negative consequences.	Assesses delay tendency in academic tasks.	-
Academic Procrastination Scale [24]	APSM	Both, it has dimensions related to both types of procrastination.	Assess the type of procrastination using cognitive efficiency, peak experience, deliberate procrastination, preference for pressure, ability to meet deadlines, and outcome satisfaction to measure active procrastination and passive procrastination using fear of failure, taskaversiveness, and laziness.	-
Academic Procrastination [59]	APF	Passive, it reports on task avoidance, which is related to passive procrastination.	Assesses the avoidance of academic tasks using five self-reported items.	-
Academic Procrastination Questionnaire [60]	APQ	Passive, it relates to the delay of academic work without mentioning benefits.	Assesses procrastination of academic work and tasks using a questionnaire format.	-
Academic Procrastination Scale [61]	EPA	Passive, it relates to self-regulation failure and can therefore not be active.	Assesses academic procrastination through two dimensions named academic self-regulation and postponement of activities through a 12-item questionnaire.	-
Academic Procrastination Scale [62]	APSC	Passive, it aims to define procrastination in one dimension with a negative connotation.	Assesses academic procrastination behaviours using 19 self-assessment items to indicate greater or more procrastination behaviours.	$r = 0.89$
Academic Procrastination Scale [9]	APSG	Passive, it assesses the negative aspects of academic procrastination.	Assesses student academic procrastination based on five self-assessment items.	-
Academic Procrastination Scale [63]	APSMT	Passive, it focuses on the difficulty to start an academic task.	Assesses academic procrastination with a focus on homework, examinations, and papers using seven items.	-
Academic Procrastination Scale [64]	APSO	Passive, it relates to the negative aspects of procrastination behaviour.	Assesses the probability of procrastination behaviour using 11 self-assessment items.	-

Table A1. Cont.

Measurement	Abbreviation	Active or Passive Procrastination	How Procrastination Is Assessed	Test–Retest Reliability
Academic Procrastination Scale-Short Form [65]	APSS	Passive, it notes the negative outcome of procrastination on academic tasks.	Assesses academic procrastination using five items on tendency to procrastinate on academic tasks.	-
Academic Procrastination State Inventory [66]	APSI	Passive, it has a focus on state procrastination with a negative connotation.	Assesses state procrastination using 13 items with facets such as delay, lack of energy, and concentration.	$r = 0.69$ [67]
Academic Time Management and Procrastination Measure [68]	ATMPM	Passive, it gives a rating to procrastination's relationship to poor time management.	Assesses behaviours related to time management (planning and monitoring) and procrastination using 14 self-report items.	
Active Procrastination Scale [30]	APSCM	Active, highlights the positive aspects of procrastination. The scale can be reverse keyed for passive procrastination.	Assesses four characteristics of procrastination items: satisfaction with an outcome, ability to meet deadlines, intention to procrastinate, and preference for time pressure using 16 self-assessment items.	$r = 0.80$
Adult Inventory of Procrastination [69]	AIP	Passive, it highlights the negative relationship with time.	Assesses adult procrastination on the subscales: time loss, time management, and time commitment.	$r = 0.71$ [70]
Aitken Procrastination Inventory [71]	API	Passive, it is used to differentiate students from chronic academic procrastinators.	Assesses students and analyses their level of chronic academic procrastination using 21 items.	$r = 0.87$ [72]
Avoidance Reactions to a Deadline Scale [73]	ARDS	Passive, it focusses on avoidance instead of the positive aspect of delay.	Assesses avoidance reactions indicative of procrastination using 8 self-reported items.	-
Behavioural and Emotional Academic Procrastination Scale [74]	BEPS	Passive, it provides a rating based on negative aspects of delay and comfort.	Assesses the self-reported behavioural aspect of procrastination using three items on academic task delay and the emotional aspect of procrastination using three items on subjective discomfort.	$r = 0.62$ (delay) and $r = 0.52$ (subjective discomfort)
Conscientiousness Measurement [75]	CCM	Passive, it measures the opposite of procrastination behaviour.	Assesses self-reported conscientiousness using the facets industriousness, perfectionism, tidiness, procrastination refrainment, control, caution, task planning, and perseverance using 68 items.	-
Decisional Procrastination Scale [5]	DPS	Passive, negative aspects of decisional procrastination.	Assesses five items that relate to delay in coming to decisions and delay in implementing decisions.	$r = 0.69$ [76]
General Procrastination Scale [32]	GPS	Passive, keyed towards procrastination in everyday situations and tasks.	Assesses general procrastination using 20 items on everyday situations and tasks.	$r = 0.80$ [77]
Irrational Procrastination Scale [78]	IPS	Passive, as scores are lower when procrastination is not viewed negatively.	Assesses the self-reported feeling of experiencing an irrational delay.	$r = 0.84$ [79]

Table A1. Cont.

Measurement	Abbreviation	Active or Passive Procrastination	How Procrastination Is Assessed	Test–Retest Reliability
Melbourne Decision Making Questionnaire [80]	MDMQ	Passive, it is related to the negative results of procrastination.	Assesses decision-coping patterns using the factors procrastination, hyper-vigilance, buck-passing, and vigilance using 22 self-report items.	-
Metacognitive beliefs about Procrastination scale [26]	MaP	Both, relates to the positive and negative metacognitive beliefs about procrastination.	It assesses metacognitive beliefs about procrastination using 16 self-assessment items.	-
Multidimensional Academic Procrastination Scale [81]	MAPS-15	Passive, it is related to the negative consequence of procrastination.	Assesses academic procrastination using the factors core procrastination, poor time management, and work disconnection.	$r = 0.85$
Passive Procrastination Scale [23]	PPSC	Passive, it is meant to contrast with active procrastination.	Assesses academic procrastination using six self-reported items adapted from the DPS and APSI.	-
Procrastination Checklist Study tasks [28]	PCS	Passive, it is related to study behaviours and time in a negative fashion.	It is an external procrastination measurement using 12 study behaviours scored for both the intended and complete time.	-
Procrastination Assessment Scale for Students [6]	PASS	Passive, as student scores are lower when they do not think procrastination is a problem.	Assesses procrastination and to what extent it causes problems using 12 items and two subscales related to frequency and problem.	$r = 0.57$
Procrastination Inventory [82]	PI	Passive, it denotes the negative connotation of procrastination.	Assesses procrastination using the four subscales controllability, expectation to change, motivation to change, and justification using 36 items.	-
Procrastination Log-Behaviour [83]	PLB	Passive, it has a focus on procrastination behaviour and satisfaction.	Assesses self-reported procrastination behaviour weekly with a satisfaction rating using 11 items.	-
Procrastination State in Academic Tasks [84]	PATS	Passive, it relates to negative aspects of procrastination behaviour and state of mind.	Assesses self-reported procrastination over the course of a week using the factors procrastination behaviour, fear of failure, and lack of academic motivation.	-
Procrastination Styles Questionnaire [85]	PSQ	Passive, it accounts for delay of academic tasks but not the benefit of delay.	Assesses behavioural procrastination using ten academic scenarios that are rated using the four responses: classic procrastination, non-academic productive procrastination, academic productive procrastination, and non-procrastination.	-

Table A1. Cont.

Measurement	Abbreviation	Active or Passive Procrastination	How Procrastination Is Assessed	Test-Retest Reliability
Pure Procrastination Scale [78]	PPS	Passive, it highlights the dysfunction of procrastination.	Assesses dysfunctional procrastination using 12 self-report items from different procrastination identifiers.	$r = 0.89$ [86]
Revised NEO Personality Inventory [87]	NEO-PI-R	Passive, it relates to the refrainment of negatively associated procrastination.	Assesses procrastination refrainment through items of the facet of self-discipline.	-
Student Learning Inventory [88]	SSLI	Passive, it highlights the negative aspect of procrastinative metacognition.	Assesses five self-assessment factors on metacognition named postdictive, predictive help, predictive no help, procrastinative, and piecemeal.	-
Test Procrastination Questionnaire [89]	TPQ	Passive, it focuses on the likelihood of procrastination over a test.	Assesses the likelihood of procrastination over a test using ten self-assessment items.	-
The Studying Procrastination Scale [90]	SPS	Passive, it views active procrastination as wrong by the definition of procrastination.	Assesses study procrastination of students and the self-assessed implications towards performance alongside affect and self-forgiveness.	-
The Unintentional Procrastination Scale [91]	UPS	Passive, it is related to unintentional procrastination and highlights the negative aspects of procrastination.	It assessed unintentional procrastination using 6 items.	-
Tuckman Procrastination Scale with 35 items [92]	TPS	Passive, no items related to positive aspects of procrastination.	Assesses 35 statements about the participant's relationship with procrastination including self-efficacy and self-regulated performance items.	$r = 0.90$

Note. This table gives a summary of most indicators of procrastination and how they assess procrastination, including the type of procrastination and the test-retest reliability. If the test-retest reliability was not found, then a hyphen is used instead. When a source is cited next to the test-retest coefficient, then the coefficient is extracted from a different source than the original article in the measurement section. The abbreviations have been gathered from the article in which the measurement tool was found, or the abbreviations have been composed from the first letters of each the measurement and when necessary the first letters of the author's name.

## Appendix B. An Overview of Included Studies

Table A2. Studies included in the meta-analysis.

Number	Author	Year	Sample Size	Sample Age	Location
1	Alp and Sungur [93]	2017	117	College	Turkey
2	Artino et al. [94]	2012	170	College	United States
3	Atalayin et al. [95]	2017	452	College	Turkey
4	Balkis [96]	2011	364	College	Turkey
5	Balkis and Duru [97]	2017	441	College	Turkey
6	Balkis (a) [31]	2013	290	College	Turkey
7	Balkis (b) [98]	2013	323	College	Turkey
8	Balkis et al. [99]	2012	281	College	Turkey
9	Batool [100]	2019	502	College	Pakistan
10	Bolden and Fillauer [101]	2020	114	College	United States
11	Bong et al. [102]	2014	304	Secondary education	South Korea
12	Caratiquit and Caratiquit [103]	2023	223	Secondary education	Philippines

Table A2. Cont.

Number	Author	Year	Sample Size	Sample Age	Location
13	Cerezo et al. [104]	2016	140	College	Spain
14	Chen and Zeng [105]	2022	566	College	China
15	Chissmom et al. [106]	1989	118	College	United States
16	Chu and Choi [23]	2005	230	College	Canada
17	Clariana et al. [107]	2012	171	College	Spain
18	Clarke and MacCann [108]	2016	457	College	Australia
19	Corkin et al. [56]	2011	206	College	United States
20	Corkin et al. [109]	2021	223	College	United States
21	Cosnefroy et al. [110]	2018	303	College	France
22	Custer [111]	2018	195	College	United States
23	de la Fuente et al. [112]	2021	430	Secondary education	Colombia
24	Duru and Balkis [113]	2017	348	College	Turkey
25	Duru and Balkis [114]	2014	261	College	Turkey
26	Elias et al. [115]	2005	145	College	Malaysia
27	Estrada Araoz et al. [116]	2020	47	College	United States
28	Fernández Da Lama and Brenlla [117]	2022	257	College	Argentina
29	Franzen et al. [118]	2021	6609	Secondary education	Luxembourg
30	Gadosey et al. [119]	2022	1556	College	Germany
31	García-Ros et al. [9]	2022	728	Secondary education	Spain
32	Gareau et al. [120]	2018	258	College	Canada
33	Garzón-Umerenkova et al. [121]	2018	363	College	Spain
34	Ghayas et al. [122]	2022	200	College	Pakistan
35	Goroshit [123]	2018	142	College	Israel
36	Grunschel et al. [124]	2016	635	College	Germany
37	Han et al. [125]	2023	1216	College	United States
38	Hensley [126]	2014	320	College	United States
39	Hofer et al. [127]	2012	697	Secondary education	Germany
40	Job et al. [128]	2015	145	College	United States
41	Kandemir [129]	2014	619	College	Turkey
42	Karatas [130]	2015	475	College	Turkey
43	Kármen et al. [131]	2015	162	College	Romania
44	Kertechian [132]	2018	404	College	France
45	Kim and Nembhard [133]	2019	59	College	United States
46	Kim and Seo [134]	2013	278	College	South Korea
47	Kim et al. [26]	2017	178	College	Switzerland
48	Kindt et al. [135]	2019	418	Secondary education	Germany
49	Klassen et al. [136]	2008	456	College	Canada
50	Klingsieck et al. [137]	2012	1396	College	Germany
51	Kljajic and Gaudreau [138]	2022	269	College	Canada
52	Kljajic and Gaudreau [139]	2018	208	College	Canada
53	Kljajic et al. [140]	2022	359	College	Canada
54	Kljajic et al. [141]	2017	510	College	Canada
55	Kurtovic et al. [142]	2019	227	College	Croatia
56	Lim [143]	2016	214	College	United States
57	Lubbers et al. [144]	2010	9811	Secondary education	Netherlands
58	MacCann et al. [75]	2009	275	College	United States
59	Macher et al. [145]	2011	147	College	Austria
60	Martín-Antón et al. [146]	2022	794	College	Spain
61	Martinie et al. [147]	2022	236	College	France
62	Michinov et al. [148]	2011	83	Adults	France
63	Moon and Ilingworth [149]	2005	303	College	United States
64	Moon et al. [150]	2020	96	College	United States
65	Morris and Fritz [151]	2015	67	College	United Kingdom
66	Paechter et al. [152]	2017	225	College	Austria
67	Pekpazar et al. [153]	2021	378	College	Turkey
68	Pilotti et al. [154]	2022	609	College	Saudi Arabia
69	Purwanto and Natalya [155]	2019	239	College	Indonesia
70	Ragusa et al. [156]	2023	991	Secondary education	Spain

Table A2. Cont.

Number	Author	Year	Sample Size	Sample Age	Location
71	Rikoon et al. [87]	2016	426	College	United States
72	Roig and DeTommaso [157]	1995	58	College	United States
73	Sæle et al. [158]	2016	379	College	Norway
74	Sage et al. [159]	2021	96	College	United States
75	Saman and Wirawan [160]	2021	1670	College	Indonesia
76	Seo <sup>a</sup> [18]	2011	172 <sup>a</sup>	College	South Korea
77	Seo <sup>a</sup> [52]	2012	172 <sup>a</sup>	College	South Korea
78	Shaked and Altarac [161]	2022	145	College	Israel
79	Steel et al. [162]	2001	152	College	United States
80	Suárez-Perdomo et al. [163]	2022	1784	College	Spain
81	Sun and Kim [164]	2022	157	College	United States
82	Tian et al. [165]	2020	108	Secondary education	China
83	Tian et al. [166]	2021	3511	College	China
84	Tice and Baumeister [167]	1997	104	College	United States
85	Tisocco and Liporace [168]	2022	928	College	Argentina
86	Wesley [169]	1994	244	College	United States
87	Westgate et al. [85]	2016	1104	College	United States
88	Wolters [170]	2004	525	Secondary education	United States
89	Wolters and Hussain [171]	2014	213	College	United States
90	Wu [172]	2020	78	College	Taiwan
91	Xu [173]	2023	1072	Secondary education	China
92	Yang et al. [174]	2020	242	College	Estonia
93	You [175]	2015	569	College	South Korea
94	Yu et al. [176]	2021	465	Secondary education	China
95	Zhang and Zhang [177]	2022	55	College	China
96	Zhang et al. [178]	2022	265	College	United States

Note. The sample size of each article is reported as the highest number of participants reported per correlation coefficient in cases of pooled participants and the combined number of participants in cases of multiple separate studies to report the number of unique participants per article. <sup>a</sup> These studies share sample sizes but are analysed using different indicators.

Appendix C. Funnel Plot

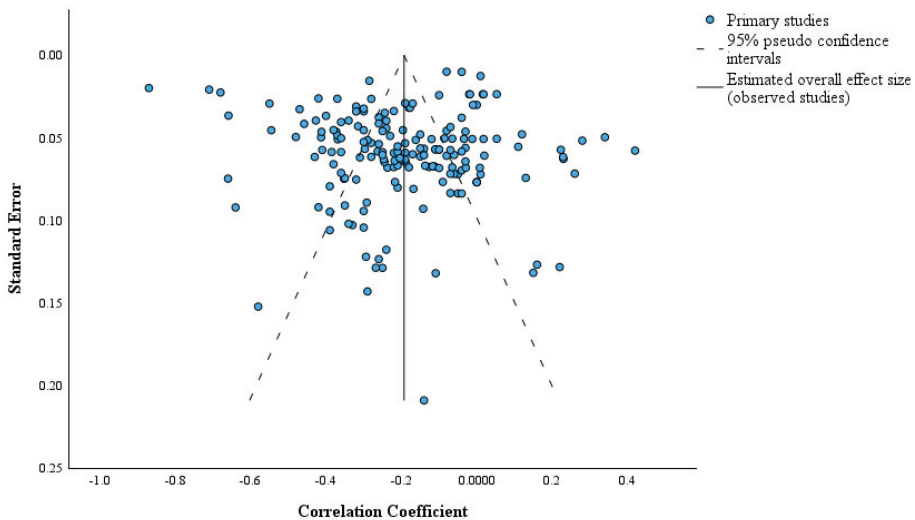


Figure A1. The funnel plot related to the Egger’s regression test for correlation coefficient and standard error. Note. The blue dots in the funnel graph represent individual correlation coefficients.

**Appendix D. The Results of Subgroup Statistical Tests**

**Table A3.** Results of effect size (*r*) estimates for subgroup academic performance indicators.

Academic Performance Indicator	<i>k</i>	Effect Size ( <i>r</i> )	Std. Error	Z-Value	Sig. (2-Tailed)	95% Confidence Interval	
						Lower	Upper
ACT	2	0.04	0.0700	0.575	0.565	-0.097	0.177
Average Grade	23	-0.27	0.0292	-9.388	<0.001	-0.332	-0.217
Course grade	25	-0.28	0.0583	-4.831	<0.001	-0.396	-0.168
Coursework	1	-0.39	0.1060	-3.680	<0.001	-0.598	-0.182
Exam	39	-0.16	0.0293	-5.566	<0.001	-0.220	-0.106
Flesch-Kincaid Grade Level	1	-0.27	0.1287	-2.082	0.037	-0.520	-0.016
General Average	1	-0.19	0.0650	-2.891	0.004	-0.315	-0.061
GPA	60	-0.18	0.0219	-8.284	<0.001	-0.224	-0.138
Homework assignment	7	-0.14	0.0919	-1.476	0.140	-0.316	0.044
Research specific	9	-0.12	0.0559	-2.084	0.037	-0.226	-0.007
WATs	5	0.01	0.0124	0.977	0.329	-0.012	0.037
Written report	3	-0.33	0.0666	-4.967	<0.001	-0.461	-0.200
Overall	176	-0.19	0.0153	-12.569	<0.001	-0.223	-0.163

SATs = Standard Assessment Tests.

**Table A4.** Results of effect size (*r*) estimates for subgroup procrastination indicators.

Procrastination Indicator	<i>k</i>	Effect Size ( <i>r</i> )	Std. Error	Z-Value	Sig. (2-Tailed)	95% Confidence Interval	
						Lower	Upper
Absence	2	-0.63	0.0800	-7.893	<0.001	-0.788	-0.475
APF	2	-0.18	0.1400	-1.289	0.197	-0.455	0.094
API	13	-0.27	0.0393	-6.759	<0.001	-0.343	-0.189
APSCM	22	0.07	0.0356	2.050	0.040	0.003	0.143
APSG	1	-0.24	0.0349	-6.986	<0.001	-0.312	-0.176
APSMT	1	-0.21	0.0802	-2.618	0.009	-0.367	-0.053
APSO	2	-0.25	0.0543	-4.673	<0.001	-0.360	-0.147
APSS	7	-0.30	0.0275	-10.917	<0.001	-0.355	-0.247
CCM	2	-0.08	0.0998	-0.835	0.404	-0.279	0.112
Days between assignments	1	-0.25	0.0647	-3.786	<0.001	-0.372	-0.118
Days to complete	1	-0.39	0.0586	-6.566	<0.001	-0.500	-0.270
Days to start	1	-0.13	0.0677	-1.875	0.061	-0.260	0.006
Days-hand-in	1	-0.35	0.0748	-4.703	<0.001	-0.499	-0.205
Dilatory behaviour	10	-0.24	0.0296	-8.085	<0.001	-0.297	-0.181
DPS	1	-0.20	0.0637	-3.139	0.002	-0.325	-0.075
EDA	1	-0.38	0.0660	-5.757	<0.001	-0.509	-0.251
EPA	1	-0.30	0.0324	-9.272	<0.001	-0.363	-0.237
GPS	11	-0.31	0.0614	-5.059	<0.001	-0.431	-0.190
Inactive time	2	-0.61	0.0567	-10.679	<0.001	-0.716	-0.494
IPS	9	-0.21	0.0404	-5.172	<0.001	-0.288	-0.130
Late submission	2	-0.58	0.1050	-5.489	<0.001	-0.782	-0.371
NEO-PI-R	1	0.12	0.0479	2.504	0.012	0.026	0.214
PASS	21	-0.14	0.0381	-3.746	<0.001	-0.217	-0.068
PI	1	-0.04	0.0838	-0.477	0.633	-0.204	0.124
PPS	4	-0.27	0.0707	-3.845	<0.001	-0.410	-0.133
PPSC	2	-0.37	0.0691	-5.322	<0.001	-0.503	-0.232
PSQ	4	-0.09	0.0507	-1.828	0.067	-0.192	0.007
Research specific	25	-0.18	0.0417	-4.375	<0.001	-0.264	-0.101
SPS	1	-0.35	0.0744	-4.702	<0.001	-0.496	-0.204
SSLI	2	-0.04	0.2050	-0.217	0.829	-0.446	0.357
Time pressure reactivity	2	-0.21	0.0922	-2.259	0.024	-0.389	-0.028
TPS	20	-0.24	0.0247	-9.646	<0.001	-0.286	-0.190
Overall	176	-0.19	0.0153	-12.569	<0.001	-0.223	-0.163

Note. The abbreviations found in the 'Procrastination Indicator' row are explained in Appendix A.

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Article

# Parental Help-Giving Orientations Scale (PHGOs) in Children's Learning: Construction and Validation

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**Abstract:** Parental involvement in the education and learning processes of children in general has become central in the last few decades. Following this involvement, the home arena is considered highly influential in providing a supportive environment for children's learning processes. Help-giving orientations of parents to their children in relation to homework and learning assignments can be crucial for the children's futures. According to the Help Relations theory regarding the two main orientations—dependent versus autonomy help (dependent help-giving rather than autonomy help), prevents opportunities to develop autonomous coping abilities in future. The Parental Help-Giving Orientations scale was designed to measure parental help to their children in learning at home. In Study 1, eleven experts evaluated orientations of parental help-giving that emerged from interviews. In Study 2 ( $n = 255$ ), exploratory factor analyses (EFA) indicated four reliable factors: autonomic, dependent reminder, dependent partner, and dependent student. The confirmatory factor analysis (CFA) in Study 3 in an independent sample of parents ( $n = 303$ ) exhibited a good model-fit of the data and demonstrated measurement invariance across parental gender. The scale can be used to measure individual differences in orientations in help-seeking among mothers and fathers.

**Keywords:** autonomy help-giving; dependent help-giving; factor analysis; learning at home; parents

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## 1. Introduction

### 1.1. Parental Involvement in the Home Arena

Parental involvement has been widely examined in recent decades, in both the school and the home arenas [1–4]. Epstein's model suggests six dimensions of involvement [5,6], two of which focus on the home arena: parenting and learning at home. Parenting highlights the ways in which parents provide a supportive home environment to help their children's learning, while learning at home focuses on how parents help their children with diverse learning assignments. Previous studies have indicated the importance of these dimensions for building parenting capacity; encouraging learning-at-home activities; and enhancing a strong relationship between the two parties: the home and the school arenas [7–10].

The dominance and significance of parental involvement in the home arena was particularly increased as a result of a rapid and unpredicted process—the COVID-19 pandemic—which broke out in 2020 and was characterized by lockdowns and quarantine [11]. Thus, the home arena became highly central in providing a supportive environment and in parents' involvement in their children's learning processes [12–17]. One of the main characteristics of the home arena is the help parents give their children in various areas of learning, such as homework [18–20] and studying for exams [21]. Yet, in general, while parental involvement is considered positive and beneficial, helping at home with homework does not necessarily ensure students' academic success [22,23]. It seems that it is the quality and type of help offered which is beneficial, rather than the help itself,

which is not enough on its own [20,24]. Thus, the orientations of help-giving are crucial for achieving motivation and success among students.

### 1.2. Help-Giving Orientations

The suggested development and validation of the Parental Help-Giving Orientations scale is based on the theoretical framework of Nadler [25,26], distinguishing between autonomy versus dependent helping relations. Autonomy help-giving means assistance in providing tools, guidance, and support in the independent coping of the recipient of the help. It strengthens the coping abilities of the recipient of the help in future challenges [25]. On the other hand, dependent help-giving means providing the final solution of the problem for the recipient of the help. This type of help does not contribute to the development of independent abilities and harms the recipient's future ability to deal with challenges [26].

Previous studies have dealt with intergroup helping relationships in the educational context (for parents and teachers, see [27,28]; for students and teachers, see [29]; for parents and children, see [28]). While help-seeking has been broadly addressed (e.g., [30–32]), less attention has been given, to the best of our knowledge, to the type of help that parents give their children in the educational context. An exploratory qualitative study conducted among Israeli teachers focused on the help with homework that parents give their children [33]. It was found that parents broadly used different types of dependent help-giving, rather than autonomy help. Providing long-term dependent help impairs the recipient's learning and development process and prevents opportunities to develop autonomous coping abilities in future [25,29,34,35].

Past research indicates two main areas in the literature on providing help. The first is a body of research that investigates the relationship between family-centered help-giving practices and parent, family, and child behavior and functioning (e.g., a meta-analysis of 47 studies, [36]). This line of research focuses on studies dealing with systemic interventions for the benefit of families dealing with different types of distress, populations at risk, children with developmental delays, and more. The second main area in the literature on providing help is literature from the field of the social psychology of helping relations: in this field, measurement of help-giving focuses on laboratory studies and not self-report studies and, in recent years, has dealt extensively with helping relations between groups as power relations (e.g., [35,37]).

The present study focuses on parental help-giving; the research described above was not directly focused on parental help-giving to their child in the educational context. Thus, focusing on different parental help-giving orientations can deepen the understanding regarding learning processes among children as shaped by their parents in the home arena. The current research is aimed at mapping and conceptualizing the help-giving orientations of parents in their children's learning activities at home in the broader context of interpersonal parental dimensions. Its specific objectives are to develop and validate the content and structure of a Parental Help-Giving Orientations scale (PHGOs), using exploratory (EFA) and confirmatory (CFA) factor analyses. Thus, the main research questions are: (1) What are the different patterns of help that parents give their children in learning processes at home, and what are the characteristics of each pattern of help? (2) Is there a distinction between the different patterns of help, and how is this distinction reflected in the factorial structure of the questionnaire (i.e., in the questionnaire's measurement scales)? Upon reaching a model structure that describes the data well (i.e., in terms of adequate model-fit), we also aim to test the PHGO scales against external parent-child relation variables and to discriminate their measurement from social desirability. For that purpose, a series of three studies was conducted. Each study was an independent and separate process [38], as further described and elaborated.

## 2. Method

The development and validation of the scale was conducted as a process of three separate studies (for the full description, see Table 1). Study 1 focused on the classification



of the items in the scale by experts [39,40]. Study 2 and Study 3 focused on an exploratory and confirmatory factor analysis, as is presented further.

**Table 1.** The research model.

Description	Analysis	Relevant Variables	Participants
<b>Study 1</b>			
Development and content validation of questionnaire by experts	Content analysis	Help-giving orientations	Eleven experts in the education and/or psychology disciplines
<b>Study 2</b>			
Identification of the factorial structure of the parental help-giving orientations scale (PHGOs)	Exploratory factor analyses (EFA)	Help-giving orientations	255 parents (Sample 1)
<b>Study 3</b>			
Testing of the PHGOs model-fit, gender measurement invariance, and concurrent validity against related parenting variables; Testing the scales' susceptibility to social desirability	Confirmatory (CFA) factor analyses	Gender, parent-children relations, social desirability	303 parents (Sample 2)

#### *Participants in Studies 2–3*

The samples used in Study 2 (below, Sample 1) and Study 3 (below, Sample 2) were independent, as they were used for separate factorial analyses. Participants in both samples were Jewish, Hebrew-literate parents, who have at least one child in elementary school. The questionnaires were delivered in the Hebrew language and were translated by a professional translator to English for the purposes of international publication.

The sample was collected in January 2022, by I panel—the largest online panel in Israel, based on over 100,000 paid members from various socioeconomic clusters and backgrounds—which adheres to the international guidelines and standards of ESOMAR concerning credibility and control. Convenience sampling was used, including parents who were available and who volunteered to participate in the research study. All of the participants gave their informed consent after receiving from the researchers the full details of the study, including its purpose, the procedures, possible risks and benefits, and their ability to withdraw and refuse to participate any time with no penalty [41].

### **3. Study 1: Building the Parental Help-Giving Orientations Scale**

Four orientations of parental help-giving were measured in the current research. For each of the four orientations, 6–12 items were generated, based on theoretical knowledge [25,26], and thematic analysis of 24 interviews with parents and teachers was conducted. The analysis was conducted in an initial deductive step, followed by an inductive step. Based on the deductive analysis employing Nadler's theory, two main patterns of help-giving were identified in the interviews—autonomy help and dependent help. Subsequently, on the basis of an inductive analysis based on the field and the interviews with teachers and parents, three patterns of dependent help-giving emerged, reflecting an extension of the existing theory: parent as a reminder, parent as a partner, and parent as a student (for the main dimensions of the thematic analysis, see Appendix A). This process yielded an initial pool of 42 items. A total of eleven experts from the fields of education and psychology, who are engaged in researching and teaching aspects related to parenting, were asked to give their opinion on the suitability of the items formulated for measuring the various help-giving orientations at home. The procedure was conducted in two rounds. In the first round, three experts classified each of the 42 items according to one of the four helping orientations. For the structure validation stage, items upon which at least two out of three experts agreed were re-formulated. At this stage, 12 items were discarded, six were rephrased, and four new items were generated, reducing the total amount to 34 items. In the second round, eight experts gave their opinion regarding the 34 items. Only items that achieved consent among at least five of the eight experts were re-formulated. At the end of

this round, 11 items were discarded and four were rephrased, reducing the total number of items to 23, which was the final number of items in the questionnaire delivered to parents. The 23 items were presented on a 6-point scale which ranged from 1 (*strongly disagree*) to 6 (*strongly agree*), aimed at providing more gradated choices [41].

## 4. Study 2

### 4.1. Methods

#### 4.1.1. Participants

Sample 1 consisted of 255 parents (127 fathers and 128 mothers) whose ages ranged from 27 to 59 (*Age* = 41.56, *SD* = 6.47). The majority of the sample's parents were married (about 89.4%) and the rest were either single parents (about 2.7%) or divorced (about 7.5%). More than 80% of this sample's parents reported at least 13 years of schooling.

#### 4.1.2. Measures

The Parental Help-Giving Orientations scale (PHGOs) with 23 items.

### 4.2. Results

#### Exploratory Factor Analysis (EFA)

In order to test the instrument's factorial structure, we conducted an exploratory factor analysis (EFA) using the principal component method with Varimax rotations. The EFA was employed with an initial 23-item instrument in a sample of 255 parents, after verifying its adequacy for factor analysis using the Kaiser-Meyer-Olkin measure of sample size adequacy ( $KMO = 0.86$ ) [42] and Bartlett's test of sphericity ( $\chi^2(253) = 2525.32, p < 0.001$ ). Both indications met the minimal standards for conducting a factor analysis [43]. The EFA yielded two comparable solutions (4-factor and 5-factor solutions), with their factors explaining a similar proportion of the models' variance (of approximately 61.5%). The 5-factor solution was discarded, since its fifth factor contained just two items that explained a small proportion of model's variance. Conversely, the 4-factor solution presented a more balanced factorial composition that better described the model's conceptual dimensions, and was therefore favored. We also used a principal factoring EFA with oblique rotation, which did not significantly improve or change the four-factor solution; thus, the current orthogonal solution was preserved, as possible when two strategies yield similar factorial solutions [44].

As a rule [45], items loaded above 0.40 on a single factor were retained for further factor analysis with a separate sample. Accordingly, two items were excluded from the original model for small item-loading on a factor ("I sometimes feel very frustrated with the feedback my child gets on her/his assignments because I was involved in their preparation" (item 22); "My child doesn't do homework and assignments at home unless I'm involved and take part in their preparation" (item 23). Three items were also excluded for simultaneous significant loading on more than one factor ("I often remind my child about the learning assignments s/he has to complete" (item 4); "I enter the feedback system to check what assignments/tasks my child was given and then draw her/his attention to it" (item 13); "I usually sit with my child while preparing learning assignments that need guidance or help from an adult" (item 14). The parsimonious 4-factor solution with 18 items is displayed in Table 2, after excluding five items from the original instrument using these statistical considerations and rerunning the factor analysis on the remaining items. Based on the items' themes in each factor, the model's four scales were conceptualized according to the salient type of parental help-giving orientation and named: Partner, Student, Autonomy, and Reminder.

**Table 2.** Factor loadings with Varimax rotation for the 18 items with four-factor solution.

Item Number and Content	Factor 1 Partner	Factor 2 Student	Factor 3 Autonomy	Factor 4 Reminder
6. When my child has homework, we sit down together to prepare it, and go over the material taught in class.	0.874			
5. I usually sit with my child when s/he is doing homework.	0.866			
3. I'm actively involved in preparing learning assignments together with my child.	0.745			
7. My child prefers to do homework in my presence, so I can be involved in preparing it.	0.735			
18. I believe that preparing learning assignments together is a form of quality time shared by me and my child.	0.599			
11. When I sit down with my child who has homework to do, ultimately, it's me who does most of the work.		0.858		
2. When my child has difficulty with learning assignments, I answer the questions instead.		0.788		
8. When my child has a big project, I try and do it myself.		0.746		
1. I do the homework instead of my child.		0.746		
17. In areas where I'm stronger, I answer the questions instead of my child.		0.693		
12. If my child has difficulty solving a question or exercise, I try to give them tools that can help them cope better alone.			0.782	
9. It's important for me to strengthen in my child the academic skills that will help them tackle learning assignments or homework alone.			0.754	
20. It's important for me that my child work independently, so if necessary, I provide explanations that will lead her/him towards handling tasks independently.			0.745	
15. I help/assist my child in guiding and developing skills, as long as s/he copes independently with the educational tasks.			0.697	
10. I check on WhatsApp and in emails for messages about homework and make sure that my child indeed did the homework				0.683
19. I don't prepare assignments and tasks instead of my child, but I do make sure they are done on time.				0.639
16. I ask friends/other parents from the class about tasks that had to be done at home and compare their child's performance with mine.				0.591
21. I make sure that my child does everything they must do academically, even if it means repeatedly asking my child about the subject.				0.556
% Variance	18.99%	18.45%	14.77%	9.36%
Eigenvalue	3.42	3.32	2.56	1.69

## 5. Study 3

### 5.1. Methods

#### 5.1.1. Participants and Procedure

Sample 2 consisted of 303 parents (148 fathers and 155 mothers), whose ages ranged from 28 to 59 (*Age* = 40.06, *SD* = 5.89). Of the sample's participants, the majority of parents were married (about 89%) and the rest were either single parents (about 4%) or divorced (about 7%). The distribution of the participants' education was as follows: about 20% reported up to 12 years of schooling, 34% reported 13–15 years of schooling, and the rest reported above 15 years of schooling. Participants simultaneously completed the 18-item PHGOs and the validity indexes detailed below (i.e., the PCRI scales and the Social Desirability scale).

#### 5.1.2. Measures (PHGOs and Validity Indexes)

Parental Help-Giving Orientations Scale (PHGOs). The 18-item PHGOs with four hypothesized factors.

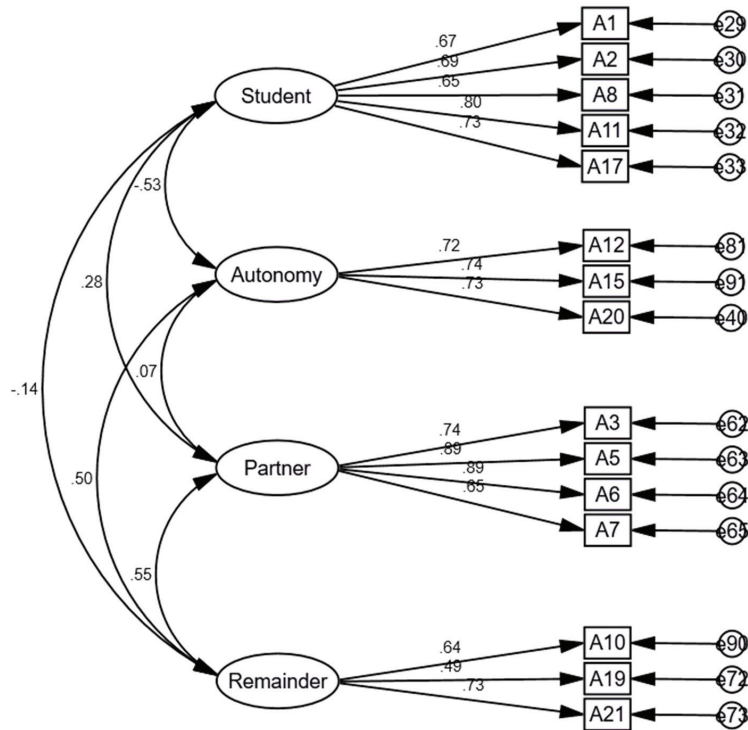
Parent-Child Relationship Inventory (PCRI). The instrument assesses parents' attitudes toward parenting and toward their children, originally designed as a complementary clinical evaluation for families [46]. The full instrument consists of 78 items, divided by factor analysis and expert ratings into 7 content scales. For the purpose of validating the PHGOs scales, we used 4 of the PCRI scales: parental satisfaction (e.g., "I regret having children";  $\alpha = 0.85$ ), communication (e.g., "My child tells me all about his or her friends";  $\alpha = 0.81$ ), involvement (e.g., "I feel very close to my child";  $\alpha = 0.80$ ), and limit-setting (e.g., "I have trouble disciplining my child";  $\alpha = 0.77$ ).

The Marlowe Crowne Social Desirability Scale (MCSDS). A scale that measures the level of social desirability bias, which refers to the need to respond in culturally sanctioned ways [47] was used. The Marlowe Crowne Social Desirability Scale is a 33-item model, with true/false choices dichotomously scored, with a 1 indicating a socially desirable response, which is a “true” for the 18 socially desirable items (e.g., “Before voting, I thoroughly investigate the qualifications of all the candidates”) and a “false” for the 15 socially undesirable items (“It is sometimes hard for me to go on with my work if I am not encouraged”).  $\alpha = 0.75$ .

5.2. Results

5.2.1. Confirmatory Factor Analysis (CFA)

In this section, the 4-factor solution with 18 items was tested using Structural Equation Modeling (SEM) to ascertain a model-fit in a larger sample of parents ( $n = 303$ ). The AMOS 16 program was used to conduct the CFA analyses and to test the scales’ measurement invariance. Upon testing the items’ fit, three items were discarded at this stage (Autonomy–A9; Partner–A18; Remainder–A16), as their 15 loadings on the hypothesized factors were poor and attenuated the model’s overall fit. Also, we avoided a possible distortion of the real structure of the data by allowing errors to correlate [48]. Figure 1 describes the final 4-scale model with 15 items of the Parental Help-Giving Orientations scale, along with its fit-indices elaborated below.



**Figure 1.** Description of the 4-factor model of the PHGOs: Latent factors, indicator variables, and factor loadings; Estimates are significant at 0.1%. Model-fit indices:  $\chi^2 / df = 173.88$ ,  $p = 0.001$ , normed fit index [NFI] = 0.910; Tucker–Lewis fit index [TLI] = 0.938; comparative fit index [CFI] = 0.950, root mean square of error approximation [RMSEA] = 0.060; standardized root mean square residual [SRMR] = 0.059.

As Figure 1 indicates, all of the observed variables in the 4-factor model are loaded significantly (at <0.01%) on their hypothesized latent factors, with their loading sizes ranging from 0.49 to 0.89. Further, despite the significant chi-square value and the borderline RMSEA value, in general, the model exhibits acceptable fit indices, with its CFI, TLI, and NFI values all exceeding the threshold of 0.90, and the SRMR index reaching below the value of 0.80 [49–51].

### 5.2.2. Measurement Invariance across Parental Gender

The model in Figure 1 was tested for measurement invariance for mothers and fathers. Measurement invariance across gender was examined by dividing the full sample into two subgroups of 148 fathers and 155 mothers. On scaling the participants' years of schooling into ordinal 4-point scales, there were no statistically significant differences between the two parental gender groups in level of education ( $\chi^2(3) = 2.35, p = 0.53$ ). We did record, however, significant differences in their mean age (*Mean difference* = 3.02;  $t(301) = 4.59, p < 0.001$ ). Yet, since the instrument's scales were principally not correlated with the parental age, we retained the sample sizes as is, while not matching the groups by this variable prior to testing the model's measurement invariance. Table 3 presents the fit indices for the configural invariance, metric invariance, and scalar invariance, generally exhibiting an adequate fit for all three invariance models with regard to the PHGOs measurements across gender. Specifically, under the model's multi-group analysis, all model-fit indices do not fall below the 0.90 threshold, indicating a good model-fit at three invariance levels (that is, three levels of model constraint). Also, the chi-square values of the differences between the models were statistically insignificant for the metric and the scalar invariance models, both indicating a measurement indifference between mothers and fathers. Consistently, the model-fit change in the CFI and the RMSEA indices between the invariance models were all <0.01, indicating no significant decrease as a result of the imposition of equality constraints between models [52]. Taken together, we concluded that the findings support measurement invariance of the PHGOs across gender at the three levels of invariance.

**Table 3.** Model-fit indices of measurement invariance for the PHGOs across gender.

Model	$\chi^2$ (df)	$\chi^2$ /df	RMSEA (90% CI)	TLI	CFI	Comparison	$\Delta \chi^2$	$\Delta$ CFI
M1: Configural invariance	279.81* (168)	1.67	0.05 (0.04–0.06)	0.924	0.939	-	-	-
M2: Metric invariance	293.47* (179)	1.64	0.05 (0.04–0.06)	0.927	0.937	M1, M2	13.66	0.002
M3: Scalar invariance	316.83* (194)	1.63	0.05 (0.04–0.06)	0.927	0.933	M3, M2	23.37	0.004

**Note:**  $\chi^2$  Chi-square, df degrees of freedom, RMSEA root mean square error of approximation; TLI Tucker–Lewis fit index, CFI comparative fit index.\*  $p < 0.001$ .

### 5.2.3. Concurrent Validity and General Psychometric Properties

The final scores of the instrument's scales are displayed in Table 4, along with the scales' internal consistence reliability index and their association with numerous related parental constructs. Apart from the borderline Alpha coefficient recorded in the Autonomy scale, the three other scales exhibited adequate reliability indices, especially given the scales' small number of items. To further establish the instrument's construct validity, we tested the PHGO scales against the parents' concurrent reports of their parent-child relationship in the family using the four PCRI scales: parental satisfaction, communication, involvement, and limit-setting. As mentioned earlier, the PCRI is a family diagnostic tool originally designed for clinical purposes, which can also be used in other contexts, including research settings [46,53]. Consistent with our expectations, we obtained positive significant correlations of small to moderate sizes between the PHGOs' autonomy and reminder scales and all four PCRI scales. A moderate negative significant correlation between the PHGOs' student scale and the four PCRI scales was also found. Apart from

the partner scale, which was not correlated with the PCRI scales, these findings reinforce the validity of the current scale as a measure of parent-child relations.

**Table 4.** Means (SD), reliability (Cronbach’s Alpha), and the correlations between the PHGO scales and external variables.

PCRI	POHGs			
	Autonomy	Reminder	Partner	Student
Satisfaction	0.36 **	0.25 **	0.08	−0.30 **
Involvement	0.40 **	0.25 **	0.11	−0.34 **
Communication	0.36 **	0.19 **	0.06	−0.35 **
Limit-Setting	0.36 **	0.17 *	−0.14 *	−0.40 **
Mean	4.87	4.39	3.78	1.93
SD	0.82	0.97	1.18	0.85
Cronbach’s Alpha	0.65	0.78	0.87	0.83

\*  $p \leq 0.05$ , \*\*  $p \leq 0.001$ .

#### 5.2.4. Examining the Relationship between the PHGOs and Social Desirability

Ultimately, since parents’ self-reports of their help-giving orientations toward their children’s educational assignments at home might be affected by their social desirability motivations, it is essential to determine whether the PHGOs are vulnerable to the effects of the latter variable. To that end, we tested the parents’ scores on the PHGO scales against their corresponding reports on a social desirability scale. Social desirability refers to one’s tendency to distort self-presentation according to socially desirable standards and is normally used in test development to measure the association between a tested scale and social desirability responses as part of validation procedures [54]. The correlations recorded in the current sample between the PHGOs’ “autonomy”, “reminder”, “partner”, and “student” scales and the social desirability scale were 0.11 ( $p = 0.052$ ), 0.03 ( $p = 0.56$ ), 0.05 ( $p = 0.43$ ), and  $-0.09$  ( $p = 0.11$ ), respectively, principally affirming that the PHGOs’ measurements are not affected by social desirability.

## 6. General Discussion

The present research reported the development and validation of the Parental Help-Giving Orientations scale (PHGOs), a new scale aimed at assessing patterns of parental help-giving in regard to their children’s learning in the home arena. The resulted scale consisted of 15 items that composed one factor of autonomy help-giving and three factors of dependent help-giving: parent as a reminder, partner, and student. The meanings of the developed scale can be discussed both theoretically and methodology.

Theoretically, the importance of learning at home and the role of parents in this learning has been extensively studied and its contributions have been presented in numerous studies [18,20]. The current study enhances the importance of the meaning and role of parents in helping with homework and learning at home processes [17,21]. Particularly, the study highlights the phenomena of dependent help-giving that is expressed in the conduct of the parents in various ways, from a relatively limited level of creating dependence, such as the parent as a reminder, to involvement that creates great dependency, such as the parent as a student who performs the tasks for the child.

These help-giving orientations are liable to be more significant against the background of the COVID-19 crisis, which has made the home arena not only more central to distance learning processes, but sometimes almost the only arena for learning processes [13,14]. Therefore, it is important, even in the post-COVID period, to illustrate the different meanings of the help provided by parents, while emphasizing the implications of this help for both parents and their children in the short and long term.

Receiving autonomous help has clear advantages in these two channels. Autonomy help grows and helps develop the child’s ability to cope with similar problems and challenges in the future, while, at the same time, it strengthens their sense of self-efficacy and

self-worth, as a result of increasing independence and the ability to cope personally and successfully with the challenges [28,35,55]. On the other hand, receiving dependent help from the parent, in which the child actually does not cope with the challenge on his/her own, is less likely to help over time in developing future coping abilities [32] and, in addition, impairs the development of a sense of self-efficacy and self-worth, and does not encourage independence [26,34].

When it comes to the educational field, the child's ability to cope with tasks on his/her own is important and constitutes a basis for the learning processes at school. Also, with regard to the relationship between the helper and the recipient, in the current study, which focused on the parent-child relationship, there is significance in establishing a dependency relationship between parent and child, over time, in fostering the child's expectations of receiving this type of assistance, and in the implications of this assistance relationship for the future of the relationship in adolescence and adulthood. A follow-up study that focuses on the parent-child relationship in the context of homework and learning at home will be able to examine these ideas.

Methodologically, several strengths can be mentioned regarding the process of the scale development and validation and its results. First, the items of the scale were formulated based on a thematic analysis of interviews and relied on eleven experts who separately evaluated each item as it related to its theoretical meaning. Second, the scale was tested in two separate, large, independent samples, allowing us to identify and confirm its structure using EFA and CFA in two statistically consecutive stages. In this regard, the hypothesized four-dimensional construct of parental help-giving orientation (that is, autonomy, dependent reminder, dependent partner, and dependent student) found support in the data in the form of good model-fit and gender measurement equivalence. Finally, the construct measured by the scale was tested against five fundamental variables of parent-child relationship, establishing the scale's validity as a measure of parent-child relations in the home arena. Moreover, examining the relationship between PHGOs and social desirability, the scale confirmed that the PHGOs' measurements are not affected by social desirability.

## **7. Conclusions**

Help-giving orientations of parents to their children in the home arena can be viewed as part of the general phenomena of parental involvement. Following the two main orientations—autonomy and dependent help—a scale of 15 items was developed in the current study. The scale demonstrates the measurement of autonomy help by three items, and dependent help by 12 items, which include three sub-types: Parent as a reminder, parent as a partner, and parent as a student. Emphasizing diverse types of dependent help demonstrates the elaboration of the general dependent help orientation and can be used in future studies as further described. The final scale (see Appendix B) is based on well-designed constructs and content that were both theoretically and methodology established and demonstrated. The practical implications of the newly developed and validated scale can be relevant for educators, clinicians, parents, and students. The scale can be used among families with children at risk of academic failure, or among families from diverse cultural backgrounds. It can also estimate the influence of the help-giving orientations for predicting short- and long-term learning behaviors in both K-12 and higher educational systems.

## **8. Limitations of the Study**

Several limitations can be described regarding the current study. First, the data collection was carried out in Israel, which is characterized as a particular culture. Broader attention is required, both for different sectors within Israeli society and the distinctions between them, and for references to cultures in different countries around the world. Second, in the present study, a preliminary examination was conducted of the factorial structure of the questionnaire and the psychometric characteristics of its scales against the hypothetical dimensions included in the theoretical structure of the field of parental

help-giving to their child in the educational tasks at home. Further validation of the questionnaire requires further examination of the quality of the model reflected in the factorial structure of the tool through a separate sample of parents.

## 9. Future Directions

Several steps will be beneficial for further establishing the scale's construct validity. First, other similar or diverse constructs should be examined. For example, over-parenting, or "helicopter parents", can be regarded as additional alternative tools that differ from the scale in the current research. Second, the scale could be examined in different cultures and populations. In Israel, for example, the scale could be validated in Arab and Jewish ethnicities. From an international perspective, the scale could be examined in different countries, establishing cross-cultural patterns of parental help-giving with respect to children's learning assignments in the home arena. Finally, as help-giving can influence both children and parents, it could be used to predict variables whose influence could be measured in both the school and the home arena. Considering the situation that COVID created, and the increasing phenomenon of learning at home, the meaning and the influence of diverse help-giving orientations is particularly relevant.

The instrument in its final form can be used for future research in at least three main research directions; first, to understand the relationship between the type of help the parent gives the child and the child's academic achievement and functioning in the specific field in which help is provided, as well as in other areas of learning. This direction can be examined both through academic achievement and through teachers' reports on the degree of independence, sense of competence, and commitment to student learning. A second research direction can focus on parent-child relationships dealing with other aspects; for example, the assessment of the child's abilities by the parent, the relationship between the type of help the parent provides and the child's unique characteristics and special needs, and other parental characteristics. Finally, as the help-giving orientations can be based on the motives for responsibility that are complex and can be both intrinsic and extrinsic [28], future studies can deepen the connections between the parents' motives and the help-giving orientations.

The research can highlight the importance of the quality of help that parents give their children. While this research focuses on parental conduct and patterns, creating a body of knowledge will lay the foundations for future research examining the implications of these variables for the students, their achievements, and ways of learning, as a result of different help-giving orientations.

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## Appendix A. The Themes, Segments, and Statements' Examples

Themes (Deductive Analysis)	Sub-Themes (Inductive Analysis)	Segments	Examples of Statements
Autonomy help		Providing assistance, giving directions, transferring responsibility to the child, providing tools	<p>"I really like to show him how to do things on his own, to provide academic skills that will help him in general, not specifically. But I'm not a professional at it" (Omer, parent)</p> <p>"Homework today, the way it's delivered, can't really change students' thinking. This does not encourage them to be autonomous learners, to manage their time and priorities, and to be able to apply the learning process in their real life" (Rona, teacher)</p>
	Parent as reminder	Checking, reminding, asking regularly, following the instructions	<p>"I remind him all the time because I think it's important. I see that it helps him" (Majed, parent)</p> <p>"A student comes to tell me that his parents work late, and sometimes he forgets to do his homework. This is important for the child" (Shula, Teacher)</p>
Dependent help	Parent as partner	Doing homework together, sitting with the children, sharing time, being with the child	<p>"They don't sit alone. Usually, they need us with them. It's like a contract between us—'If I come, you'll come'" (Zohar, Parent)</p> <p>"Sometimes a student tells me, 'I didn't do my homework because no one was available (or at home) to do it with me'" (Rowan, teacher)</p>
	Parent as student	Doing homework for child, taking responsibility instead of the child, improving the child's work	<p>"They (the teachers) give difficult assignments, beyond his ability. It's easier for me to do that and show him what I've done" (Nurit, parent)</p> <p>"I know when a parent did their homework. When I talk to the child, he tells me: 'We didn't have time,' or 'My parents were in a hurry'" (Hagit, teacher)</p>

## Appendix B. The 15 Items of Parental Help-Giving Orientations Scale (PHGOs)

Item No.	The Item	The Help-Giving Orientation
1	I do the homework instead of my child.	Student
2	When my child has difficulty with learning assignments, I answer the questions instead.	Student
3	I'm actively involved in preparing learning assignments together with my child.	Partner
4	I usually sit with my child when s/he is doing homework.	Partner
5	When my child has homework, we sit down together to prepare it, and go over the material taught in class.	Partner
6	My child prefers to do homework in my presence, so I can be involved in preparing it.	Partner
7	When my child has a big project, I try and do it myself.	Student
8	I check on WhatsApp and in emails for messages about homework and make sure that my child indeed did the homework.	Reminder
9	When I sit down with my child who has homework to do, ultimately, it's me who does most of the work.	Student
10	If my child has difficulty solving a question or exercise, I try to give them tools that can help them cope better alone.	Autonomy

Item No.	The Item	The Help-Giving Orientation
11	I help/assist my child in guiding and developing skills, as long as s/he copes independently with the educational tasks.	Autonomy
12	In areas where I'm stronger, I answer the questions instead of my child.	Student
13	I don't prepare assignments and tasks instead of my child, but I do make sure they are done on time.	Reminder
14	It's important for me that my child works independently, so if necessary, I provide explanations that will lead her/him towards handling tasks independently.	Autonomy
15	I make sure that my child does everything they must do academically, even if it means repeatedly asking my child about the subject.	Reminder

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Article

# “Who’s the Student at Home?”: Parental Help-Giving Orientation in Learning at Home Predicted Using a Parent’s Personal Characteristics

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**Abstract:** The present study focuses on the involvement of a parent in their child’s learning processes, particularly, their help-giving orientation while learning at home. The main goal of the study was to identify the connection between the parent’s personal characteristics and the help-giving orientation the parent provides to their child: autonomous vs. dependent (parent as student) help-giving. The sample was collected using online participant recruitment surveys in Israel. In total, 306 parents aged 27–59, who had at least one child in elementary school, answered five questionnaires measuring the research variables: the short grit scale; the satisfaction with life scale; the advice/affect management–overparenting subscale; the parenting sense of competence scale; the parental helping orientations scale (PHGOs), and a background questionnaire. The findings identified negative associations between parental personal characteristics (grit, advice/affect management, well-being) and parent-as-student orientation and positive associations between the parent’s characteristics and parental autonomous help-giving orientation, with all of these effects at least partially mediated by parental self-efficacy (indirect effects). The results provide greater insight into the relationship between a parent’s personal characteristics and their choice of assistance to their child and contribute to the knowledge regarding parental involvement in learning at home and educational contexts in general.

**Keywords:** help-giving orientation; parental self-efficacy; grit; subjective well-being; advice/affect management

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## 1. Introduction

The present study investigates parental involvement in learning processes while focusing on the parent–child helping relations in the context of learning at home. The theoretical framework of this study is based on the integration of educational and psychological perspectives that examine the effect of a parent’s personal characteristics while giving assistance to the child in academic matters at home. Much attention has been given in recent years to family–school collaboration and creating a partnership [1–3]. Epstein [4] conceptualizes family involvement as occurring on multiple levels, considers the overlapping spheres of influence that families and schools have on students and how those spheres interact, and calls for a greater overlap between roles than those which often exist in schools as well as for greater partnerships between home and school. Studies conducted in recent years have supported the importance of this collaboration [5] which have encouraged learning-at-home activities and a strong relationship between the home and school arenas [6,7] and have demonstrated the variety of ways that families are involved in children’s education, as well as the positive outcomes in terms of better performance, better attitudes toward school, and higher graduation rates [5,8,9].

The parent–teacher–student relationship has been examined from different angles. Epstein [4] distinguished between parental school-based activities, such as volunteering, communicating, decision making, and collaborating and home-based activities, such as

parenting or learning at home. Accordingly, Medwell and Wray's research [10] indicates that the vast majority of teachers felt that practice and learning assignments at home promoted partnership between the school and parents in regard to their child's learning.

In the present study, we focus on the involvement of a parent in their children's learning processes at home and specifically, in parental help-giving with learning assignments and academic matters at home. The main goal of the present study is to examine a parent's personal characteristics that are associated with the type of help the parent provides to their child in academic assignments. We see importance in understanding the helping relations in this area because of the impact of different types of involvement which may contribute to encouraging effective and proactive assistance for the child, in addition to the understandable importance of parental involvement in their children's educational processes. Therefore, first, we will present the helping relations in an educational context, focusing on the help-giving of a parent to their children, and later, we will lay out the foundations for predicting the parent's personal characteristics that can influence the parental help-giving orientations which we examined in the present study.

## 2. Literature Review

### 2.1. Help Giving in an Educational Context

Providing assistance in educational contexts has been of interest to various researchers in recent decades. Much research has been conducted to examine helping relations between teachers and students and the variables influencing this relationship. For example, the relationship between teachers' behavior and attitudes and children's willingness to receive assistance from them [11,12]; the effect of classroom characteristics and classmates' perceptions on helping relations in the classroom [13]; and teachers' perceptions of student characteristics were examined in this context [14].

In addition, much attention has been given to parents' contribution to home learning processes and the provision of assistance to their children. Hoover-Dempsey et al. [15] reviews research on parental involvement in student homework, focused on the reasons given by parents for providing assistance to children, and the implications of the help provided. Findings suggest that parents involve themselves in student homework because they believe that they should be involved, believe that their involvement will make a positive difference, and perceive that their children or children's teachers want their involvement. William and William [16] examined the impact of different learning assignments on parental involvement in home learning and pointed out the importance of matching home tasks to the ability of parents to provide help for their child.

Parental involvement in learning processes, especially in dealing with challenges and difficulties, can be expressed in different ways. Parents see support for their children's education as a key part of their parenting [8,17] reflected, among other things, in the provision of study assistance at home and help-giving to their child with learning at home [18,19].

As in recent studies [18,20–22], in the present study, the theoretical framework of helping relations according to Nadler [23,24] was used. Nadler's theory of helping relations emphasizes the differences between dependent versus autonomous help-giving. Where autonomous help-giving fosters the recipient's ability to cope with similar challenges in the future, dependent help-giving establishes the recipient's inability to deal with similar challenges as a result of over-reliance on the help provider [25]. In educational contexts, dependent help-giving means providing the student with the solution to the problem instead of explaining how to solve the problem, and how to establish control and understanding on the subject matter [26].

Following Nadler's theory of helping relations [18,23,24], identified different types of help-giving orientations that characterize a parent's involvement in learning at home: autonomous help-giving, parent as reminder, parent as partner, and parent as student. The last three themes are increasingly dependent help-giving orientations, with parent as student reflecting the parent's over-involvement in the introduction of learning assignments,

as if the assignments were for them. Moreover, in a study that synthesized the results of nine meta-analyses which examined the impact of parental involvement on academic achievements, Wilder [27] found that the relationship between parental involvement and academic achievement was positive, regardless of the definition of parental involvement or the measure of achievement and that this correlation was strongest if parental involvement was defined as parental expectations for the academic achievements of their children and weakest if parental involvement was defined as homework assistance. Wilder's distinction is consistent with the difference between the provision of autonomous versus dependent help-giving as presented above and, therefore, supports the importance of understanding the personal characteristics that predict the provision of distinct parental help-giving orientations: dependent help-giving—parent as student—on the one hand, and parental autonomous help-giving, on the other.

## 2.2. Personal Characteristics Influence Parental Help-Giving in Learning at Home

Parental self-efficacy is the parent's belief in their ability to perform their parenting role successfully [28], a critical factor that determines the goals a parent chooses for themselves and how persistent they are in working toward those goals [29]. Parental self-efficacy is also reflected in the parent's choices in a variety of areas [30]. Regarding parental self-efficacy for helping children succeed in school, it is usually influenced by a variety of sources [29] such as a parent's educational experiences, their own relationships with teachers during childhood, and their readiness for their role as caregiver as well as a socio-economy status parameter [31]. Previous research showed that parental self-efficacy is associated with encouraged social, academic, and psychological well-being of their child [28]. For example, Liu and Leighton [31] provide evidence for significant mediating relationships between parental perceptions and children's math achievement via positive association with parental self-efficacy, and negative association with parental involvement in children's schoolwork. The negative association between parental involvement and children's achievement was demonstrated in other previous research, such as Nii et al., [32] which indicated that the partially inconsistent results regarding the relationship between parental involvement and academic achievement can be explained by the lack of theoretical and methodological uniformity regarding the nature of parental involvement in children's schooling. Parents' involvement and help-giving may lower children's autonomous and self-directed motivation and result in children developing negative perceptions about themselves which, in turn, may negatively affect their academic achievement [31,33]. In the present study, we seek to focus on dependent vs. autonomous help-giving orientations in learning at home and to examine the role of parental self-efficacy in mediating the effect of additional parental characteristics to those distinct help-giving orientations: subjective well-being, grit, and parental advice/affect management.

A previous study indicates that parental self-efficacy is predicted by a parent's subjective well-being and their parenting style [18]. In a study conducted among parents of elementary school children which focused on parental help-seeking from teachers, an authoritative parenting style and high subjective well-being were positive predictors of parental self-efficacy, whereas non-authoritative parenting styles were negative predictors of parental self-efficacy. Moreover, parental dependent help-seeking from teachers was positively correlated to non-authoritative parenting styles, low subjective well-being, and low parental self-efficacy [20]. Another study found that parental self-efficacy was a positive predictor of autonomous parental help-seeking, whereas negative parental self-efficacy correlated with dependent help-seeking from teachers [18]. Following these studies that focused on parental help-seeking, the current study focuses on a parent's help-giving for their child in order to identify the parent's personal characteristics which predict parental autonomous versus dependent over-involvement in help-giving, as reflected by the parent-as-student orientation. In this context, we sought to examine parental characteristics related to providing assistance, and we, therefore, choose to focus on advice/affect management, one of four dimensions of overparenting [34]. Overparenting is a form of parenting in

which a parent applies overly-involved and developmentally inappropriate tactics to their children who are otherwise able to assume adult responsibilities and autonomy [34–36]. Even though this parenting practice can occur at any stage of childhood, argued Segrin and his colleagues, it is most often used in reference to parents of late-adolescent or young-adult children. Overinvolved and overly controlling parenting may lead to negative child outcomes, and children come to expect that problems will be solved for them and that they should not have to tolerate or suffer discomfort or dissatisfaction with their desires. It is worthwhile noting that parenting children of primary school age has other responsibilities which vary, among other things, in the degree of autonomy required for the child, relative to young adults [37] and which should be taken into account when examining this concept at younger ages.

In the overparenting conceptual and methodological development, Segrin and colleagues [34] presented four different metrics for this behavioral structure, one of which is used for the present study: advice/affect management. This inverted dimension in the scale for measuring overparenting refers to providing assistance to the child in a variety of areas through advice given by the parent as well as addressing the emotional aspects of coping with difficulty. The researchers found that this dimension was related positively to the authoritative parenting style and negatively to the non-authoritative parenting style [34]. In the present research context, we would expect a positive correlation between parental advice/affect management and parental self-efficacy as well as autonomous help-giving in learning at home.

Finally, in a recent study focusing on help-seeking in the context of music learning, autonomous help-seeking and grit were positively correlated with amateur musicians' self-efficacy [38,39]. Grit is a personal characteristic which is defined as passion and determination towards achieving a long-term goal, perseverance with effort, and consistency of interest [40]. Grit impacts psychological outcomes, including commitment in learning and careers [41] and meaning in life [42]. Alhadabi and Karpinski [43] suggest that grit is positively associated with academic performance through a sequential pathway of mediators, including self-efficacy.

### 3. The Current Study

The present study differs from previous studies that examined parental involvement in learning at home in two ways: (1) it focuses on the type of help provided by the parent; in other words, the help-giving orientation characteristics, following recent previous studies that identified different help-giving orientations of parents [21,22]. (2) It identifies the parent's personal characteristics which affect the help-giving orientation the parent provides in learning at home.

In the present study, which focuses on providing parental help to a child while learning at home, we aim to introduce a path model predicting parental help-giving to their child depending on their parental self-efficacy, which mediates the effects of the parent's grit, advice/affect management, and subjective well-being.

Following the literature reviewed, we expected that parental grit would be inversely associated with the orientations of parental help-giving at home: a positive association with autonomous help-giving and a negative association with parent as student (Hypothesis 1). Accordingly, parental advice/affect management would be positively associated with autonomous help-giving in learning at home (Hypothesis 2). Since a parent's personal characteristics are frequently associated in the research literature with educational outcomes also through mediating variables (see above), we expected the links between parental grit and advice/affect management and the parental help-giving orientations (i.e., autonomous help-giving and parent as student) to also be indirect, via parental self-efficacy as a mediator (Hypothesis 3). Finally, based on previous evidence, we expected that parental subjective well-being would be positively associated with PSE which, in turn, would be positively and negatively (respectively) related to the autonomous help-giving and the parent-as-student



orientation. In other words, we hypothesize that PSE will mediate the relationship between parental well-being and help-giving orientations (Hypothesis 4).

## 4. Method

### 4.1. Participants

We use a cross-sectional study design, in which data were collected from families with elementary school children using mothers' and fathers' self-reports on valid questionnaires. The research is based on 306 Israeli parents with at least one child in elementary school (156 females, 150 males) aged 27–59 ( $M = 40.06$ ;  $SD = 5.90$ ). Eighty-nine percent were married, another 7% were single parents (divorced or widowed), and 4% were cohabiting without being married. Seven percent of the participants had one child, 39% had two children, 35% had 3 children, 12% had 4 children, and 7% had 5 children or more. Forty-two percent of participants had a child in first grade, 21% of participants had a child in second grade, 17% of participants had a child in third grade, 18% of participants had a child in fourth grade, 14% of participants had a child in fifth grade, and 20% of participants had a child in sixth grade. About 7% were self-defined as lower class, 78% as middle class, and 15% as upper class. Twenty percent of the participants had no academic education, 34% had an academic education without a degree, and 46% had a B.A. degree or higher.

Parents were asked to answer five questionnaires described below: the short grit scale (Grit-S); the satisfaction with life scale (SWLS); the advice/affect management–overparenting subscale; the parenting sense of competence scale (PSOC); and the parental help-giving orientations scale (PHGOs). They also answered a general background questionnaire.

### 4.2. Measures

**Short grit scale (Grit-S).** Duckworth and Quinn's [44] scale which measures trait-level perseverance and passion for long-term goals was used. The short grit scale (Grit-S), the eight-item version of the grit scale, retains the two-factor structure of the original scale and improved psychometric properties. Participants ranked their agreement with eight statements on a five-point scale ranked from 1 (*not like me at all*) to 5 (*very much like me*). Higher scores mean a stronger sense of grit (e.g., "I finish whatever I begin") and lower scores mean a weaker sense of grit ("I was obsessed with a project or idea for a short time and then I lost interest in it"). The scale was scored by totaling the individual five-point items after reverse-scoring the negatively worded items (2, 4, 7, 8). The reliability of the test scores in the current research was Cronbach  $\alpha = 0.70$ .

**The satisfaction with life scale (SWLS)** [45]. The SWB, well-known as the satisfaction with life scale (SWLS), was used. Participants were asked to rate their agreement with five items on a seven-point Likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). All five items together make up one grade of SWB. The higher the grade, the better the SWB, e.g., "In most ways my life is close to my ideas". The reliability of the test scores in the current research was Cronbach  $\alpha = 0.91$ .

**Advice/affect management** [34]. The present study measured advice/affect management as a parenting strategy, one of three subscales of overparenting [34]. It is a six-point Likert scale ranging from 1 (*strongly disagree*) to 6 (*strongly agree*). The scale was originally built and validated for measuring young adults' parents' behavior. In the present study, the advice/affect management strategy was used among parents of children in primary school in an attempt to point out the positive meanings of parental behaviors for this particular strategy. The items from the original scale of advice/affect management are 1, 2, 9, 10, 13, 20, 22, 23. Item 20 was removed from the overall score of this variable because it compromised the scale's reliability level. After that, the reliability obtained in the present study is Cronbach  $\alpha = 0.88$  (instead of 0.72).

**Parenting sense of competence scale (PSOC)** [46]. A measure of parenting satisfaction and parental self-efficacy, well-known as the parental self-efficacy scale (PSOC), was used. It is a six-point Likert scale ranging from 1 (*strongly disagree*) to 6 (*strongly agree*). Nine items are reverse scored (2, 3, 4, 5, 8, 9, 12, 14, 16), so that high scores indicate positive

parental experience. Originally, the scale has a 17-item self-report questionnaire divided into two subscales: *satisfaction from parental experience*: items 1–9, and *parental self-efficacy*: items 10–17. Based on later studies on this scale (e.g., Gilmore and Cuskelly, [47]), in the present study, the eight items measuring *parental self-efficacy* were used (e.g., “Relative to the time I have been functioning as a parent, I feel completely comfortable with the role”), with Cronbach’s  $\alpha = 0.85$ .

**Parental help-giving orientations scale (PHGOs)** [22]. In the current study, we used two distinct subscales of the *parental help-giving orientations scale (PHGOs)* questionnaire which has a six-point Likert scale ranging from 1 (*strongly disagree*) to 6 (*strongly agree*). Four items measuring the *autonomous help-giving orientation* (e.g. “It’s important for me to strengthen in my child the academic skills that will help them tackle learning assignments or homework alone”) and the five items measuring *dependent help-giving—parent as student* (e.g., “When my child has difficulty with learning assignments, I answer the questions instead”) were used. The more the parent agrees with the details of the help-giving orientation, the higher the score in the subscale. In the current study, Cronbach’s  $\alpha = 0.81$  and Cronbach’s  $\alpha = 0.83$ , respectively.

**General background questionnaire** includes the following variables: gender, age, family status, number of children, the grades in which the children study, socioeconomic status (SES), and education of the parent.

#### 4.3. Procedure

The study was planned during the months of July–August 2021. After receiving approval from the research ethics committee, the sample was collected in December 2021 by IPanel—an online participant recruitment service for surveys based on over 100,000 paid participants from Israel, which adheres to the international guidelines and standards of ESOMAR concerning credibility and control. The sample population were parents (mothers and fathers) who had at least one child in elementary school. Only those who meet this criterion among those registered as potential research participants in IPanel received an invitation to participate in the research for a \$20 gift card. Data collection was stopped after 306 participants completed all the questions and submitted their answers, based on the existing research budget. Participants received gift certificates for their participation in the research after answering all the survey questions and submitting their answers. There were no missing data. It took about 15 min to answer the questionnaires. For the statistical analyses, we used IBM SPSS, ver. 22, and AMOS statistical packages.

## 5. Results

### 5.1. Preliminary Analyses

The general correlations between the study variables (Table 1) initially confirmed our research hypotheses, as the independent variables of the parent’s personal characteristics (i.e., grit, advice/affect management, subjective well-being, and parental self-efficacy) were inversely associated with the parental help-giving orientations of parent as a student (i.e., negatively) and autonomous help-giving (i.e., positively). The study’s independent variables were positively intercorrelated, and they significantly differed by parent’s gender only with respect to parental subjective well-being ( $t(304) = 2.07, p = 0.040$ ; Cohen’s  $d = 0.24$ ) and parental advice/affect management ( $t(304) = 3.73, p < 0.001$ ; Cohen’s  $d = 0.43$ ), whereby mothers scored significantly higher than fathers in both indexes. Parental gender also had a significant effect on the study’s dependent variables of parent as a student ( $t(304) = 2.31, p = 0.022$ ; Cohen’s  $d = 0.26$ ) and autonomous help-giving ( $t(304) = 2.00, p = 0.046$ ; Cohen’s  $d = 0.23$ ), according to which fathers were higher than mothers on the former orientation and mothers were higher than fathers on the latter orientation. It should be noted that these effects are statistically significant but small. Parent’s age was not significantly correlated with either of the study’s independent or dependent variables. Finally, the parental help-giving orientation did not differ by parent’s education level, either with respect to parent as a student ( $F(3, 302) = 0.87, p = 0.46$ ) or to autonomous help-giving ( $F(3, 302) = 2.53, p = 0.06$ ).

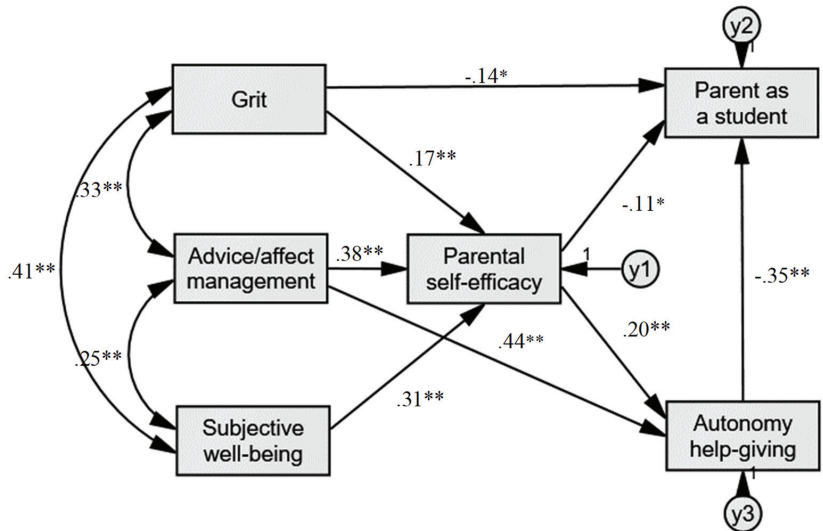
**Table 1.** Means, standard deviations, and zero-order inter-correlations between the variables of the study.

	1	2	3	4	5	6
1. Grit	-	-	-	-	-	-
2. Subjective Well-Being	0.41 **	-	-	-	-	-
3. Advice/Affect Management	0.34 **	0.26 **	-	-	-	-
4. Parental Self-Efficacy	0.43 **	0.47 **	0.54 **	-	-	-
5. Parent as a Student	-0.28 **	-0.19 **	-0.26 **	-0.32 **	-	-
6. Autonomous Help-Giving	0.27 **	0.15 *	0.56 **	0.43 **	-0.43 **	-
Mean	3.60	4.95	4.98	4.42	1.93	4.89
SD	0.57	1.44	0.69	0.80	0.85	0.82

Note: N = 306; \*  $p \leq 0.01$  \*\*  $p \leq 0.001$ .

5.2. The Associations between a Parent’s Personal Characteristics and Parental Help-Giving Orientation with Parental Self-Efficacy as Mediator

Based on our hypotheses, we established a path analysis linking between a parent’s personal characteristics and parental help-giving orientations in a child’s learning at home assignments (i.e., parent as student and autonomous help-giving) while testing the mediating role of parental self-efficacy in this context (Figure 1). The model was also considered separately for mothers and fathers, due to gender differences on some of the study variables (as detailed in the preliminary analysis section). However, since the separate models merely partially differed in the estimates of the effects measured for some paths (pairwise parameter comparisons using Z scores indicated insignificant differences between the effects observed for fathers and mothers in the model), we used the parents’ sample as a whole and presented one unified model for both parents. The fit indexes for the gender multiple group analysis of the path model were good ( $\chi^2 = 12.161, p = 0.14$ ; normed fit index [NFI] = 0.974; comparative fit index [CFI] = 0.991, root mean square of error approximation [RMSEA] = 0.041), indicating configural measurement invariance across parental gender [48]. This also warrants using a unified model.



**Figure 1.** Path model describing the direct and indirect effects (standardized estimates) of a parent’s personal characteristics on parental help-giving orientations (note that only the path with significant effects appears in the model). Note:  $\chi^2 = 4.81, p = 0.31, \chi^2/df = 1.20$ ; normed fit index [NFI] = 0.990; comparative fit index [CFI] = 0.998, root mean square of error approximation [RMSEA] = 0.026. \*  $p \leq 0.05$  \*\*  $p \leq 0.001$ .

Consistent with our hypotheses, a parent's grit is negatively associated with the *parent-as-a student* orientation, both directly and indirectly (via self-efficacy). Both CI's values of the indirect path are below zero (Table 2), indicating that the indirect effect of grit on the parent-as-student orientation is significant. A parent's grit was also indirectly associated with higher parental autonomous help-giving, meaning that those two variables are positively associated due to the mediation effect of high parental self-efficacy. (Note that the CI's values of that indirect path are both above zero.) However, in this model, grit was not positively–uniquely associated with autonomous help-giving as hypothesized ( $\beta = 0.050, p = 0.32$ ). Moreover, the size of the significance effects must be observed, and will be addressed in the discussion chapter. As can be seen from Figure 1, the other two independent variables, parenting style and subjective well-being, have stronger predictive power in the current model.

**Table 2.** Path estimates, SEs, and bootstraps 95% CIs with 5000 samples for the regression model predicting parental help-giving orientations from a parent's personal characteristics.

Model Paths	Unstandardized (B)			Standardized ( $\beta$ )
	Estimate (SE)	Lower 95% CI	Upper 95% CI	Estimate (SE)
Direct effect				
Grit–PSE	0.25 (0.06)	0.15	0.35	0.17 (0.04)
Grit–Parent as Student	–0.20 (0.09)	–0.35	–0.05	–0.14 (0.06)
Advice/Affect M.–PSE	0.57 (0.09)	0.44	0.72	0.38 (0.06)
Advice/Affect M.–Autonomy HGO	0.69 (0.11)	0.58	0.86	0.41 (0.07)
SWB–PSE	0.17 (0.04)	0.12	0.24	0.31 (0.06)
PSE–Autonomy HGO	0.20 (0.07)	0.10	0.32	0.20 (0.06)
PSE–Parent as a Student	–0.12 (0.08)	–0.26	0.00	–0.12 (0.08)
Autonomy HGO–Parent as a Student	–0.36 (0.08)	–0.48	–0.23	–0.35 (0.07)
Indirect effect (via PSE)				
Grit–Autonomy HGO	0.05 (0.02)	0.02	0.09	0.03 (0.01)
Grit–Parent as a Student	–0.05 (0.02)	–0.09	–0.02	–0.03 (0.02)
Advice/Affect M.–Autonomy HGO	0.12 (0.05)	0.05	0.20	0.08 (0.03)
Advice/Affect M.–Parent as a Student	–0.36 (0.06)	–0.47	–0.27	–0.22 (0.04)
SWB–Autonomy HGO	0.04 (0.01)	0.02	0.06	0.06 (0.02)
SWB–Parent as a Student	–0.03 (0.02)	–0.06	–0.01	–0.06 (0.03)

Note: CI = confidence interval; Advice/Affect M. = advice/affect management; PSE = parental self-efficacy; Autonomy HGO = autonomous help-giving orientation; SWB = subjective well-being.

In detail, both parental advice/affect management and subjective well-being were related to higher parental self-efficacy which, in turn, significantly mediated their effect on both parental help-giving orientations. Fully confirming our primary hypotheses, parental advice/affect management was found to be positively associated with parental autonomous help-giving both directly and indirectly (via parental self-efficacy) and also negatively–indirectly associated with parent as student. Parental subjective well-being was associated with the parental help-giving orientations in a similar way (i.e., positively and negatively), as expected via parental self-efficacy as a mediator (for both independent variables, positive indirect effects on the parental help-giving orientations are represented in Table 1 bootstrapping by positive lower CI values and negative indirect effects by negative upper CI values). It could be generally concluded that the links between a parent's personal characteristics and parental help-giving orientations are at least partially explained by the mechanism of higher parental self-efficacy which mediates the association with higher and lower levels of autonomous help-giving and parent-as-student orientation, respectively. This conclusion is in accord with our expectations regarding the mediating role of parental self-efficacy in the relationships between a parent's personal characteristics and parental help-giving orientation to the child which was reflected in all the hypotheses of the study.

Taken together, the proposed model showed a good fit to the data (see Figure 1 for the specific model-fit indexes), with its independent variables explaining proportions of 32%

(Cohen's  $f^2 = 0.47$ ) and 22% (Cohen's  $f^2 = 0.28$ ) of variances of the autonomous help-giving and parent-as-student variables (respectively).

## 6. Discussion and Conclusions

The present study aimed to advance the understanding of the connections between a parent's personal characteristics and the kind of help given to their child for academic assignments at home. The results demonstrated a path analysis linking between parental grit, advice/affect management, and subjective well-being and parental help-giving orientations in a child's learning at home, with parental self-efficacy as mediator in this context. Generally, in accordance with our primary expectations, the findings identified inverse links between a parent's personal characteristics and the parental help-giving orientations of the parent as student (with negative associations) and parental autonomy (with positive associations), with all of these observed effects to be at least partially mediated by parental self-efficacy (i.e., indirect effects).

The results provide greater insight into the relationship between a parent's personal characteristics and the choice of assistance to their child. Moreover, as demonstrated in the distinction between parent-as-student and parental autonomous help-giving, the findings of the present study demonstrate the way in which the personal characteristics of the parent, such as parental self-efficacy, advice/affect management, and subjective well-being are reflected in the type of help the parent provides to their child in academic matters. As for grit, it has little impact on the type of help a parent provides to their child. Noting the subjective well-being and advice/affect management correlations with grit, it is possible that, in fact, only these two variables have an effect on the type of help that a parent provides to their child, and not grit. This result is consistent with recent evaluations of grit (e.g., Lam and Zhou, [49]).

As demonstrated in previous research, different types of help have different effects on a child's abilities, their ways of dealing with challenges, and their perception of self-efficacy [11,12]. For this reason, it is important to recognize the consequences of these parental characteristics on a child, academically. From this, we emphasize the importance of increasing awareness of the various types of help that a parent can provide to their child academically, in order to expand the range of parental behavior.

Further, the results contribute to the expanding knowledge regarding parental involvement in learning at home and in the educational context in general. Hoover-Dempsey et al. [15] demonstrated that a parent's involvement in activities in learning at home can take many forms, from establishing structures for homework performance to teaching, for understanding and developing student learning strategies. Moreover, Judge [50] argued that creating opportunities for a sense of control and mastery, while coping with family challenges, by help-givers are more likely to promote and enhance a child's development and personal well-being as well as the family's well-being and can also serve as a method for empowering families through helping relations. The findings of the present study help to complete the picture that emerges from previous studies, such as by Silinskas et al. [17], who investigated through a longitudinal study the associations between a child's academic performance and the mother's perceptions and behavior in homework situations. The results showed that the more help the mothers gave with their children's homework, the slower the development of their children's academic performance was during elementary school, especially if mothers perceived their children not to be able to work autonomously. The distinction we have focused on in the present study—the parent-as-student orientation vs. autonomous help-giving—is consistent with and clarifies these findings, but, at the same time, it raises the question of the direction of the relationship between the parent's perceptions of the child's abilities and the help the parent provides. It is possible that a parent who perceives their child's abilities as low will provide dependent assistance and thus reduce the child's future coping ability and, in fact, will impair their academic success. In the present study, the parents' perceptions of their children's academic ability were not measured, and, therefore, further research is needed to clarify this issue.

Further to this idea, there are help-giving practices that have empowering outcomes and consequences that can positively influence beliefs about personal control and self-efficacy over a variety of life events and situations [51,52]. Therefore, we believe that the findings indicate a need to consider the design of program characteristics as part of the efforts to better understand a parent's assessment of their help-giving attitudes and practice. Dunst and Trivette [19] include a description of a family-systems model for implementing child and family support assessment and intervention practices, and they recommended the adoption of help-giving principles that emphasize competency enhancement and avoid dependency. The findings of the present study highlight the importance of developing intervention programs that emphasize the importance of a child's independent coping abilities as well as the relationship between their parent's help-giving orientation and his or her personal characteristics. It can raise a parent's awareness of the impact their characteristics have on the help they provide to their child and the possible long-term consequences of their choices for their child's academic achievements.

#### *Limitations of the Study and Recommendations for Further Studies*

The current findings need further illumination. First, the study was conducted among Israeli Jewish parents, and it is desirable to broaden the understanding regarding the model and its generalization capability through a cross-cultural comparison based on diverse samples. Second, it would be interesting to examine additional personal characteristics regarding parental involvement from a gender perspective, due to the gender differences regarding parental advice/affect management that we have found in the present study and the fact that fathers were found to be more dependent help-givers (parent as student) while mothers were autonomous help givers. It is important to note that these gender differences are significant but small; further research is required to test their existence in another sample. If clear significant differences are found between fathers and mothers in providing help to their children, it would be interesting to examine them in family contexts, job characteristics, and other personal differences.

Third, although parenting age has not been found to be related to the variables of the present study, it is worth examining the current model among parents of children of different ages, not taken into account in the present study, leading us to the next and final idea in this context.

In the current study, two interesting characteristics that may affect the findings of studies in the field, and which concern a child's academic abilities, were not measured. One measure is the child's objective educational achievements. This variable has the potential to influence the type of help the parent provides to the child, even given different parental characteristics. A second measure in this context that is not taken into account concerns the parent's perception of the child's abilities. This characteristic may also affect the type of help the parent gives the child. For example, if the parent's perception of the child includes a lack of confidence in their abilities, the parent may be overinvolved and provide assistance, as in the example of the parent as the student. The current study did not examine this issue, and it is recommended to consider it in a follow-up study.

Another interesting topic that arises from the findings of the current study and requires clarification in further research concerns the different implications that overparenting components have at different child ages. While studies show a predominantly negative effect of overparenting in young adults [35,36,53], in the present study which focused on parents of primary school-aged children, the dimension of advice/affect management is of positive significance in terms of parental involvement. Although even in Segrin et al. [34], this dimension was linked to authoritative parenting, when it comes to young adults who do not live at home, such a parental attitude is considered overparenting. Further research should focus on the different components of overparenting at different ages and their implications. In general, the current findings demonstrate the relationship between a parent's characteristics and the help they provide to their child and the extent of their

involvement, in an educational context. Expanding understanding and research on the subject may contribute to this important field of knowledge.

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Article

# 'A Different Voice' in Peer Feedback: Gender Specificity in Students' Willingness to Provide Peer Feedback

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**Abstract:** In the context of the efforts to reach equity in the classroom, peer feedback (PFB) is used, among other participative learning methods, as it is considered to minimize gender differences. Yet, recent studies have reported gender discrepancies in students' willingness to provide feedback to their peers. Building on Gilligan's theory of moral development, we tried to refine the source of this difference. We conducted a semi-experimental study during which education students of both genders performing a PFB activity in a face-to-face course were asked to fill out a questionnaire. This allowed us to estimate the link between, on the one hand, the comfort in providing PFB and the willingness to provide PFB, and on the other hand, personal characteristics like self-esteem, self-efficacy, and empathic concern, and intellectual characteristics like self-efficacy in the learned discipline and the proficiency to write and understand feedback. The linear regression analysis of 57 students' answers to the questionnaire did not reveal gender differences in comfort in providing PFB and willingness to do so, but showed that the comfort in providing PFB was linked to cognitive proficiency in students of both genders, whereas the willingness to provide PFB was independent of any other variables in men and linked to self-esteem, empathic concern, and comfort in providing feedback in women. This result indicates a differential sensitivity to social factors in male and female students, aligning with Gilligan's model of women's 'ethics of care'. Possible applications in education would be the use of PFB to train women in self-esteem or, inversely, the improvement of psychological safety in PFB exercises in groups including female students.

**Keywords:** peer assessment; gender; self-esteem; empathy; feminist pedagogy

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## 1. Introduction

School and academia are not places free of gender issues: gender biases and discrepancies, internalized prejudice, and fear of prejudice are still encountered there. Though the gap between female and male students diminishes regarding skills and achievements (in many fields, women, on average, even outperform men (See [1]), women are still less comfortable in situations involving social components like "enrolling, attending, fully participating . . . in school" [2]. Indeed, several learning settings in widespread use have proved to be unfavorable for female students. For instance, in lessons consisting of whole-class discussions, male college students are reported to participate more than females [3,4]. But conversely, other learning settings seem to favor female students. For instance, in collaborative learning, all-girls groups compared with all-boys groups demonstrate more collaboration and a less argumentative quality [5]. The proportion of females in a learning group improves the group's emotional management [6]; and finally, improves the group's performance [7]. Based on these considerations, progressive pedagogical practices try to balance the diversity of learning settings in order to ensure a fair learning experience for

each student and at the same time to educate the students on egalitarian behaviors that they can apply to real-life settings. For these two purposes, the stream called ‘feminist pedagogy’ calls for favoring non-dominative learning configurations that respect and make room for individual differences, such as collaborative learning or participatory assessment [8]. Yet, not every participative learning strategy implies genders equity. Specifically, providing peer feedback is sometimes experienced quite differently by male and female students [9–13].

### *1.1. The Possible Gender Discrepancies in Peer Feedback*

Peer feedback (PFB) is a formative assessment method in which students formulate a reaction about the performance or the learning product of fellow students in order to help them improve it [14]. This method is known to improve both the assessor’s and the assessee’s learning, to help students grasp assessment processes [15], and to develop students’ high order thinking skills [16,17] and critical thinking [18], their ability to cope with critique [14], and their self-esteem [19,20]. In most cases, it enhances students’ motivation to learn and their self-efficacy (for a review, see [21]).

Today, PFB is becoming more popular through its use in online courses with wide attendance [22] that have equal opportunity as one of their goals. Yet, it is not always accepted by students [23] and a negative attitude towards PFB also impairs the benefits it can bring [24,25]. The involvement of social interactions in peer feedback influences its outcomes in complex ways [12,21,26,27]: for instance, discomfort due to the fear of hurting a peer may diminish the motivation to participate in PFB [28], and peer pressure often impairs the reliability of the feedback [26,29]. Thus, this learning method suffers from both a gender bias and gender differences: the content of PFB is sometimes guided by the receiver’s gender (gender bias) [30,31], and students’ willingness and ways to provide PFB seems to be gender-dependent (gender difference). In what concerns gender differences in the attitudes towards PFB, the literature displays non-consistent results. Some authors do not report any gender difference in students’ attitude towards PFB in group work [32,33] or online settings [30,34–36]. Others [9,10] report that female students (in all cases pre-service teachers) were less willing to provide PFB than male students, or less comfortable to do so [10,37]. Finally, one article [1] described more positive attitudes towards PFB in female students. At the same time, from the point of view of PFB quality, some researchers estimate that women’s feedback on academic tasks was more profound and personal than men’s [38–40], but others report that mixed gender assessor-assessed dyads conducted a more polite but less profound interaction during feedback [41]. This unclear picture of students’ attitude towards PFB should be elucidated in order to help male and female students to cope with, take advantage of, and overcome gender differences in their attitude toward PFB [42,43]. This is the general goal of the research that we introduce in the present report.

### *1.2. Psycho-Social Models of Gender Differences*

As a factor predicting differences in feelings and beliefs, gender is expected to influence in multiple ways the reactions of students to the requirement of providing PFB. In this paper, we use the term “gender” to distinguish between men and women, as it is customary when the topics that are considered are social issues and not biological characteristics [44]. At the same time, we categorized male and female participants in this research according to their declared sex. In doing so, we are conscious that we might miss some of the nuances of gender issues. The first nuance concerns specific people who do not identify according to their assigned binary biological sex or do not agree to identify in a binary mode. The second nuance concerns all the people, and it pertains to the definition of gender as a continuum: indeed, independently of biological sex, different people may behave in a more masculine or in a more feminine way, and this impacts many of their personal characteristics. Therefore, when gender is measured as a continuum (with a questionnaire such as the Bem Sex-Role Inventory [45]), some of the personal characteristics that are only weakly correlated with sex appear to be strongly correlated with gender as it is measured. This is what was found,

for instance, in studies linking the degree of femininity or masculinity of the participants' self-concept with their empathic concern (e.g., [46]) or with their self-esteem (e.g., [47]). Yet, in most populations today, the social treatment conferred to people is based on their biological sex, and therefore it is also important to characterize people as belonging to the two clearly defined groups: men and women. In the following part, we consider two theoretical models which were developed in order to rationalize the differences between men and women.

The first model of gender differences is the basic feminist theory [48,49] that states that the different socialization of men and women leads women to feel that, compared with men, they have some inferiority (*internalized oppression*), or to fear that they will be supposed to have some inferiority (*fear of prejudice*) in certain fields [2]. In the general national population, this global inferiority feeling is translated into several personal characteristics. One of them is the trait self-esteem, which is defined as the extent to which a person prizes, approves, likes, or values him or herself [50] and has been consistently observed as lower in women [51,52]. Another personal characteristic is self-efficacy, that is, the evaluation of one's proficiency and chances of succeeding at a specific task or in learning a specific discipline [53]. Women's lower self-efficacy in some activities like mathematics has even been observed when women had the same objective achievements [54]. These differences in self-esteem and self-efficacy persist from childhood to college years [55]. An additional difference that can be explained by gender-specific acculturation is women's lesser willingness to stand out than men [56]. Yet, among teachers, most studies report no gender difference in self-esteem, even in very culturally diverse societies (e.g., [57,58]).

The second model of gender differences pertains to characteristics that do not assume inferiority. Departing from the point of view of simple power relationships, several theoreticians claimed that a fundamental difference between men and women lies in the way they take others into account. In particular, Gilligan's theory of moral development [59] proposes that, on average, moral reasoning in men is based more on principles like justice or individual rights, whereas moral reasoning in women is based more on social connectedness and on responsibility for people's needs ('an ethics of care'). Gilligan's theory is not an essentialist view of gender differences [60], since it considers men's and women's tendencies in moral judgement as socially constructed to various extents and as possibly fluid, but it describes an actual difference between men and women that has successfully explained various behaviors. This model explains, for instance, the greater propensity of women to choose professions focusing on caring for people [61]. In terms of personal characteristics, this model allows one to account for the observed relative superiority of women in emotional abilities [62], including emotional intelligence [19] and dispositional empathic concern [63,64]. It also yields a greater conformity to the group among women [65]. Yet, as the case of self-esteem, gender differences in empathic concern among teachers are less pronounced than in the general population [66].

### 1.3. A Model of Gender-Sensitive Factors Influencing Attitudes towards PFB

The two theories reported here allow us to form hypotheses about the way gender may influence students' feelings when providing PFB, and attitudes about providing PFB. In order to do so, we recall that in general, attitudes (here for instance, the willingness to provide feedback) are shaped by cognitive influences (for instance, the knowledge about one's proficiency in the learned discipline or in feedback) and affective influences (for instance, fear of hurting someone when providing feedback) [67]. Affective influences may be emotions experienced when performing the activity [34], such as comfort, discomfort [68], and pleasure. They may also be beliefs rooted in cognitive appraisal, like the belief that peers' assessments are less accurate than the instructor's assessment, or the belief that it is not fair to assess peers [69]. Emotions and beliefs may not be fully correlated: some people may think it is good to give feedback but feel uncomfortable when doing so [70]. In accordance with this dichotomy between cognitive and affective factors, several typologies of factors influencing attitudes towards peer feedback have been built. For

instance, Panadero [71] distinguished between ‘intrapersonal’ feelings (e.g., discomfort), cognitively based feelings (e.g., trust in the self as an assessor), and ‘interpersonal’ feelings (e.g., friendship). In parallel, Zou and colleagues [70] distinguished between ‘interpersonal negative concerns’ (will PFB impair relationships?) and ‘procedural negative concerns’ (is PFB fair?), and we [12] made up a classification based on two dichotomies: concrete (cognitive or practical) vs. affective factors, and personal vs. task-related factors. In the following part, we review those personal factors that influence students’ feelings and attitudes towards PFB, and which are at the same time known to display a recognized gender difference.

The theory of women’s relative sense of inferiority allows one to predict gender differences in students’ attitudes towards PFB, which occur directly or through the mediation of personal traits. First, women’s lower perceived status in society could directly influence their attitude towards PFB. Indeed, doubts about PFB’s fairness is a known problem [69,72,73] that may impair the willingness to participate in the exercise [11,70,74]. In the case of female students, the fear of gender bias can explain part of the stronger fairness concern observed among women in PFB [43]. Second, women’s social position is linked to several factors that could mediate the influence of gender on attitudes towards PFB.

One of these factors is the trait **self-esteem**. Providing PFB includes standing out, resisting social pressure, demonstrating some superiority to another person [75,76], and even taking the risk of hurting them [77,78]—that is, gaining power over somebody [18,79]. Therefore, it is logical that a lower self-esteem impairs the willingness to provide PFB [10,80]. Conversely, receiving PFB implies being able to stand the critique of peers [11,23,26] and a possible ‘loss of face’ [81]. Therefore, lower self-esteem impairs the ease of receiving critiques [82,83], and this is what has been observed with women in specific settings [84]. Another close phenomenon, the stronger tendency of female students to interpret negative feedback as indicating a lack of ability rather than lack of motivation [85], has also been related to women’s relatively lower self-esteem. Through an identification mechanism, these problems in receiving feedback possibly influence students’ willingness to provide PFB. As a conclusion, one can expect the link between gender and the willingness to provide PFB to be mediated by **self-esteem**.

The same rationale can be used to predict that the impact of gender on PFB could be mediated by **self-efficacy** in the subject matter and self-efficacy as an assessor (‘trust in oneself as an assessor’ [86]. Indeed, self-efficacy in the subject matter and self-efficacy as an assessor have been shown to be positively linked to students’ attitudes about PFB [24,86]. Students [18,23], and among them pre-service teachers [87], often question the legitimacy of students’ feedback in comparison to the instructor’s feedback. The lower ‘trust in the self as assessor’ observed in women [88,89] could explain women’s reported lower trust in peer feedback in comparison with the instructor’s feedback [18].

Another factor that can be related to a power difference between men and women is students’ **epistemic beliefs**: like most non-dominant groups in society, women were found to hold less conservative epistemic beliefs than men: they were less inclined to see science as a collection of truths that cannot be discussed, or scientific writing as representing a universal truth. A conservative view of science has been shown to correlate with a lower confidence in the feedback of peers as compared with instructor feedback, which seems more secure [90], and even with a lower peer feedback quality [91,92]. Therefore, contrary to the other variables, women’s less conservative conception of knowledge [91–93] should predict a greater acceptance of PFB and better performance in it [40,94].

The theory of gender-specific ethics also applies to PFB, since providing PFB involves the comparison of the performance of somebody else to a norm, and as such, it is essentially a judgement activity. This theory allows us to predict the existence of gender differences linked to social cohesion issues. Since women appear to be more concerned than men about group cohesion, their assessment should be directly subjected to biases like “friendship marking” and “decibel marking” [95], and the consciousness of this problem should impair their conception of PFB, as observed in mixed populations [86]. Women’s greater focus on

interpersonal relationships may also influence their attitude about PFB though personal traits, one of them being dispositional **empathic concern**, as we have already stated.

Since the specific influence of dispositional empathic concern on the attitude towards PFB has not yet been researched, we can only express hypotheses here. On the one hand, the fact that feedback is a kind of help suggests that higher empathic concern should be linked to a greater willingness to give feedback to a peer, as has been observed in some cases [14]. On the other hand, the consciousness that peer feedback may hurt its recipient is expected to raise negative emotions towards PFB [96]; one of these emotions is, for instance, the feeling that PFB is less fair to other students than the instructor's assessment [23,97]. Yet, in some cases, even this consciousness has been shown to be positively correlated with participation in PFB [70], and the anxiety to provide feedback was shown to be linked with feedback accuracy [98]. Thus, regarding gender differences, if women display higher empathic concern in comparison to men [63], and therefore have a higher consciousness that PFB may help and also hurt [86], then they should have a greater willingness than men to provide PFB [43] but also feel less comfortable doing so.

In conclusion, the two models of gender differences allow us to hypothesize that two kinds of variables may predict gender differences in PFB: the model of felt inferiority generates hypotheses about 'intrapersonal' [71] variables and the model of different ethics generates, rather, hypotheses about 'interpersonal' [71] variables. Moreover, the existing knowledge in these fields leads to several predictions concerning the influence of the different variables on comfort and willingness to provide feedback and some of these predictions contradict each other. The purpose of the present work is to help evaluate the relative impact of these influences.

#### 1.4. Research Questions

On the basis of the preceding discussion, the specific goal of the present research was to check the possibility of explaining gender differences in attitudes towards PFB by differences in the trait self-esteem and dispositional empathic concern. Since, as we recalled, an attitude always has an affective basis, we split the students towards PFB into two variables: we defined the **comfort in providing PFB** [71] (or ease of providing feedback [37,99]) as the degree of positive feelings and beliefs experienced by the student during the activity, and the **willingness to provide PFB** as the degree of positive attitude towards providing PFB (or positive opinion about PFB's usefulness [37]). Our general hypothesis was that these two variables could be influenced by personal characteristics like the trait self-esteem [50] and dispositional empathic concern [63], controlling for academic characteristics such as students' self-efficacy in the learned discipline [100] and students' proficiency in feedback [21], and that self-esteem and empathic concern could mediate gender differences.

The hypotheses that we intended to verify are listed here with a distinction between cognitive (cog) and social (soc) parameters:

- Compared with men, women should display lower **self-esteem** and lower **self-efficacy** in the learned discipline, but higher **empathic concern** ( $H_1$ );
- The **comfort in providing PFB** should increase with students' self-esteem or self-efficacy in the studied discipline as well as their proficiency in providing PFB ( $H_{2cog}$ ), but decrease with empathic concern ( $H_{2soc}$ );
- The **willingness to provide PFB** should increase with students' self-esteem or self-efficacy in the studied discipline as well as their proficiency in providing PFB ( $H_{3cog}$ ), and increase with empathic concern ( $H_{3soc}$ );
- **Self-esteem, self-efficacy, and empathic concern** should mediate the link between **gender** and attitudes towards PFB ( $H_4$ )—compared with men, women should display a lower **comfort in providing PFB** and a lower **willingness to provide PFB**.

## 2. Materials and Methods

### 2.1. Study Design

The research was conducted according to a semi-experimental design. It involved a convenience sample including 57 pre-service teachers studying in a small teacher training college. The students were aged from 18 to 37 years, 19 were men and 38 were women. The sex imbalance in the sample reflects the situation of the teaching sector. The students were in different years of study, and already had a succinct teaching experience that included giving feedback to pupils. Most students (43) were physical education teachers, and the others were science pre-service teachers. The students performed a PFB activity in one of four different F2F courses where one of the final requirements was to prepare and give a whole-class presentation as a team, and to give public feedback to another team of students who taught another topic. In the two physical education courses, the students had to present to the class an actual sports activity, and in the two science courses, they had to perform a computer-supported presentation on a topic enlarging the knowledge acquired in the course (see [101]). After each presentation, the other students in the class were required to give oral feedback. There was no special training in feedback giving. This open FTF feedback, as opposed to online feedback, fit the goal of the research, since it maximized the human interactions for which we wanted to account. Face to face feedback is also thought to yield specific gains to the feedback activity [71]. We did not record which gender pairing occurred during the actual PFB activity between providers and recipients of feedback and assumed that men and women gave feedback to men and women in a random way. On the day when the students completed these two requirements, they were presented with an informed consent form and a questionnaire. The study received the approval of the Authors' College's Ethics Research Policy, and was conducted in accordance with its principles.

### 2.2. Research Tools

The self-reported questionnaire included the following Likert scales (all of them except self-efficacy, from 1 = "I do not agree at all" to 5 = "I very much agree"). For each index, the reported Cronbach alpha values were computed on our sample. Alpha values obtained were close to the ones published in the literature, except for IRI.

Self-esteem was evaluated using a 5-point Rosenberg's scale [46] including positive and negative items and used as a continuum (alpha 0.859).

Self-efficacy in the studied discipline was evaluated using the 8 corresponding items of MSLQ's 7-point Likert scale according to Pintrich and colleagues [100] (alpha 0.936).

Empathic concern was evaluated using the Interpersonal Reactivity Index (IRI), a 5-point Likert scale [66] including 7 items (alpha 0.601).

The proficiency in feedback was evaluated by two items: 'I find it hard to find what to write in my feedback' and 'It is hard for me to express what I want to say in my feedback' (alpha 0.660).

Comfort in providing PFB (alpha 0.792) and willingness to provide PFB (alpha 0.765) were assessed on 5-point Likert scales using the following items inspired by Cheng & Warren [102], Authors [12], and Vanderhoven and colleagues [99], and covering most categories defined by Panadero [71]: our variable "comfort" related to Panadero's [71] intrapersonal (emotion, fairness and comfort, and interpersonal factors (friendship, psychological safety)), and our variable "willingness" related to some of his cognitive factors (trust in the self as assessor, trust in the other as assessor), and one intrapersonal factor (fairness).

#### 2.2.1. Comfort in Providing Feedback (\* Indicates Inverse Coding)

- I feel uncomfortable providing peer feedback \*;
- It is difficult for me to formulate feedback to a peer;
- When I provide feedback to a peer, I fear hurting him or her \*;
- Feedback containing negative remarks can hurt \*;
- If I provide critical feedback, this can hurt me afterwards \*;

- When I provide feedback, I do not think it can hurt;
- I loved providing feedback;
- I have no affective difficulty in providing feedback, I am not shy or careful when providing feedback.

### 2.2.2. Willingness to Provide Feedback (\* Indicates Inverse Coding)

- People manage their learning as they wish, no matter what feedback they will receive from a peer \*;
- In my opinion, it is not right to criticize a peer \*;
- I think that when I provide feedback to a peer, it helps both of us;
- My feedback will help people learn;
- People are certainly grateful about the help they receive in feedback;
- I do not think that my feedback will be useful to the people who receive it \*;
- It is important to give feedback to peers because it helps them learn.

Comfort in receiving (instead of giving) PFB was also measured and found to have a high correlation with comfort in providing PFB, but it did not add an explanatory dimension to our analysis and therefore we did not include the corresponding data in this report.

Gender was asked according to three possibilities: 'male', 'female' or 'other'. Only two students chose the third possibility, and since they were the only ones, they were discarded from the sample.

### 2.3. Data Analysis

Questionnaire validation was made on an independent sample and led to slight modifications in the original questionnaires up to the form published here. Before using the data of the sample, we checked with appropriate T-tests that there were no significant statistical differences between the different kinds of students (different years of study, different courses, and different mother tongues) involved in the quasi-experiment, according to any of the parameters that were considered in this research. All the following calculations, including linear regression, were made and examined both for the whole group and for each gender separately. A Shapiro–Wilk test was performed on every variable and did not show evidence of non-normality. The distributions of the variables for each gender group were slightly skewed in opposite directions, but as reported in the following part, this did not impair the validity of the linear regression analysis. The possibility of collinearity was checked on the basis of the correlations and every explanatory variable was subjected to regression analysis against relevant others, in order to refine its relationships with them and to detect possible mediation effects. No significant correlation was found between the two main explanatory variables (self-esteem and empathic concern). The correlations between the other variables and self-esteem are accounted for in the analysis.

## 3. Results

As a first step, the means and standard errors of the studied variables were computed (Table 1), as well as the zero-order correlations between them (Table 2).

**Table 1.** Students' characteristics, comfort in providing PFB, and willingness to provide PFB (means, standard deviations, and *t*-test comparison between gender groups).

	Men's Mean (N = 19)	Men's SD	Women's Mean (N = 35)	Women's SD	<i>t</i>	<i>p</i>
Self-esteem	4.40	0.632	4.33	0.668	0.379	0.71
Empathic concern	3.62	0.620	3.62	0.871	−0.013	0.989
Self-efficacy in discipline	4.59	0.736	5.03	1.15	−1.49	0.143
Proficiency in feedback	3.82	0.869	3.51	0.996	1.16	0.255
Comfort in providing PFB	3.44	0.848	3.44	0.770	0.007	0.995
Willingness to provide PFB	3.68	0.752	3.56	0.871	0.194	0.847



**Table 2.** Zero-order correlations between students' characteristics and attitudes towards PFB (first row is the whole sample and, in parentheses, correlation in men only/women only).

	1	2	3	4	5
1. Self-esteem	0.108				
2. Empathic concern	(0.114/0.091)	0.576 **			
3. Self-efficacy	(0.375/0.688 **)	0.236			
4. Proficiency in feedback	0.322 *	0.556 **	0.287 *		
5. Comfort in providing PFB	(0.365/0.305)	(0.287/0.659 **)	(0.229/0.361 *)	0.106	
6. Willingness to provide PFB	0.297 *	0.298 *	(-0.418/0.312)	<b>0.591 **</b>	
	(0.205/0.399 *)	(0.272/0.345 *)		<b>(0.521 */0.644 **)</b>	
	0.475 **	0.484 **	0.266 *	0.701 **	0.656 **
	<u>(0.511 */0.475 **)</u>	<u>(0.221/0.602 **)</u>	(0.154/0.335 *)	<u>(0.646 **/0.737 **)</u>	<u>(0.589 **/0.684 **)</u>

\*: significant ( $p < 0.05$ ); \*\*: very significant ( $p < 0.01$ ). The **bold** correlations are those that were large and significant enough to be addressed in the following discussion. The underlined correlations indicate variables that proved to be linked to one another only through the mediation of a third variable, as will be explained in the discussion.

The goal of the analysis that was performed in a second step was to deepen the links between the variables. We addressed the problem of multiple comparison by running a set of linear regression calculations with each of the variables as the dependent variable, in order to estimate the relative influence of the different variables on each other and to pick up the variables that explained a larger part of others' variance. Moreover, in order to create a directional order between the variables, we made the fundamental hypothesis that, in accordance with the theory of attitudes [67], comfort in providing PFB could influence the willingness to provide PFB, but not the contrary. On this basis, we applied multiple linear regression by first studying the predictive potential of students' characteristics (proficiency in feedback, self-esteem, self-efficacy, and empathy) on the comfort in providing PFB (Table 3), and then included the comfort in providing PFB as one of the explanatory variables along with the four latter characteristics in the study of the willingness to provide PFB (Table 4). In each case, the homoscedasticity of the distribution was evaluated by assessing the predicted probability plot, and the residuals were found to be rather equally distributed. Mediation analyses were performed when appropriate.

In men, on the one hand, 56% of the variance in comfort in providing PFB was predicted by self-efficacy in the discipline and proficiency in feedback (Table 3), and further regression analyses showed that these variables did not mediate any other personal characteristics. Specifically, it appears that higher self-efficacy in the discipline was linked to a lesser comfort in providing feedback. On the other hand, men's willingness to provide PFB was not significantly predicted by any of the studied variables (Table 4), with the most probable but not significant link being proficiency in feedback.

**Table 3.** Regression analysis predicting comfort in providing peer feedback.

	Men			Women		
<b>Analysis 1: Predicting Comfort in Providing Feedback from Students' Characteristics (Enter)</b>	<b>R<sup>2</sup> = 0.556</b>	<b>F(4, 14) = 6.63, p = 0.003</b>		<b>R<sup>2</sup> = 0.397</b>	<b>F(4, 30) = 6.61, p = 0.001</b>	
Variable	<b>B</b>	<b>β</b>	<b>t</b>	<b>B</b>	<b>β</b>	<b>t</b>
Self-esteem	0.318	0.237	1.33 ( $p = 0.205$ )	0.306	0.266	1.40 ( $p = 0.170$ )
Empathic concern	0.276	0.202	1.22 ( $p = 0.242$ )	-0.076	-0.086	-0.473 ( $p = 0.640$ )
Self-efficacy in learned discipline	<b>-0.762 **</b>	<b>-0.661 **</b>	<b>-3.85 (<math>p = 0.002</math>)</b>	-0.056	-0.083	-0.436 ( $p = 0.666$ )
Proficiency in feedback	<b>0.515 **</b>	<b>0.528 **</b>	<b>3.01 (<math>p = 0.009</math>)</b>	<b>0.502 **</b>	<b>0.650 **</b>	<b>3.46 (<math>p = 0.002</math>)</b>

\*\* : very significant ( $p < 0.01$ ). The **bold** coefficients are those of variables significantly predicting the dependent variable.

**Table 4.** Regression analysis predicting willingness to provide peer feedback.

Analysis 2: Predicting Willingness to Provide Feedback from Students' Characteristics and Comfort (Enter)	Men			Women		
	R <sup>2</sup> = 0.446	F(5, 13) = 4.14, <i>p</i> = 0.018		R <sup>2</sup> = 0.678	F(5, 29) = 15.3, <i>p</i> = 0.000	
Variable	B	β	<i>t</i>	B	β	<i>t</i>
Self-esteem	0.270	0.226	1.09 ( <i>p</i> = 0.295)	<b>0.501 *</b>	0.384 *	2.69 ( <i>p</i> = 0.012)
Empathic concern	−0.075	−0.062	−0.324 ( <i>p</i> = 0.751)	<b>0.330 *</b>	0.330 *	2.48 ( <i>p</i> = 0.019)
Self-efficacy in learned discipline	0.251	0.246	0.910 ( <i>p</i> = 0.379)	−0.160	−0.211	−1.51 ( <i>p</i> = 0.142)
Proficiency in feedback	0.214	0.247	1.00 ( <i>p</i> = 0.336)	0.249	0.285	1.76 ( <i>p</i> = 0.089)
Comfort in providing feedback	0.473	0.534	1.82 ( <i>p</i> = 0.092)	<b>0.338 *</b>	0.299 *	2.24 ( <i>p</i> = 0.033)

\*: significant (*p* < 0.05). The **bold** coefficients are those of variables significantly predicting the dependent variable.

In women, 40% of the variance in the comfort in providing PFB was significantly explained by the proficiency in feedback (Table 3). Proficiency in feedback entirely mediated the influence of empathic concern on the comfort in providing feedback, as could be shown by a separate regression analysis predicting the proficiency in feedback in women from personal characteristics ( $R^2 = 0.397$ ,  $F(3, 31) = 10.2$ ,  $p = 0.000$ ,  $b = 0.628$ ,  $p = 0.000$  for empathic concern), but proficiency in feedback did not mediate any link with the other personal characteristics self-esteem or self-efficacy. Regarding the willingness to provide PFB, 67.8% of the variance was significantly explained by two orthogonal variables expressing personal traits (Table 4): self-esteem and empathic concern, and by the comfort in providing feedback, which fully mediated the influence of the proficiency in PFB. Self-efficacy in women was strongly correlated with self-esteem but was not directly linked to the willingness to provide feedback ( $p = 0.142$ ). A regression analysis performed on the whole sample (men and women together) gave results close to those of the women's group.

#### 4. Discussion

No gender discrepancies in self-esteem, self-efficacy, and empathic concern were found in our sample ( $H_1$  was not verified). The absence of gender differences in the trait self-esteem confirms previous results obtained on teachers [57] and may be explained by the feminization of the teaching profession: indeed, female respondents feeling more aligned with their situation are known to score higher on self-esteem tests. Since our sample consisted of physical education and science pre-service teachers, which are disciplines considered as more manly, it is possible that the women in the sample gained special self-esteem from the fact that their field of study already challenged the superiority of men. The nature of the teaching profession can also account for the absence of gender differences in the trait empathy, since teaching requires a mindset from practitioners of both genders that is closer to what is considered as feminine empathic capacities [58].

In what concerns the correlations between personal characteristics, the absence of a link found between self-esteem and empathic concern in both genders was in accordance with previous research [63]. In female students and not in male students, self-efficacy and the trait self-esteem were observed to be very significantly correlated, and this is in accordance with the hypothesis that both characteristics are slightly impaired among women because of the same difference in socialization [54]. In female students only, there was a significant link between the proficiency in feedback on the one hand and empathic concern on the other hand. This suggested that empathic concern is a personal trait that, at least in our sample, women built on when providing peer feedback more than men did.

With respect to gender differences in attitudes towards PFB, our results did not confirm the claims reported in some of the previous research [9–11] and match ( $H_4$  not confirmed): in our sample, students of both genders displayed, on average, moderate to positive comfort in providing PFB and moderate to positive attitude towards PFB (Table 1.) This

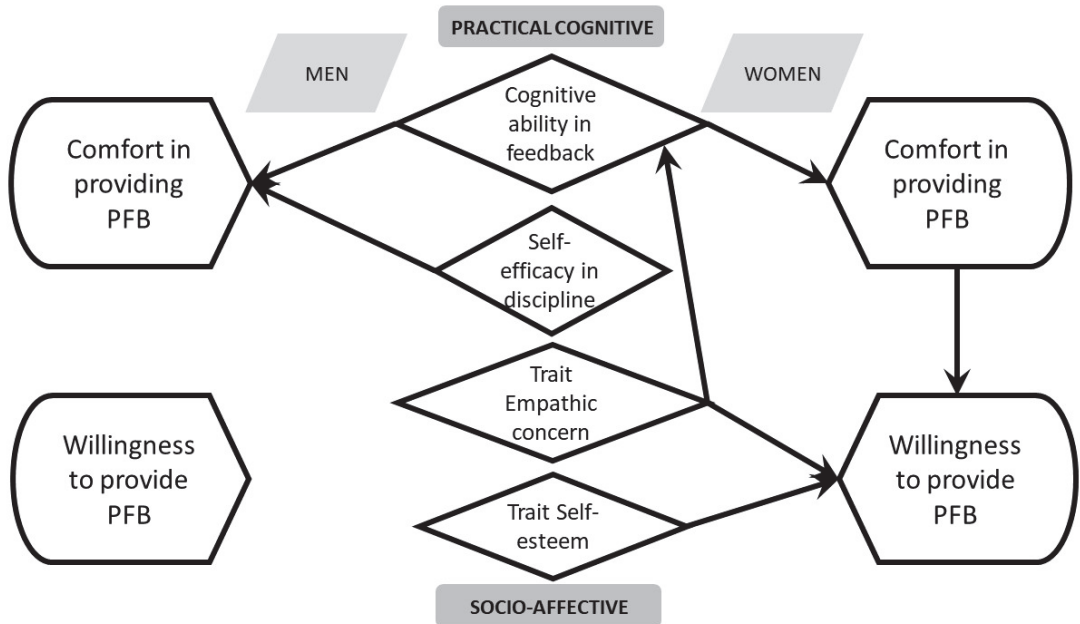
modest feeling of comfort is in accordance with previous research, see [21]. Yet, our results unveiled more subtle phenomena that were not described before.

First, and independently of gender considerations, our results suggest that comfort in providing PFB (an emotion) and willingness to provide PFB (an attitude) have some different foundations in students' minds. In our sample, comfort in providing PFB was mostly linked to cognitive variables: in men, 56% of the variance in the comfort in providing PFB could be explained by self-efficacy in the learned discipline and by proficiency in feedback, and in women, 40% of its variance could be explained mostly by proficiency in feedback ( $H_{2cog}$  verified,  $H_{2soc}$  invalidated). This result strengthens the finding of other authors about the link between proficiency in feedback and comfort in providing feedback [86]. The negative link found in men between self-efficacy in the discipline and comfort in providing feedback can be explained by the supposition that students with a stronger proficiency in the discipline have more features to critique in their peers' products, and therefore they have more reasons to fear they may hurt their peers [28,98]. The willingness to provide feedback, on the contrary, was eventually (in women) linked to social traits, self-esteem, empathic concern, and to comfort in providing feedback, but was not directly linked to cognitive characteristics ( $H_{3cog}$  invalidated,  $H_{3soc}$  confirmed). In the framework of the theory of attitudes, this separation between cognitive and social influences is a common configuration [67]. In practice, this shows an essential difference between comfort in providing PFB and willingness to do so. Indeed, when a student is required to provide PFB, he or she will feel more difficulty in doing this and fear hurting the other more if he or she has a lesser proficiency in doing this, or if he or she is more knowledgeable on the topic and expects to have a lot of critique to deliver, and this shows that students are conscious that in academic settings, intellectual proficiency determines the appropriate impact of PFB on the receivers. Conversely, when a student needs to make the decision to provide PFB or is asked to approve this type of exercise on a fundamental level, his or her reaction is not based on specific cognitive considerations, but eventually involves social and affective components.

Second, regarding gender differences, our results suggest that although men and women in our sample displayed the same level of comfort in providing PFB and of willingness to provide PFB, the underlying mechanisms leading them to their attitudes were different for each gender (Figure 1).

The original finding of this study was that instead of influencing the willingness to provide PFB through the mediation of personality traits, like we hypothesized ( $H_4$ ), gender seemed to be a factor that moderated the link between socially significant traits and the willingness to provide PFB. Indeed, in our experiment, it appears that men were willing to give feedback anyway, independently of what they knew they were able to say, of their self-esteem, of how they feared to hurt others, and of their willingness to help the other person, and this despite their possessing these characteristics at the same level as women, on average. In contrast, in our sample, for an average female student to be more willing to provide PFB, she had to be self-assured enough to stand out, she had to possess a stronger desire to help the receiver, or for additional reasons, she had to experience less discomfort when providing PFB. The link found for women between the willingness to provide PFB and two alternative socially significant traits, self-esteem and empathic concern, suggests that for women, the principal concern in PFB was not cognitive but social. This hypothesis of the importance of social traits in the willingness to provide feedback is reinforced by the fact that self-efficacy in the learned discipline, which depends partly on cognitive characteristics, as opposed to self-esteem, was not a predictor of the willingness to provide PFB, whereas the more social trait, self-esteem, was. In summary, in our sample, PFB seemed to be considered by women as a socially loaded act, whereas for men, it seems to be . . . just an act. Our findings fit the logics of Gilligan's model [59], since according to this model, moral judgement is driven more by social considerations in women, and by formal considerations in men. They also corroborate the finding that in free non-academic settings, male students give more feedback but are less prone to interpret comments as

a critique than female students [84]. On a day-to-day casual level, our conclusion can be brought together with the impression given by conversations in adolescent groups: in these situations, boys generally criticize one another without restraint and receive critiques without much discomfort, whereas girls have a much more careful, sophisticated, and lengthy way of providing critiques and reacting to them.



**Figure 1.** The relationships among the variables in the case of male students (left) and female students (right) according to the statistical analysis of the data.

#### *Limitations of the Present Work*

From a methodological point of view, on the one hand, several biases are possible in the present research. The drawbacks of self-reporting as a data collection methodology are well-known. The small sample size and its sex imbalance may generate validity issues, and some of the insignificant correlations found could be attributed to it. Self-reported questionnaires imply the risk of social-desirability bias or of gender bias. Moreover, while the trait self-esteem and dispositional empathic concern are generally stable in students, on the contrary, self-reported self-efficacy [53,100], self-reported proficiency in feedback [21], and the attitude towards PFB [21,36,74] may be influenced by contingent variables. For instance, the PFB exercise which was performed close to filling out the questionnaire could influence the feelings of self-efficacy and the willingness to provide PFB that they declared in the questionnaire [23,102] and influence students' attitudes towards PFB [11]. On the other hand, the relationships found in this study between personal traits and comfort or willingness to provide feedback seem to be strong enough to compensate for the small sample size. It is worth suggesting that since, in our sample, women and men displayed similar levels of self-esteem and empathic concern, the effects revealed in this study should be even stronger in samples where women and men display these characteristics at different levels. An additional methodological suggestion can be based on the regression analysis that we performed of our whole sample: this analysis yielded results similar to those of the female students alone and occulted the effects that were found for male students. This

analysis suggests that the results of other studies on PFB using mixed gender samples without gender differentiation may hide gender effects similar to the one identified here.

From a theoretical point of view, it is clear that the model of influences that we built upon two major paradigms of gender differences has limitations. We could include in this model additional personal characteristics that are known to be moderated by the gender parameter. For instance, in relationship with women's weaker power in society, women were found to hold less conservative epistemic beliefs, and in relationship to women's stronger concern with social issues, women, on average, were found to seek more conformity than men. These characteristics and perhaps others could explain additional parts of the variance in the comfort to provide PFB and the willingness to do so.

## 5. Conclusions

From the point of view of gender studies, our results describe a rather optimistic global picture where male and female students display homogenous behaviors in self-esteem and empathic concern, as well as comfort in providing PFB and willingness to provide PFB. At the same time, these results suggest that similar behaviors in men and women do not automatically mean similar mindsets. Indeed, in our sample, men who displayed more willingness than the others to provide PFB did not have a special profile in terms of self-esteem or of the trait empathic concern; yet women who displayed more willingness than other women to provide PFB had mostly either more self-esteem or more willingness to help other people (empathic concern). This could imply that, in order to behave in the same manner as men in PFB, women had to dig into psychological resources that men did not have to use. Thus, it is possible that women find ways to adapt to men's behavioral norms in peer feedback, but that they do it without changing their internal tendencies. Such an effect is well-known in women's studies. Of course, this insight does not allow us to draw conclusions about the innate or socially acquired nature of gender differences in attitudes towards PFB [59], but it shows that a difference between men and women in PFB may exist even if it is not blatant.

### 5.1. Directions for Future Research

The model that we tried to confirm in this report may help to understand psycho-social influences affecting PFB. First, the reproduction of our research design with larger samples and other populations (students in other disciplines and non-students) could ascertain the validity of this model. Second, attempts to improve this model could be made by envisioning additional parameters that possibly influence students' attitudes towards PFB. Since the characteristics that were our focus did not explain all the variance in students' feelings and attitudes towards PFB and willingness to provide PFB, one could search for other factors that could act differently on men and women, such as additional personal traits or cultural factors. The use of qualitative research tools in the study of students involved in PFB could help to approach these additional factors. Third, regarding gender, the use of a questionnaire defining gender as a continuum could help to distinguish between those PFB-relevant behaviors that are linked to the social categorization of people according to their biological sex (for instance, the fear of discrimination), and those behaviors that stem from personal traits linked to gender measured on a continuum (for instance, the fear of standing out), and should therefore be addressed independently from their biological sex. Finally, from an educational point of view, an experimental manipulation of the learning climate or of the learning methods in use is also expected to yield gender differences in comfort and willingness to provide PFB and could be used to devise new teaching methods.

### 5.2. Educational Development

From a practical point of view, our results show that behavioral homogeneity in a mixed gender group does not negate the need to be aware of deep gender differences in the psychological mechanisms that allow students to shape their behavior. Therefore, our study could inspire some improvements in the use of PFB in learning settings. The format of

PFB exercises could be adapted to the motivations of each gender. For instance, in order to enhance women's motivation to participate in PFB, one could devise conditions enhancing the feeling that PFB is helpful to others, as is the case for feedback in microteaching, for instance, or conditions grouping the learners in groups of friends [103] or groups characterized by a high interdependency and psychological safety. Conversely, the use of PFB with no gender adaptation could help in raising students' awareness of gender differences, just as the use of non-anonymous peer feedback is valuable in order to foster deep interpersonal cognitive exchanges in learning [104]. Thus, it could help to forge female students' self-assurance [20] and men's thoughtfulness. Finally, the gender difference emerging in this research also suggests the need to differentially train teachers to adapt their feedback to the situation they are in, independently of the personal and sometimes gender-biased way of expressing feedback. We think that in some cases, like in feedback to a skilled student on a technical exercise, it is important to bluntly express the truth about the other's performance, and this suggests the need for some women to behave in a more 'manly' way. In other cases, for instance, when teaching low achievers [105], we think that it is important to be careful about the affective and social significance of feedback, and this requires that men, too, behave according to an 'ethics of care'.

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**Institutional Review Board Statement:** The study was conducted in accordance with the Declaration of Helsinki, and approved by the Ethics Committee of the former Ohalo Academic College (2008 and 2016).

**Informed Consent Statement:** Informed consent was obtained from all subjects involved in the study. Written informed consent has been obtained from the patient(s) to publish this paper.

**Data Availability Statement:** The data presented in this study are available on request from the corresponding author.

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Article

# Brief Mindset Intervention Changes Attitudes but Does Not Improve Working Memory Capacity or Standardized Test Performance

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**Abstract:** There has been extensive research conducted on mindset and grit, involving both experimental and observational methods. However, the findings in the literature remain mixed. This should give educators and researchers pause from an intervention perspective—if we still do not have a good understanding of how mindset works, then more research is needed. We implemented a mindset intervention with undergraduate women to improve cognitive performance measures relevant to academic performance—working memory capacity and standardized test performance in math. To better understand how mindset interventions work, we also examined self-report measures (e.g., pertaining to academic attitudes and belonging) as well as post-intervention behavior. We expected the growth mindset intervention to significantly improve cognitive performance and to cause more positive academic attitudes and attitudinal change. The mindset intervention did change students' beliefs about ability and also caused students to report higher grit overall (no condition difference), and to feel less belonging in terms of connection to their university—which was not in line with our hypotheses. We also found that the growth mindset intervention had no significant effects on improving WMC or standardized test performance. We discuss the implications of these findings and make suggestions for future work in this area.

**Keywords:** mindset; academic performance; intervention; working memory

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## 1. Introduction

In the 2014 *New York Times* article “Who Gets to Graduate?”, Paul Tough describes research on graduation rates, showing that the biggest challenge for students is not simply making it to college but rather learning how to be successful once they get there. The article states that 40% of students have not earned their degree after six years, and additional research suggests that their likelihood of graduating depends on how much money their parents make. Tough argues that students struggle the most with their sense of belonging and beliefs about their abilities, so how students think about themselves, their status and position in college, and their abilities when faced with intellectual challenges are of great importance. With this in mind, the question becomes whether addressing these beliefs and attitudes may promote positive attitudinal shifts and help boost academic performance for students.

Many factors impact academic performance. Individual differences spanning backgrounds, abilities, goals, motivations, expertise, practice, and personalities have all been found to play a role [1–3]. One attitudinal factor has gained considerable momentum in the realm of academic performance—mindset. As defined by [4], mindset theory proposes that people hold varying beliefs about the malleability or rigidity of certain human attributes, such as intelligence. Dweck distinguishes these implicit theories between two main groups, fixed mindset and growth mindset, and suggests that one's mindset can also

impact performance. People with a fixed mindset, or entity theorists, believe that one's attributes are relatively stable or unchangeable. Research shows that people who believe their successes result from an innate, fixed ability do not appreciate challenges and are more often devastated by difficulties [4]. Fixed mindsets are thought to prime a "learned helplessness" orientation, which involves feeling powerless over failure and unable to change one's circumstances or performance [5]. On the other hand, people with a growth mindset, or incremental theorists, believe that they have the power to change or improve their abilities [6]. In turn, people with growth mindsets have been shown to be more apt to take on challenges and to respond more positively to failure.

Though the importance of mindset in understanding and predicting behavior extends beyond general academic performance [7,8], mindsets are most often studied in the context of education and academic achievement [9]. Within these domains, mindset has been examined through constructs like grade point average, standardized test performance, and IQ [10]. In academics, mindset theory posits that students with growth mindsets are more likely to be successful because of their propensity to persevere despite adversity in school [11]. For a student, a growth mindset is thought to address the inner forces or barriers that might restrain one's learning, such as worrying about ability or negative stereotypes [12]. In other words, growth mindsets may afford students the psychological tools to thrive under pressure, improve academic attitudes, and ultimately lead to enhanced learning and higher academic achievement [11,13].

## **2. Social–Psychological Mindset Interventions**

The implications of mindset in academics have spurred a wave of attention, and mindset has become a staple of social–psychological interventions aimed at improving academic achievement. Mindset interventions aim to manipulate students' beliefs about learning and their intellectual ability. They try to instill a growth mindset in participants by conveying that challenges and setbacks are opportunities for growth and that the brain is like a muscle that gets stronger through hard work [14]. Social–psychological intervention research focusing on mindset claims that a shift in attitude is what helps students improve scores on cognitive performance measures in the short- and long term [12,15]. The methodology of these studies varies, spanning resource-intensive and context-specific remedies [12,16] to low-resource and scalable solutions [17]. Target populations also cover a wide age range, ranging from young children to college students [18].

Furthermore, social–psychological interventions like these take hold through recursive processes that tap into students' motivation, behavior, and self-perception in context and over time [12,19]. These interventions are intended to support lasting academic improvement through attitudinal shifts and self-perpetuating behavioral cycles, altering the way a student approaches challenges and encouraging resiliency. Changing the meaning attributed to academic challenges makes it possible for students to shift their perspectives and to approach future challenges with a different belief system [12]. The key to these belief-altering tactics is that they are properly timed and implemented in a way that keeps students from feeling targeted as "low achieving" [20]. Though these interventions remain a popular approach for addressing issues related to attitudinal change and performance, a better understanding of the relationship between mindset interventions and measures of cognitive ability is still needed.

## **3. Inconsistent Effects of Mindset Interventions and the Role of Individual Differences**

Mindset interventions have demonstrated an inconsistent degree of efficacy [21–23]. Yeager and Walton [12] claim that mindset interventions are remarkable tools for boosting academic achievement measures like GPA and test scores, and ref. [24] found that a short mindset intervention raised grades in lower-achieving students and increased enrollment in advanced math courses when the intervention message was congruent with peer norms. On the other hand, some recent research suggests that the claims pertaining to mindset's influence over measures of cognitive ability are too bold and that the investment in mindset

interventions should be tempered [25]. A large mindset intervention study delivered in 101 schools throughout England found that students who received the intervention did not significantly improve in verbal or quantitative domains compared to students who did not receive the intervention [26]. Other researchers have also found no association between mindset and improvements in reading abilities [27]. Furthermore, comprehensive meta-analyses by [21] suggest weak and unreliable effect sizes across interventions, except for populations from low-SES households or those at risk of failing.

It is still unclear whether mindset interventions boost academic performance for everybody, and replicability and generalizability remain significant concerns within the current mindset intervention literature. As previously mentioned, these interventions take hold through self-perpetuating cycles of attitude change, so individual factors and the contexts in which they are applied might be involved in the differential responses. For instance, some work shows that these interventions have the strongest effect on poorly performing, at-risk, and low-SES populations [9,17,21], as well as students facing situational challenges, like school transitions [28]. Other work stresses the importance of investigating the roles of age or developmental stage in the effectiveness of non-cognitive or attitudinal-based interventions [2].

Despite the inconsistencies, the prospect of mindset interventions as feasible, scalable, and resource-efficient tools to improve academic achievement is worthy of consideration. The value of these interventions is further emphasized by the potential long-term outcomes of one's academic trajectory. For example, poor performance in school puts students at risk of fewer job prospects, worse health, and higher incarceration rates [29], an issue underscored by the approximate 20% of U.S. students who will not finish high school on time [30]. Therefore, the potential of mindset interventions to bolster measures of cognitive ability may extend far beyond academics to reduce the risk factors associated with inequality [31].

The inconsistent findings in the mindset literature, coupled with the potential for mindset to alleviate long-term negative effects in academics and beyond, highlight the importance of understanding when, how, and for whom mindset interventions work. In order to answer these questions and elucidate the boundary conditions relevant to mindset interventions, we must first consider the general and specific cognitive outcomes and attitudinal factors of greatest interest. The present study focuses on standardized test performance in math and working memory capacity (WMC). We also explore the effect of mindset on various attitudinal survey measures and attitudinal change in order to provide further clarity. Given the underrepresentation of and unique challenges for women in STEM areas [31–33], we focused our research on the domain of math in a sample of people who identify as female. As such, we will next discuss previous research on mindset and the cognitive factors of WMC and standardized test performance, focusing on women's math performance.

#### **4. Mindset, Test Performance, and Working Memory Capacity**

Targeted measures of cognitive ability and academic performance following social-psychological interventions vary, but examining standardized test performance is common practice [15,34]. Although standardized tests have been criticized and higher education institutions' overreliance on test scores is waning [35], standardized testing is still a widely accepted measure of academic performance and plays a significant role in the admissions processes of many post-secondary and graduate education institutions [36]. Furthermore, the number of students who take these tests continues to grow. In 2019, over 2.2 million people—the largest group ever—took the SAT, and around 675,000 people take the general GRE annually [37]. We employ standardized test performance in the current study based on the acceptance of these tests as markers of cognitive ability and the vast number of students whose future prospects heavily depend on these measures.

We focus on standardized test performance in the domain of math because of its pertinence in academic achievement. Additionally, math performance is important to

focus on in the context of mindset because of the perception that math ability is innate and highly indicative of one's intelligence, as well as the stereotypes about women's math performance, which likely contribute to the gender gap in math [13,15,24,33]. Seminal work in mindset theory also focuses on math performance. For example, ref. [32] note that the abrupt conceptual transitions that occur during new topics in math make it a particularly challenging subject for students, so they examine whether one's attitudes toward new and confusing material influences performance. They found that when confronted with confusing material, people with a more "mastery-oriented" (i.e., growth) mindset performed better than people with a more "helpless" (i.e., fixed) mindset. Importantly, mindset did not predict performance when the material was not difficult, ultimately suggesting that mindset is most important in challenging or confusing domains, like math. Furthermore, after teaching a growth mindset theory of intelligence to struggling junior high students, ref. [13] found that students were more motivated in their math class and even reversed their downward performance trajectory in math, but students in the control group who were taught other useful information instead of a growth mindset theory of intelligence continued their downward trajectory. Additionally, while investigating the effects of mentorship and messages on student achievement gaps, ref. [15] found that when students were taught about the malleability of intelligence or that academic challenges are common and surmountable, the discrepancies between women and men's performance in math disappeared. More recently ref. [38] found that growth mindsets are beneficial for both genders in math, but women demonstrate a greater effect of math achievement, which was explained by the increased expectancy beliefs (i.e., confidence in one's ability to succeed; ref. [39] for women with greater growth mindsets. Together, these studies emphasize the importance of studying mindset not only in the context of math but also in populations that are underperforming or underrepresented (e.g., women in math) due to educational inequities.

In addition to focusing on performance in math, we also explore WMC because it is an academically relevant outcome that, to our knowledge, has been largely understudied in the mindset literature. Working memory represents our ability to attend to a task while storing, retrieving, and updating other information simultaneously [40,41]. As the capacity component of working memory, WMC defines the parameters by which people employ cognitive resources and has been found to vary across individuals [42,43]. WMC is typically assessed via automated complex span tasks, such as the operation span (OSPAN) and reading (RSPAN) span, which require people to solve math problems or read sentences, respectively, while remembering lists of letters. Further, WMC assessed via complex span tasks has been found to be an important factor in academic performance and has been shown to be highly related to measures of intelligence, long-term memory and retention, and cognitive control abilities, and it even supports mental resilience during identity-threatening experiences that typically undermine performance for women and minorities [44–47]. WMC is also commonly used as a subtest in the Wechsler Adult Intelligence Scale and thought by some to be a malleable cognitive factor that can be improved by both cognitive and non-cognitive training approaches [5,48]. As such, WMC is a reliable predictor of cognitive ability and linked to many of the same performance outcomes in academic settings as mindset.

However, research surrounding the relationship between mindset, WMC, and performance enhancement remains conflicting. Some research suggests that there is no correlation between mindset and WMC performance or mindset and improvement in WMC following training exercises designed to boost WMC [49]. Others have shown that people with a growth mindset improve less than people with a fixed mindset during WMC training [50]. On the other hand, some have found that people with more malleable views of intelligence show greater improvement following WMC training than their fixed-mindset counterparts [51]. Not only are these findings mixed, but they also only explore the role of mindset as a predictor of WMC, or improvement in WMC, when people were training on a WMC task.

Moreover, it is important to better understand the role of WMC in the context of mindset and cognitive performance considering the extensive literature demonstrating the central role of WMC in the control of cognition in performance contexts. We know that WMC is key to helping individuals to control the use of their cognitive abilities through focusing their attention [52], inhibiting task irrelevant information [53], and maintaining focus in the process on goal achievement [44]. WMC also helps to support performance on challenging math problems and standardized test performance in both quantitative and verbal reasoning, depending on the extent of task demands and situational pressures [45,54,55].

The implications of WMC in controlled cognition can be informative for interventions by shedding light on which conditions and to what extent both mindset and WMC can help improve performance. Taken together, evidence suggests that WMC predicts performance on a wide range of cognitive tasks and remains a critical factor of academic achievement in a number of domains, but to our knowledge no current studies explore how mindset interventions affect WMC and what role this might play in subsequent academic achievement, such as standardized test performance in math. For these reasons, WMC performance, measured through RSPAN and OSPAN, is a worthwhile cognitive factor to investigate through mindset intervention. Next, we will consider previous research on student attitudes in relation to mindset and academic success, seeing as mindset has been linked to more positive academic attitudes and attitudinal change is thought to help improve performance.

## **5. Mindset and Attitudinal Measures**

Given previous research investigating the role of attitudinal and non-cognitive factors in addition to cognitive factors in the mindset literature [10], we also focus on mindset's effect on attitudinal survey measures and attitudinal change. Attitudinal measures help provide a more comprehensive understanding of the relationship between mindset and measures of cognitive ability, namely WMC and standardized test performance. Since mindset is thought to influence performance through peoples' beliefs about themselves and their abilities, examples of theoretically relevant measures include grit, anxiety, and questions surrounding students' feelings of belonging and academic attitudes in school. These measures not only provide more nuance to our understanding of mindset interventions' effects but also permit inquiries into the individual differences in baseline academic attitudes and beliefs that could influence a mindset intervention's efficacy.

Specifically, we focus on grit because of its theoretical proximity to mindset. Grit has been defined as the perseverance and passion for long-term goals [1]. In accord with grit theory, people who exhibit high levels of grit are more likely to persist through difficulties while people with low levels of grit are more likely to give up when faced with difficulties [1,56]. Similarly, mindset theory and research suggest that people with a growth mindset are more likely to seek challenges and persevere more than people with a fixed mindset [4,12]. Recent research has demonstrated a more nuanced relationship between grit and mindset. For example, ref [57] show that grit and mindset mutually predict each others' development during adolescence, and Zhao et al. [58] use structural equation modeling to suggest that a greater growth mindset predicts a sense of autonomy over one's learning, which in turn improves students' grit. Thus, manipulations that make mindsets more malleable may also increase one's grittiness. To our knowledge, no studies have examined how mindset manipulations influence grit and related attitudinal measures. Additionally, because academic challenges are thought to cause anxiety and impact students' feelings about belonging in an academic setting, we also explored the relations between these factors and mindset, providing additional contextual information to uncover potential individual differences involved in mindset interventions as well as elucidate whether mindset can lead to positive attitudinal change.

## 6. Purpose of the Present Study

The present study aims to provide a more nuanced understanding of the contexts in which transfer occurs between a successful mindset intervention and certain measures of cognitive performance in women. We implement a short mindset intervention in order to examine its effects on standardized test performance, WMC, and theoretically relevant attitudinal measures.

## 7. Hypotheses

Based on our research goals outlined above, we propose three hypotheses. First, participants in the growth mindset condition will show higher scores on WMC measures compared to the fixed mindset condition (Hypothesis 1). Second, participants in the growth mindset condition will perform significantly better on the math standardized test measure than participants in the fixed mindset condition (Hypothesis 2). Third, participants in the growth mindset condition will demonstrate increased persistence in the form of grit, more positive academic attitudes, and lower anxiety, while participants in the fixed mindset condition will exhibit the reverse (Hypothesis 3).

## 8. Material and Methods

### 8.1. Participants

Participants were drawn from the secondary data of a dissertation study that examined relationships between stereotype threat; mindset interventions; and cognitive, non-cognitive, and attitudinal differences ([59]; or see Supplementary Materials S1 for full methods and results). Ninety-nine subjects were invited to participate in the study. Based on subjects' failure to complete various measures and/or data missingness (e.g., incomplete tasks or submissions), there was a final sample of 81 subjects (30 White, 9 Black, 23 Asian, 9 bi-racial, 9 unreported, and 1 Other). Participants were students at a private university who identified as female and received credit toward a course requirement or USD 16 cash for their participation. Participants were randomly assigned to each condition.

### 8.2. Design

Based on secondary data from the original dissertation study ([59]), the current study focuses on the effect of the mindset manipulation on cognitive performance outcomes using a between-subjects design (Mindset: Fixed vs. Growth). The original study included a 2(Condition: Threat vs. Control)  $\times$  2(Mindset: Fixed vs. Growth) factorial design that manipulated the effects of gender stereotype threat and mindset on cognitive performance in women. However, the stereotype threat manipulation failed to induce a stereotype threat effect in the initial study, so this factor was collapsed (see Supplementary Materials S1 for more information).

### 8.3. Data Analysis Plan

Based on the between-subjects design, we used *t*-tests to test for differences between conditions.

### Statistical Power

Given previous research [10,13,18] and the observed significant effects of mindset intervention between either growth and fixed or growth and control conditions, it was expected that at least  $n = 79$  total subjects [18] would be required. Additional research was used to motivate this work that found significant differences in performance between mindset conditions when  $n = 86$  [10] and  $n = 91$  [13] total subjects were recruited. Based on these studies and the `pwr.t.test` function in the `pwr` package in R [60], the original study found that for between-group differences, one could expect an effect size to range from  $d = 0.59$  [13] to  $d = 0.63$  [18] in order to correspond to the minimum of 80% statistical power. The more conservative effect size estimate ( $d = 0.59$ ) motivated the recruitment of at least  $n = 90$  total subjects ( $n = 45$  per condition).



#### 8.4. Procedure

Upon entering the research lab, participants completed a battery of baseline measures. First, participants were given a baseline WMC test on the RPSAN, followed by several pre-manipulation surveys on a battery of non-cognitive and attitudinal measures of theoretical importance, including mindset, personality, grit, and a variety of other additional measures to gauge students' academic attitudes and sense of belonging in school (see Supplementary Materials S3 for survey details). Next, participants received the mindset manipulation, which involved reading either one prompt claiming that ability is fixed or a separate prompt claiming that ability is malleable, followed by a timed written activity reflecting on the information in the prompt. They then completed a post-manipulation WMC measure on the OSPAN along with a quantitative sub-section of the Graduate Record Exam (GRE). Last, participants completed a battery of post-manipulation surveys including mindset (for manipulation check), and the same attitudinal measures completed at baseline on grit and academic attitudes. Participants also answered questions about anxiety, beliefs about bias in standardized testing, self-reported SAT scores, GPA, and demographic information. At the conclusion of the experiment, participants were debriefed and thanked for their participation. We explained that we were interested in how different beliefs about cognitive ability impact our ability to perform complex cognitive tasks. We also explained that the manipulations were for experimental purposes only and we shared current findings surrounding topics relevant to our experiment, namely mindset, working memory, and stereotype threat. The entire experiment was no longer than 1.5 h and occurred over the course of a single session. This procedure was motivated by previous research [10,13,18] as well as findings that suggest mindset is especially important and effective for underrepresented, marginalized, or at-risk students [21]. Furthermore, these data were used in a secondary and de-identified manner for the purposes of the present study, so we did not require any additional consent.

#### 8.5. Tasks

For brevity, we summarize the measures we focused on in the current study using a secondary data approach. We direct the reader to Supplementary Materials S2 for full original methods and task descriptions in the initial study.

#### 8.6. Baseline Measures

**Mindset scale.** The mindset scale was used to obtain a sense of how flexible students were in their beliefs about ability at baseline and after the mindset manipulation. The scale is a Likert scale from 1–6 and includes two questions asking subjects about their implicit beliefs about intelligence and ability. The questions were adapted and expanded from [4], and they were designed to determine whether a participant's belief about ability in the domain was more fixed or more malleable.

**Pre-manipulation measures.** In addition to the mindset manipulation, students completed several attitudinal measures. We focused on those that are theoretically relevant for the current study.

**Grit.** Students completed a grit scale [61] in order to gauge their levels of enduring effort over time. The scale includes eight items about perseverance and dedication to task completion with few distractions (e.g., "I finish whatever I begin") and are rated on a 5-point scale (1 = Not at all like me to 5 = Very much like me).

**Academic Attitudes.** To account for a variety of theoretically important individual differences in the original study, students completed survey questions probing several topics, including their interest and identification with various course domains and how much they value their academic performance. We focus on a subset of relevant questions about academic attitudes and students' feelings of belonging at their university. These questions included "Being good at academics is an important part of who I am" and "Doing well on intellectual tasks is very important to me". These questions were rated on a 7-point scale of agreement (1 = strongly disagree to 7 = strongly agree). Items were

motivated by previous work that investigated academic attitudes with a focus on identity and value systems [18]. In addition, students answered questions about how much they feel comfortable expressing their views on important matters, how much they identify or relate with their university, and how much they identify or relate with other students at their university on a 6-point scale of agreement. These items were answered both pre- and post-manipulation.

**Reading span.** The automated RSPAN was completed pre-manipulation to get a sense of participants' baseline WMC. The RSPAN requires making veridical judgments for sentences while remembering a list of letters. For example, an individual trial in a list would take the following form: "When at last his eyes opened, there was no gleam of triumph, no shade of anger. Yes or No? R". Participants were instructed to read the sentence, answer yes or no, and then remember the letter for later recall. At the end of a list of such trials, participants were asked to recall the letters in serial order, and the total was scored using the partial unit method [62]. Participants received three to seven letters per trial and three sets of each trial length, totaling 15 trials total and yielding a maximum score of 75.

### 8.7. Mindset Manipulation

**Mindset conditions.** Participants were randomly assigned to either the fixed or growth manipulation conditions. The fixed mindset manipulation informed subjects that intellectual ability has been shown to be innate and unchangeable, and it used a crafted example of a research article that claims to support this information [12,13]. Participants then completed a 15 min written activity where they detailed an instance in which they worked hard, but their increased effort did not improve their performance. In the growth mindset manipulation, participants read research showing abilities are malleable—that people continue to learn and grow and that intellectual ability can be improved with effort. Participants in the growth mindset condition then completed a short activity where they detailed an instance in which they needed to work hard in order to improve and were successful.

### 8.8. Post Manipulation Measures

**Operation span.** The automated OSPAN was completed post-manipulation to obtain a sense of students' state of WMC. The OSPAN task requires completing a series of arithmetic problems while remembering a list of letters. For example, an individual trial in a list would take the following form: "[ $5 \times 9$ ] + 5 = 45? Yes or No? P". Participants were instructed to solve the equation, answer yes or no, and then remember the letter for later recall. At the end of a list of such trials, participants were asked to recall the letters in serial order, and the total score was calculated using the partial unit method [62]. Participants received three to seven letters per trial and three sets of each trial length, totaling 15 trials total and yielding a maximum score of 75.

**GRE—math.** The GRE mathematics subsection consisted of 25 multiple-choice or short-answer questions, each requiring mathematical reasoning and quantitative comparison skills (e.g., Solve the equation  $5 = 4x + 3$  for  $x$ . Is  $x$  greater than, less than, or equal to 1?). Participants were given 20 min to complete the subsection. The material was taken from free online practice materials provided by the Educational Testing Service. The final score was the proportion of questions correct out of 25 possible questions.

**Manipulation check.** Students were asked again about their implicit beliefs about ability on the mindset scale in order to assess whether the manipulation was effective in attitude change from baseline.

### 8.9. Post-Manipulation Attitudinal Measures

**Anxiety.** Participants completed the Spielberger State–Trait Anxiety Inventory (STAI) [63] in order to observe state anxiety. The inventory consisted of 6 questions where participants were asked to indicate the most appropriate answer to each statement based on their present feelings. The inventory contained a 4-point Likert scale (e.g., "I feel calm?"

on a scale of 1 = not at all and 4 = very much). Questions associated with low levels of anxiety (e.g., “I am relaxed”) were reverse scored. For scoring purposes, the values for each question were summed—the scores ranged from 6 to 24.

Academic Attitudes. These questions are detailed in the pre-manipulation section. They were also administered post-manipulation.

Experiment survey. All participants completed an experiment survey. The survey included demographic information, and participants also reported their GPA and SAT scores in verbal and quantitative domains.

## 9. Results

### 9.1. Summary Statistics and Correlations

Descriptive statistics and correlations are presented in Table 1 and Figure 1 below. We found that participants scored above the middle of the scale (from 1–6) on mindset prior to the manipulation ( $M = 4.41$ ,  $SD = 1.22$ ), indicating that participants were reporting more of a malleable than a fixed mindset even before the intervention. There was a statistically significant negative correlation between mindset and grit at baseline ( $r = -0.27$ ,  $p = 0.014$ ), signifying that higher grit was correlated with less of a growth mindset, contrary to what we expected. Most of the relations with the mindset and other attitudinal measures were not statistically significant and in the opposite direction as predicted (see Figure 1).

**Table 1.** Summary statistics.

Measure	M	SD	Min	Max
1. GPA	3.53	0.33	2.7	4
2. OSPAN	65.95	6.96	42	75
3. RSPAN	60.09	10.21	30	75
4. Math GRE proportion correct	0.54	0.19	0.16	0.96
5. Math GRE proportion attempted	0.78	0.15	0.36	1
6. Mindset pre-manipulation	4.41	1.22	1	6
7. Mindset post-manipulation	4.3	1.26	1	6
8. Comfort expressing views pre-manipulation	4.37	1.15	1	6
9. Relating to university pre-manipulation	4.12	1.23	1	6
10. Relating to other students pre-manipulation	4.14	1.16	1	6
11. Grit pre-manipulation	3.27	0.62	1.625	4.625
12. Grit post-manipulation	3.43	0.62	1.75	4.75
13. Anxiety	12.67	3.27	6	21
14. Comfort expressing views post-manipulation	4.38	0.93	3	6
15. Relating to university post-manipulation	4.04	1.31	1	6
16. Relating to other students post-manipulation	4.13	1.22	1	6
17. Verbal SAT	749.8	45.72	620	800
18. Math SAT	734.42	55.5	600	800
19. Being good at academics is important	5.54	1.24	1	7
20. Doing well on intellectual tasks is important	5.75	1.08	3	7
21. Doing well on math tasks is important	4.59	1.47	1	7
22. Academic success is not important	1.97	1.17	1	6
23. Standardized tests are biased against me	3.05	1.57	1	7

In terms of the cognitive measures, participants scored higher overall on the post-manipulation measure of WMC on the OSPAN than on the baseline measure of WMC on the RSPAN, and this difference was statistically significant,  $t(76) = 5.41$ ,  $p < 0.001$ ,  $d = 0.62$ . We also found that while participants scored an average of about 54% correct answers on the math GRE, students attempted an average of about 78% of the test items. In terms of the relations among measures, we found that the WMC tasks were moderately correlated ( $r = 0.44$ ,  $p < 0.001$ ), but only OSPAN was statistically significant and weakly correlated with the proportion of correct answers on the math GRE ( $r = 0.29$ ,  $p = 0.011$ ). Interestingly, we also found that for the attitudinal measure of students’ beliefs that standardized tests are biased against them that there were weak-to-moderate negative relations with several measures,

including state WMC on the OSPAN ( $r = -0.24, p = 0.041$ ), self-reported GPA ( $r = -0.32, p = 0.013$ ), as well as for reported verbal ( $r = -0.41, p = 0.003$ ) and math ( $r = -0.33, p = 0.017$ ) SAT scores (see Figure 1).

Measures	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
1. GPA	—																							
2. OSPAN	0.14	—																						
3. RSPAN	0.18	0.44**	—																					
4. Math GRE proportion correct	0.34**	0.29*	0.14	—																				
5. Math GRE proportion attempted	0.35**	0.21	0.08	0.72**	—																			
6. Mindset pre-manipulation	-0.13	-0.19	-0.22	-0.16	0.03	—																		
7. Mindset post-manipulation	-0.12	-0.14	-0.19	-0.03	0.19	0.82**	—																	
8. Comfort expressing views pre-manipulation	0.13	-0.02	0.09	0.01	0.05	-0.04	-0.01	—																
9. Relating to university pre-manipulation	0.38**	-0.1	0	0.13	0.18	-0.05	0.02	0.2	—															
10. Relating to other students pre-manipulation	0.30*	0.13	0.1	0.17	0.14	-0.01	0.02	0.07	0.57**	—														
11. Grit pre-manipulation	0.25	0.15	0.12	0.01	0.07	-0.27*	-0.13	0.39**	0.29**	0.11	—													
12. Grit post-manipulation	0.18	0.21	0.21	-0.01	0.08	-0.26*	-0.14	0.24*	0.23*	0.19	0.83**	—												
13. Anxiety	0.11	-0.18	-0.07	-0.11	-0.13	0.12	0.05	0.06	0.09	0.06	-0.03	-0.09	—											
14. Comfort expressing views post-manipulation	0.14	-0.02	0.16	-0.01	0.13	0.08	0.13	0.72**	0.42**	0.21	0.36**	0.35**	-0.01	—										
15. Relating to university post-manipulation	0.39**	-0.09	-0.03	0.03	0.08	-0.05	-0.1	0.18	0.83**	0.63**	0.24*	0.31**	0	0.49**	—									
16. Relating to other students post-manipulation	0.19	0.08	-0.03	0.1	0.07	0.08	0.06	0.02	0.49**	0.85**	0.01	0.15	0.03	0.14	0.67**	—								
17. Verbal SAT	0.53**	0.03	0.09	0.59**	0.35*	-0.21	-0.11	0.31*	0.25	0	0.17	0.06	0.14	0.2	0.1	-0.07	—							
18. Math SAT	0.45**	0.21	0.12	0.55**	0.38**	-0.12	-0.06	-0.04	0.07	-0.04	0	-0.02	0.01	0	-0.02	-0.1	0.58**	—						
19. Being good at academics is important	0.22	0.02	0.03	0.15	0.14	-0.05	-0.12	0.19	0.28*	0.39**	0.15	0.20	-0.17	0.31**	0.37**	0.32**	0.08	0.11	—					
20. Doing well on intellectual tasks is important	0.26*	0.06	0.1	0.05	0.16	-0.08	-0.05	0.15	0.16	0.29*	0.23*	0.24*	-0.01	0.19	0.24*	0.25*	-0.01	-0.06	0.58**	—				
21. Doing well on math tasks is important	0.09	-0.03	-0.04	0.26*	0.20	-0.20	-0.17	-0.03	-0.02	0.27*	0.09	0.18	-0.16	-0.05	0.11	0.18	0.09	0.16	0.44**	0.50**	—			
22. Academic success is not important	-0.22	0.08	-0.01	-0.1	-0.05	-0.07	-0.07	-0.2	-0.26*	-0.14	-0.19	-0.15	-0.06	-0.19	-0.29*	-0.08	-0.18	-0.14	-0.56**	-0.42**	-0.16	—		
23. Standardized tests are biased against me	-0.32*	-0.24*	-0.16	-0.37**	-0.16	0.06	0	-0.08	-0.31**	-0.42**	-0.13	-0.19	0.09	-0.25*	-0.26*	-0.33**	-0.41**	-0.33*	-0.24*	-0.07	-0.16	0.09	—	

Note: \* indicates  $p < .05$ . \*\* indicates  $p < .01$ .

Figure 1. Correlations of variables.

### 9.2. Mindset Manipulation Effects

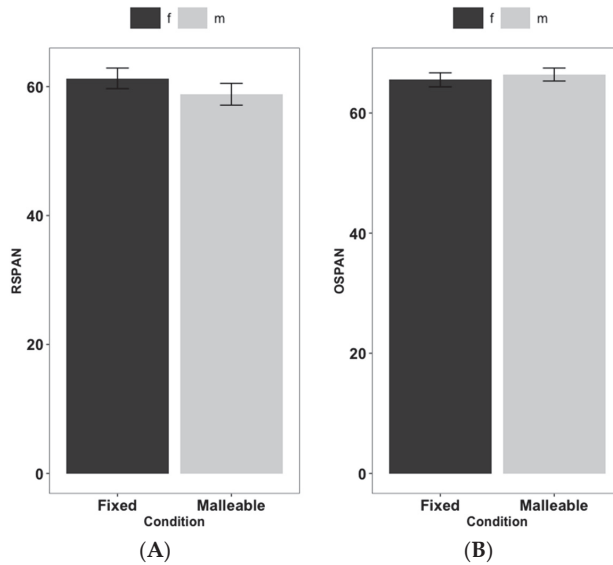
Manipulation check. To examine the degree to which the manipulations caused participants to endorse more fixed or growth mindsets, we conducted paired *t*-tests to investigate the change in students’ mindset scale scores by condition from pre- to post-intervention. We found that people in the growth condition became more malleable,  $t(36) = 2.12, p = 0.041, d = 0.35$ , and that people in the fixed condition became more fixed,  $t(38) = -3.10, p = 0.004, d = 0.50$ , indicating that the manipulation was effective in promoting attitudinal change in the hypothesized directions.

Effect of manipulations on cognitive measures. In testing the hypothesis that growth mindsets are better for cognitive performance than fixed mindsets, we conducted independent *t*-tests to investigate these effects on cognitive performance measures of WMC and standardized test performance on the math GRE. First, we found that there were no statistically significant differences in baseline WMC on the RPSAN in the fixed- and growth mindset conditions,  $t(75) = 1.06, p = 0.293, d = 0.24$ .

Next, we looked at the effect of the mindset intervention on state WMC on the OSPAN; this difference was also not statistically significant,  $t(75) = -0.55, p = 0.583, d = 0.13$  (see Figure 2).

Subsequently, we investigated whether the mindset intervention would have an impact on standardized test performance. We conducted an independent *t*-test and found no statistically significant difference in performance on the math GRE between the fixed and growth mindset conditions,  $t(78) = -0.26, p = 0.796, d = 0.058$ .

Effect of mindset manipulations on attitudinal measures. When examining overall change in grit scores ignoring mindset conditions, we found a statistically significant difference,  $t(77) = 3.79, p < 0.001, d = 0.43$ , indicating that overall, people reported higher grit scores after the manipulation ( $M = 3.42, SD = 0.62$ ) than at baseline ( $M = 3.27, SD = 0.62$ ). Next, we tested whether the fixed condition caused people to be less gritty from baseline than the growth condition as we hypothesized. We tested this by creating a gain score, taking the difference between post- and pre-manipulation grit scores. When we looked at change in grit by mindset condition, we found there was not a statistically significant difference,  $t(76) = 1.9274, p = 0.058, d = 0.44$ . Contrary to our hypothesis, we found that both fixed and growth conditions caused an increase in grit from baseline, but the fixed condition was not statistically significantly higher than the growth condition.



**Figure 2.** Effect of mindset intervention on trait WMC on the RSPAN (A) and state WMC on the OSPAN (B).

Next, we looked at the effect of mindset on academic attitudinal measures. For the item “Being good at academics is an important part of who I am”, we found no statistically significant difference,  $t(72) = 0.92$ ,  $p = 0.360$ ,  $d = 0.22$ .

Looking at the effect of mindset on the item “Doing well on intellectual tasks is very important to me”, we also found no statistically significant difference,  $t(70) = 0.76$ ,  $p = 0.510$ ,  $d = 0.16$ .

For the effect of mindset on the item “Doing well on intellectual tasks in the quantitative/mathematics domain is very important to me”, we found no statistically significant difference,  $t(72) = 0.92$ ,  $p = 0.361$ ,  $d = 0.21$ .

For the effect of mindset on the item “Academic success is not very valuable to me”, we ran a Welch  $t$ -test due to violation of Levene’s test and we found no statistically significant difference,  $t(55.33) = -0.57$ ,  $p = 0.571$ ,  $d = 0.13$ .

For the effect of mindset on the item “I feel that standardized achievement tests are definitely biased against me”, we found no statistically significant difference,  $t(72) = 1.02$ ,  $p = 0.310$ ,  $d = 0.24$ .

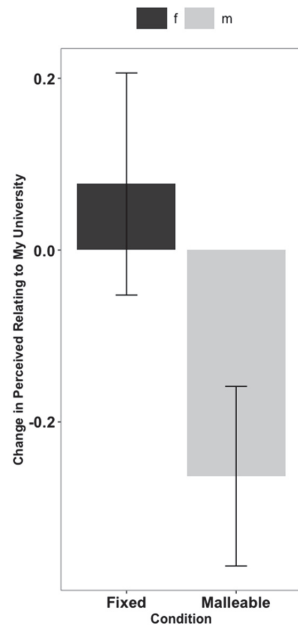
Finally, we investigated the effect of mindset on students’ reported anxiety. We found no statistically significant difference,  $t(77) = -1.26$ ,  $p = 0.213$ ,  $d = 0.28$ .

Overall, the results of these post-survey items indicate that the mindset manipulation did not have statistically significant differential effects on many of these attitudinal variables.

Next, we explored whether the mindset conditions differed in their effect on the change in several attitudinal survey items. These items probed how much participants feel comfortable expressing their views on important matters, how much they identify or relate with their university, and how much they identify or relate with other students at their university. Based on our detailing of mindset theory above, it is reasonable to expect that people primed with fixed mindsets might be less comfortable with expressing their views on important matters and may even feel less connected with those around them. We tested these hypotheses by creating gain scores for the survey items listed above.

Turning to the effect of mindset on the change in beliefs regarding how comfortable students feel expressing their views on important matters, we found no significant difference,  $t(72) = 1.14$ ,  $p = 0.256$ ,  $d = 0.26$ .

Examining the effect of mindset on the change in beliefs regarding how much students identified or related with their university, we found a statistically significant difference,  $t(75) = 2.04$ ,  $p = 0.044$ ,  $d = 0.47$ , which was not in line with our hypothesis, as the fixed condition believed this more after the manipulation (Figure 3;  $M = 0.077$ ,  $SD = 0.81$ ) and the growth condition believed this less after the manipulation ( $M = -0.26$ ,  $SD = 0.64$ ).



**Figure 3.** Change in student beliefs about relating to their university by mindset condition.

Finally, we investigated the effect of mindset on changes in beliefs regarding how much students identified or related with other students at their university, and found that this difference was not significant,  $t(75) = 1.79$ ,  $p = 0.078$ ,  $d = 0.41$ .

Taken together, the effect of the mindset intervention on the change in students' attitudes generally did not provide evidence supporting our hypotheses based on mindset theory.

## 10. Discussion

The purpose of this study was to explore the effects of a mindset intervention on WMC and standardized test performance measures for women while also considering the role of attitudinal variables. The study's methodology was motivated by the need for a more nuanced understanding of mindset intervention effects. We expected that the mindset intervention would make participants show more growth or more fixed mindsets based on the experimental conditions and that the participants with more growth mindsets would perform better on WMC and standardized test performance measures. Additionally, we predicted that in the growth mindset condition, participants would have higher grit and more positive academic attitudes and lower anxiety compared to the fixed condition.

Our results do not support these hypotheses en masse. First, a manipulation check indicated that the mindset intervention was successful in shifting participants' mindsets, but this effect did not lead to significantly higher post-manipulation WMC in the growth condition compared to the fixed condition. The results also indicate that standardized test performance was slightly higher in the growth mindset condition as expected, but this effect was small and not significant. Further, grit increased from baseline overall but was not significantly higher in the growth condition, which was contrary to our hypothesis. The majority of the attitudinal measures revealed no significant relations with mindset, no

significant differences in student attitudes between conditions, and no significant attitudinal change in the predicted directions.

These results do not provide strong evidence to support the claim that mindset interventions are generally or immediately beneficial for measures of cognitive ability, such as WMC and standardized test performance. This falls in line with the mindset intervention literature that demonstrates concerns regarding effectiveness, replicability, and generalizability [21,22,25–27]. Moreover, our finding that both growth and fixed conditions increased in grit from baseline supports the recent literature that suggests that the premises surrounding mindset theory are more nuanced and complicated than the original theory purports [25]. Specifically, mindset theory proposes that a fixed mindset is associated with aversion to challenge and persistence [4], yet we found that both growth and fixed conditions increased persistence through grit scores.

Nevertheless, we believe that our non-significant results, within the scope of mindset theory and intervention, provide a more comprehensive understanding of the conditions for a successful mindset intervention. A deeper look into the study's limitations and methodology might provide insight into the processes underlying mindset interventions, ultimately clarifying when, how, and most importantly for whom they are effective. This knowledge may contribute to a framework for precise and targeted interventions that more effectively meet the needs of students [3].

## 11. Limitations

We recognize some limitations of this research. First, we ended up with a relatively small final sample size. This limitation could contribute to the lack of statistical significance in our study, specifically regarding the higher scores on post-manipulation WMC and standardized math test performance for participants in the growth mindset condition. The small sample size could have tempered the significance of the small increase that we observed by weakening the power of this boost in performance. Our observed effect sizes were  $d = 0.13$  for post-manipulation WMC on the OSPAN, which were small to moderate, whereas the observed effect size for performance on the math standardized test was  $d = 0.058$ , which was very small and more in line with the meta-analytic average standardized mean difference reported in [21] of  $d = 0.08$ . However, this meta-analysis was published after the present experiment was conducted, so it could not have been considered for this experiment's methods. Rather, our sample size was motivated by [10,13,18]. Each of these studies contained samples with around 40 participants per condition and found significant differences between mindset conditions of interest. Nevertheless, employing a larger sample size allows for greater statistical power and may help resolve the extent to which these results were driven by low statistical power. Furthermore, due to the relatively small sample size and the exploratory nature of our measures, we performed quite a few statistical tests without correcting for multiple comparisons. The results here should be seen as trends and replicated with direct and targeted tests that make these corrections. Finally, we acknowledge that while our deliberate focus on an all-female sample for testing our hypotheses regarding mindset intervention in math was purposeful, this does slightly limit the potential generalizability of our findings for the mindset intervention literature more broadly.

## 12. Additional Explanations

Beyond the aforementioned limitations, other conceptual factors could have played a role in the outcome of our study. These factors may also offer a more in-depth understanding of mindset theory and social-psychological mindset interventions by elucidating the elements that influence an intervention's efficacy.

The length of our study may have played a role in our findings. We did not explore the effect of our mindset intervention longitudinally. Our entire study was only 1.5 h max and did not entail follow-up measures after the study. Our study's design and the lack of significant transfer to measures of cognitive ability may offer support for the

notion that one-off social–psychological interventions are less effective. Some research suggests that mindset interventions work by changing the way in which students approach challenges, bolstering students’ resilience or tapping into recursive processes [12,63]. Yeager and Walton [12] propose that these recursive processes engage motivational cycles and behaviors, which could take more time to effect positive change. These ideas, juxtaposed with our null findings, could suggest that mindset interventions may operate in a more longitudinal and contextual system and that these attributes may be necessary for their influence over measures of cognitive ability. As such, one perspective might be that our study was not long enough to see the intended effects. However, we should also note that several of the aforementioned studies in the mindset literature, including those that motivated our design, were able to show significant correlational and experimental effects of mindset for performance measures assessed in both the shorter (e.g., immediate post-intervention performance [10,32]) and longer term (e.g., performance over the course of the semester or over the course of several years [13,18,24,64]). In addition, the length of time between intervention and final test in some studies [10] was similar to ours, suggesting that longer retention intervals may not necessarily be required in order to see significant mindset intervention effects.

Additionally, our manipulations targeted general intelligence rather than domain-specific intelligence in math. Many mindset interventions target general intelligence, so we had participants read prompts and write about the innate or malleable nature of their intellectual ability. We believe that this paradigm is appropriate when translated to the domain of math due to the common perception that math ability is not only innate but also highly indicative of one’s general intelligence, and seminal works show that mindset interventions targeting general intelligence have direct effects on performance in the math domain [13,15]. Nevertheless, we cannot rule out the possibility that our lack of domain specificity in the manipulations did not contribute to our non-significant results. A math-oriented mindset intervention may have been more effective in improving performance on the OSPAN and math standardized test.

Another possible explanation for our findings involves the age of the participants. While some studies examine mindset interventions in college students [18], most target a younger demographic [12]. It is possible that younger students may be more receptive to social–psychological interventions and that one’s mindset may more easily transfer to measures of cognitive ability in younger students. Given this framework, our study’s focus on women college students may have influenced the findings. This provides further support for the importance of strategically targeted and timed interventions in order to achieve an optimal outcome [20], suggesting that older students may not be the most appropriate or practical targets for these kinds of social–psychological interventions.

Finally, the high-achieving nature of our student sample may also help explain the findings. Our sample population consisted mostly of undergraduate students from a private university. We recognize that private university students are diverse and come from different backgrounds, but entry into these universities can be competitive and requires high performance on measures of cognitive ability, like standardized testing and WMC. This high achieving sample could have attenuated the effect of the intervention on measures of cognitive ability since they may not have as much to improve regarding standardized test performance as other populations. Furthermore, we also saw increases in WMC for the fixed mindset condition and the growth mindset condition, which may be explained by the participants presumably having enough WMC at baseline to use the fixed intervention as motivation as well, which follows studies that consider how fixed mindsets may even be beneficial for people in favorable circumstances [66]. These findings offer insight into the individual differences that impact the efficacy of mindset interventions. The absence of a significant transfer between growth mindsets and WMC or standardized test performance measures suggests that mindset interventions may not be as effective in high-achieving samples. These findings also support the notion that the beneficial effects of mindset may be overstated in generalized populations [25] and may have greatest effects



in certain minority student groups, more disadvantaged and/or at-risk students, or lower SES populations [9,17,21]. Our findings fall in line, ultimately suggesting that some sample populations, such as high achievers and successful students, may not have as much to gain from academic mindset interventions.

### 13. Conclusions

Though this study did not see the intended effects of significantly increased WMC and standardized test performance following a mindset intervention for women, it provides important insight into mindset theory and the factors that may influence an interventions' efficacy. It is worthwhile to continue probing the relationship between mindset and measures of cognitive ability, and there is value in revealing when, how, and for whom mindset interventions do not improve these measures.

Given the inconsistency of social-psychological mindset interventions, the resource demands and opportunity costs associated with implementing them, and the urgency to mend pervasive and consequential academic achievement gaps, it is imperative that we know what makes these interventions effective. Our findings can help inform where limited resources are best allocated by encouraging caution for mindset interventions that have a one-off design, concern an older student demographic, or sample more high-achieving populations. Ultimately, this study strengthens our understanding of mindset theory and its effects on measures of cognitive ability and academic attitudes, equipping us with tools to make more informed decisions about future research and practical applications of mindset interventions.

**Supplementary Materials:** The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/educsci14030227/s1>, Supplementary Material S1: Original Stereotype Threat Study Methods and Results; Supplementary Material S2: Manipulation Materials; Supplementary Material S3: Survey Materials.

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**Institutional Review Board Statement:** The original study was conducted in accordance with the Declaration of Helsinki, and approved by Princeton Institutional Review Board for Human Participants (protocol code 10037 and Approval Date: November 2017).

**Informed Consent Statement:** The current data do not require IRB or additional informed consent as they are secondary de-identified data. The original data were collected under a doctoral dissertation project at a private research university in the northeast of the United States which concluded in 2018. Presently, as the first author collected this data as part of doctoral research these de-identified secondary data analyses do not require additional consent of any kind.

**Data Availability Statement:** The raw data supporting the conclusions of this article will be made available by the authors on request.

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Article

# Cognitive Control among Primary- and Middle-School Students and Their Associations with Math Achievement

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**Abstract:** Background: Math achievement is an important predictor of academic success. While many studies have examined math achievement in young children, studies with older children are scarce. This study focused on primary- and middle-school students, examining math achievements and cognitive control. Cognitive control was assessed referring to both domain-specific and domain-general cognitive control mechanisms and eliciting both simple and complex levels of conflict, and their association with math achievements. Methods: One-hundred-and-twenty-two participants performed two versions of a cognitive control task: a numerical Stroop task (NST; manipulating the numerical and physical size of Arabic numerals) and a perceptual Stroop task (PST; manipulating the location and direction of an arrow). For math achievements, participants performed math fluency and math curriculum tests. Results: Overall, the congruency effect was smaller in older students than in younger ones. Moreover, all participants demonstrated a similar congruency effect in the simple conflict task, whereas younger students showed a larger congruency effect in the complex conflict task. In addition, performance on the basic math fluency task was predicted by both Stroop tasks. However, performance on the comprehensive math achievement test was predicted only by the PST. Conclusions: Our results demonstrated enhanced cognitive control abilities of middle-school students and suggest that they can contribute to math achievements. We call for considering the implementation of both domain-specific and domain-general cognitive control activities as a potential approach to support math achievements.

**Keywords:** cognitive control; primary- and middle-school; domain-specific and domain-general; numerical and perceptual Stroop task; basic and comprehensive math achievement tests

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## 1. Introduction

Mathematical performance is important for everyday life in modern society. Math performance impacts academic success from primary school, specifically in STEM (science, technology, engineering, and mathematics) subjects, to higher education [1], paving the way to better employment options and quality of life, decision making [2], and health [3]. Researchers have highlighted the developmental changes in mathematics since acquiring mathematical skills requires attaining knowledge, which is absorbed step by step during the individual's schooling over the years [4]. For example, the capacity to solve math exercises automatically comprises a significant foundation for performing more complex calculations and forms the basis of higher mathematical comprehension [5–7].

Numerical representations among children are established and developed by their experience, with the development of formal mathematical knowledge. Moreover, the individual's neuro-cognitive development of numerical representations and calculation

abilities is related to the development of specific and general cognitive mechanisms, such as attention, cognitive control, working memory, and one's experience and environment [8].

Many studies have examined math performance in primary school (e.g., [9–11]), suggesting that domain-specific alongside domain-general factors predict math achievement. Domain-specific factors in the context of math achievement are related to basic numerical cognitive abilities, including the approximate number system [12,13], mental number line [14–16], subitizing [17,18], ordinal processing [11], and automatic processing of Arabic numerals [19,20].

Other studies have emphasized the importance of domain-general factors significant for mathematical functioning, such as working memory (e.g., [21–24]), attention and executive abilities (e.g., [25–27]).

One of the critical domain-general factors is executive functions (EFs). EFs comprise a range of high-level skills, such as inhibition, planning, organization, and conflict resolution [28,29]. EFs develop during childhood and adolescence [30], enabling the individual to control their behavior and thoughts, contributing to the ability to make coherent plans for fulfilling internal goals [31].

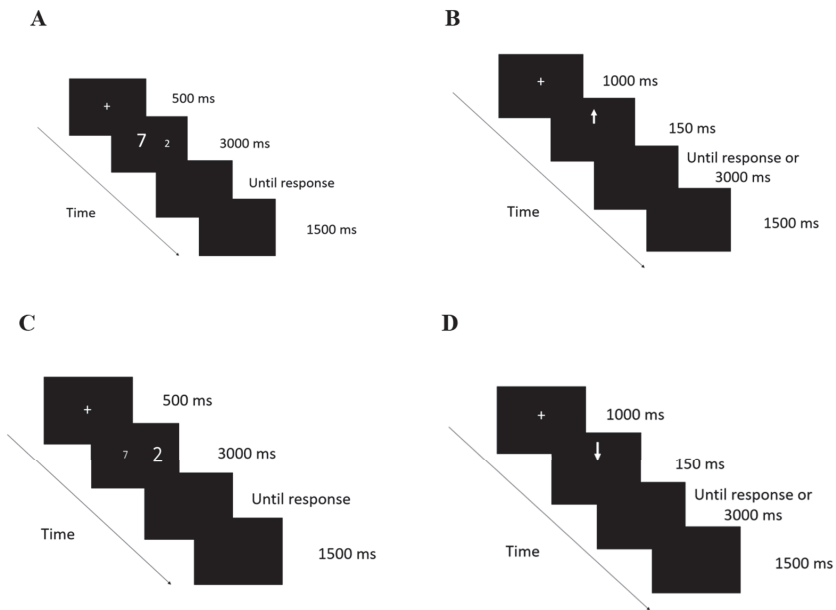
A recent meta-analysis found that EF had a significant impact on academic outcomes in elementary school [32]. Specifically, previous studies have demonstrated a strong relationship between children's EFs and their academic performance in math, suggesting that mathematical development and EF development are intertwined [25,27,33–38]. EFs were found to be a strong predictor to math achievement even when controlling for IQ and childhood socioeconomic status [27]. However, most studies examined children only up to the sixth grade. Indeed, it is possible that the role of EF components in math performance increases during adolescence [39]. Thus, a deeper examination of the complex relationship between EF and math is needed [25], especially among adolescents. Investigating this relationship among adolescents is critical due to the increased complexity of math in middle school.

One of the central components of EFs is the individual's ability to navigate conflicting situations that trigger competing responses, necessitating the suppression of responses to irrelevant information (henceforth, termed cognitive control, and specifically conflict resolution). A common task for evaluating cognitive control is the Stroop task, presenting two conflicting dimensions of a stimulus, thus activating conflicting responses. In this task, faster reaction times (RTs) are expected in congruent conditions (i.e., where both dimensions converge, presenting no conflict between the dimensions) than in incongruent conditions (i.e., when the two dimensions conflict) [36], known as the congruency effect. A larger congruency effect indicates a lower cognitive control ability.

The Stroop task comprises two subtasks. In the simple-conflict level subtask, participants are instructed to respond to the more salient aspect. In the complex-conflict level subtask, participants need to suppress responses to the more salient irrelevant aspect of the stimuli. Thus, higher cognitive control is critical for performing the complex-level conflict subtask. Faster reaction times (RTs) are expected in simple level conditions than in complex level conditions. However, previous research has not focused on comparing congruency effects at different levels of conflict tasks [40,41].

Various conflict resolution tasks have been developed in the design of the Stroop task. The numerical Stroop-like task (NST) manipulates an Arabic numeral's physical size and numerical value. In the NST, participants are presented with two digits side by side and are instructed to respond to the larger digit. In the congruent condition, the physically larger digit has a higher numerical value than the other digit (e.g., 3 5); see Figure 1A. In the incongruent condition, the physically larger digit has a lower numerical value (e.g., 3 5); see Figure 1C. The task includes two subtasks. In the physical subtask (the simple-conflict level), participants are instructed to respond to the physical dimension, and in the numerical subtask (the complex-conflict level), participants are instructed to respond to the numerical dimension [42]. Previous studies have examined the developmental trajectory of automatic numerical processing among primary-school children, applying

the NST (e.g., [40,43]). The findings revealed that the congruency effect appeared at the end of first grade and continued to develop until fifth grade. Importantly, the congruency effect emerges in the beginning of primary school, but with age, it decreases, indicating the maturation of cognitive control abilities, which in turn attenuates the processing of the numerical value of the digit, when it is the irrelevant dimension of the stimulus. Further, NST studies found a decrease in the efficacy of the congruency effect among participants with developmental [20] and acquired [44,45] arithmetic disabilities. Nevertheless, it remains unclear whether Arabic number processing continues to develop beyond the fifth grade and whether it predicts mathematics performance in middle school.



**Figure 1.** The study’s cognitive control tasks, in congruent and incongruent trials. (A) A congruent trial of the NST (numerical Stroop task)—the digit 7 has a larger physical size and a larger numerical value than the digit 2. (B) A congruent trial of the PST (perceptual Stroop task)—the arrow appears above the center of the screen pointing up. (C) An incongruent trial of the NST—the digit 2 has a larger physical size but a smaller numerical value than the digit 7. (D) An incongruent trial of the PST—the arrow appears above the center of the screen pointing down. “+”—a fixation sign.

Numerous Stroop-like tasks involve the processing of domain specific notation as letter (as in the classical Stroop task) or digit recognition, as in the NST. Another conflict resolution task, which minimizes the involvement of semantic processing, is the perceptual Stroop task (PST), which manipulates basic features such as the location (position) and pointing direction of an arrow. The position of the arrow on the screen (above/below the center of the screen) is perceived intuitively, independent of reading or numeracy acquisition or language.

In the PST, a single arrow is presented above or below a fixation mark (i.e., the arrow’s location), which can point up or down (i.e., the arrow’s direction). Here, too, the task comprised a congruent condition (e.g., an arrow located above the fixation mark, pointing up) (see Figure 1B) and an incongruent condition (e.g., an arrow located above the fixation mark, pointing down) conditions (see Figure 1D). In the location subtask (the simple-conflict level), participants were required to judge the arrow’s location, ignoring its direction, and in the direction subtask (the complex conflict level), vice versa, participants were required to judge the arrow’s direction, ignoring its location. Previous studies have shown that

children in primary schools and middle schools presented a congruency effect in the PST task [41,46].

Importantly, both the NST and the PST examine conflict between different dimensions, but only the NST includes numerical processing. Thus, incorporating both tasks in a single study enabled us to examine the respective contributions of the domain-specific cognitive control mechanism (i.e., involving numerical processing in the NST) and the domain-general cognitive control mechanism (i.e., involving non-semantic processing in the PST) as predictors of math achievement for children and adolescents.

The current study is a cross-sectional study examining math achievement in sixth graders (end of primary school) and eighth/ninth graders (beginning of middle school) and their associations with cognitive control mechanisms.

Importantly, participants' age groups in the present study were chosen due to several considerations: first, it was important to compare between primary and middle schools. The primary-school math curriculum emphasizes basic mathematical operations and procedures, while the middle-school math curriculum places greater cognitive demands on students. We focused on the end of primary school to examine children who already acquired basic mathematical skills [9]. Second, EF development continues throughout childhood and adolescence [30]. Thus, comparing between primary- and middle-school students can shed light on the role of EF in math achievements across two separate time points, including when EF is more mature.

In addition, whereas most studies examined measurements of math achievement using mostly math facts tests [47,48], we assessed math achievement with a math fact test in addition to a comprehensive curriculum-based math test for each grade level.

Our research questions were:

1. What are the changes in cognitive control abilities with age? We hypothesized that middle-school students would present better conflict resolution (i.e., a smaller congruency effect) in both the NST and the PST than sixth graders.
2. Is there a difference between the two types of conflict tasks (i.e., NST vs. PST) and between levels of conflict (i.e., simple vs. complex), and how does this difference change with age? We hypothesized that PST would be easier than NST, resulting in a smaller congruency effect in PST compared to NST. Moreover, we hypothesized that a simple level would be easier than a complex level, resulting in a smaller congruency effect in location compared to direction, and in physical compared to numerical comparisons. However, the difference between tasks may be reduced with age.
3. Most importantly, our main research question aims to investigate the association between cognitive control and math achievement, and whether this association changes when dealing with basic vs. comprehensive math achievements. We hypothesized that the domain-specific cognitive control task (i.e., NST) would predict basic performance of math achievement (i.e., math fluency). In addition, we hypothesized that both the domain-general (i.e., PST) and domain-specific (i.e., NST) cognitive control factors would predict math performance as manifested in the comprehensive math achievement task (i.e., curriculum test).

Note, however, that due to a lack of previous relevant studies with adolescents, our hypotheses for research questions 2 and 3 were partially explorative.

## 2. Materials and Methods

### 2.1. Participants

Sixty-two sixth graders (in the current study, as in most schools in Israel, sixth grade is the final grade in primary schools, and eighth and ninth grades are part of middle schools) (29 females, mean age 11.6, SD = 0.3) and sixty eighth and ninth graders (34 females, mean age 14.1, SD = 0.5) participated in the study. Chi-square analysis revealed no difference in gender distribution between the two age groups,  $t = 1.2$ ,  $p = 0.3$ .



## 2.2. Procedure

The research protocol was approved by the Chief Scientist of the Ministry of Education in Israel and the Ethics Committee of Tel-Aviv University. Participants were recruited from eight public schools in Israel—four primary and four middle schools. Approval was obtained from the school principal, and all parents and students signed an informed consent form. Each student participated in two sessions, administered on separate days. The order of the Stroop tasks (NST and PST) was counterbalanced. All sessions were performed in a quiet room during the school day, and students used noise-cancelling headphones during the tasks.

## 2.3. Tasks

### 2.3.1. Computerized Tasks

Participants completed two computerized tasks: the perceptual Stroop task (PST) and the numerical Stroop task (NST). Participants were instructed to press the QWERTY keyboard as accurately and quickly as possible on a 15.6-inch laptop screen. Both tasks included 10–15 practice trials with feedback before administering the task.

#### Numerical Stroop Task (NST)

The NST stimuli consisted of two single digits, displayed side by side in the center of the screen. The two digits differed in physical size and numerical value. In two different blocks, participants were instructed to indicate by a keypress which digit was numerically or physically larger. The stimuli were presented in two conditions: a congruent condition (e.g., the physically larger digit has a larger numerical value, 3 5) and an incongruent condition (e.g., the physically larger digit has a smaller numerical value, 3 5). Two numeric distances between the presented digits were used: distance 1 (with pairs 1 2, 3 4, 6 7, 8 9) and distance 5 (with pairs 1 6, 2 7, 3 8, 4 9). The digit sizes corresponded to font sizes 30 and 58, for smaller and larger physical sizes. The numbers were displayed in the center of the screen in an area of  $8.5 \times 11$  cm. Both subtasks (physical and numerical) consisted of two blocks with a break in the middle. They included 64 trials in each block: 2 congruent conditions  $\times$  2 numeric distances  $\times$  4 different pairs of digits per distance  $\times$  2 sides (large number left/right)  $\times$  2 repetitions. Each trial began with a fixation cross presented for 500 ms, followed by two digits in the center of the screen. The pair of digits was presented until the participant's response, up to 3000 ms. The next trial began 1500 ms after the participant's response (see Figure 1A). Response keys were 'L' (larger right) and 'A' (larger left) on the computer keyboard. Both accuracy and RT were recorded. RT was measured in milliseconds from target onset to the participant's keypress. The reported split-half reliabilities (mean of 288 split-half estimates) of the NST were 0.56 for RT and 0.42 for accuracy data [49]. An inverse efficacy score (IES) was calculated for each participant; see further description in Section 2.4 below. All participants began with the physical subtask and then performed the numerical subtask.

#### Perceptual Stroop Task (PST)

In the PST, a white arrow (1.7 cm high and 0.8 wide) was briefly presented 1.5 cm above or below a white fixation cross point. In the location subtask, participants were instructed to indicate by a keypress whether the arrow was presented above or below the center of the screen. In the direction subtask, participants were requested to judge whether the arrow was pointed up or down. Each subtask had two conditions: the congruent condition (e.g., an arrow located above the fixation point and pointing upward) and an incongruent condition (e.g., an arrow located above the fixation point and pointing downward). Each subtask (location and direction) consisted of two blocks with a break in the middle and included 80 trials: 2 congruent conditions  $\times$  2 locations (up and down)  $\times$  20 repetitions. Each trial began with a fixation cross that lasted for 1000 ms, followed by the arrow for 150 ms. The brief presentation duration in the PST was essential to refrain from eye movements. A black screen appeared until the participant responded. The subsequent

trial began 1500 ms after the response (see Figure 1B). The keyboard response keys were 'L' (above/up) and 'A' (below/down). Both accuracy and RTs were recorded. RT was measured from the target's onset to the participant's keypress. The reported split-half reliabilities (mean of 100,000 split-half estimates) of the PST were 0.95–0.96 for RT data and 0.75–0.83 for accuracy data [46]. An IES was calculated for each participant. For all participants, the location subtask preceded the direction subtask.

### 2.3.2. Math Achievement Measures

Math achievement was assessed by two tests: a math fluency test, examining performance on simple math exercises, and a curriculum-based math test, aligning with Ansari [50]. The tests were conducted in a paper-and-pencil format.

#### Math Fluency

The math fluency test was taken from the Woodcock–Johnson III Test of Achievement [51]. The test includes 160 simple single-digit arithmetic exercises, tapping addition, subtraction, and multiplication skills. Participants were given three minutes to solve as many problems as possible without skipping. Performance scores were derived from participants' accuracy rate and number of solved exercises.

#### Curriculum-Based Math Test

Committees of professional experts developed the country-wide curriculum math tests under the supervision of The Ministry of Education of MASKED. The tests included the knowledge and skills as defined in the math curriculum. One-hundred-and-six students performed the 90 min test. The test was administered and scored by the participating schools' math teachers. The tests included verbal questions, close-ended questions, and open-ended questions. For sixth graders, the test included simple and decimal fractions, calculating natural numbers including zero, data analysis, probability calculations, geometry, and measurements. For eighth and ninth graders, the test included algebra (e.g., an equation with two variables, functions), numerical (e.g., calculation rules, verbal question of power, square roots, adjusted numbers), and geometry (e.g., calculation of area and volume of geometrical shapes). As the tests differed for each grade, Z-scores were calculated for each age group.

### 2.3.3. Non-Verbal Intelligence

Non-verbal intelligence was assessed using Raven's Progressive Matrices, applied in two versions due to different age norms. A colored version, Colored Progressive Matrices (CPM [52]), was administered to the sixth graders, and the Standard Progressive Matrices (SPM [53]) was administered to the eighth and ninth graders. No differences were found between groups in the Z-score of the Raven,  $t(120) < 1$ .

## 2.4. Statistical Analyses

In both Stroop tasks, trials that were slower or faster than 2 SD from the participant's average RT were excluded from the analysis. NST and PST performance was assessed using a combined single dependent variable called the inverse efficiency score (IES). The IES variable derives from the mean RT on accurate responses and accuracy rates (i.e.,  $(\text{Mean RT}_{\text{Correct}} / \text{Accuracy Rates})$  for each condition). IES is expressed in milliseconds. However, it indicates the time spent for correct responses. When there is a trade-off between speed and accuracy, the IES effect will compensate for the differences in the percentage of incorrect responses [54]. A congruency effect in each Stroop task was calculated as the difference between IESs of congruent and incongruent trials. A lower IES score means a more efficient performance. All reported planned comparisons were conducted according to the Bonferroni correction.

### 3. Results

Descriptive statistics of accuracy rates and RTs for each condition in each age group presented in the Supplementary Materials.

First, we present the effects of age on performance in the domain-specific and domain-general cognitive control tasks. Then, we present their relation to math achievement.

#### 3.1. Cognitive Control by Task Type and Age Group

An ANOVA using inverse efficiency scores (IES) was carried out on the following variables: 2 (task: NST vs. PST)  $\times$  2 (conflict level: simple conflict, NST-physical and PST-location; and complex conflict, NST-numerical and PST-direction)  $\times$  2 (congruency: congruent vs. incongruent)  $\times$  2 (age group: primary vs. middle school).

A significant main effect for age group was found, showing that the middle-school students were more efficient ( $M = 659.03$ ,  $SD = 127.04$ ) than the primary-school students ( $M = 757.75$ ,  $SD = 169.15$ ),  $F(1,120) = 19.66$ ,  $p < 0.001$ ,  $p_{\eta}^2 = 0.14$ . Furthermore, a significant main effect for task was found, as PST performance was more efficient ( $M = 685.36$ ,  $SD = 149.01$ ) than NST performance ( $M = 732.56$ ,  $SD = 163.64$ ),  $F(1,120) = 31.20$ ,  $p < 0.001$ ,  $p_{\eta}^2 = 0.2$ . Also, a significant main effect for congruency was found, with a more efficient performance in the congruent condition ( $M = 653.03$ ,  $SD = 130.14$ ) than in the incongruent condition ( $M = 764.40$ ,  $SD = 162.57$ ),  $F(1,120) = 384.00$ ,  $p < 0.001$ ,  $p_{\eta}^2 = 0.8$ . Finally, a significant main effect for conflict level was found, as the IES in the simple-conflict conditions was smaller ( $M = 607.91$ ,  $SD = 94.86$ ) than in the complex-conflict conditions ( $M = 809.51$ ,  $SD = 97.91$ ),  $F(1,120) = 401.05$ ,  $p < 0.001$ ,  $p_{\eta}^2 = 0.8$ .

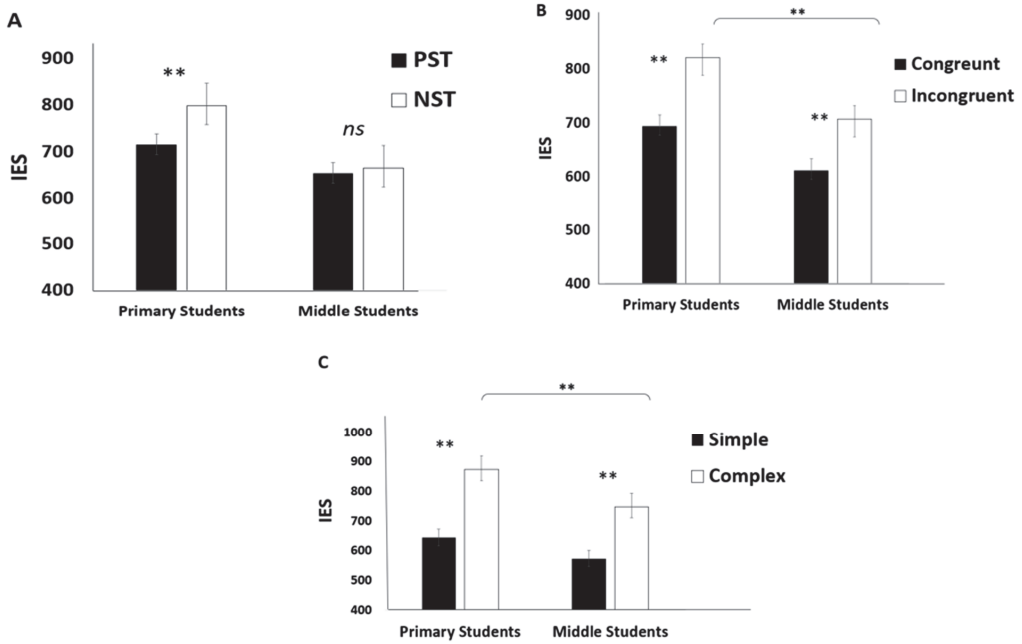
Among the interactions between all independent variables of this analysis, those involving age groups were the most critical and relevant for our study, of which four were significant. First, the task  $\times$  age group interaction was significant (see Figure 2A),  $F(1,120) = 17.67$ ,  $p < 0.001$ ,  $p_{\eta}^2 = 0.13$ . Planned comparisons revealed a significant difference between tasks among primary-school students ( $t = 6.98$ ,  $p < 0.001$ ) but not among middle-school students ( $t < 1$ , *n.s.*).

Second, the congruency  $\times$  age group interaction was significant (see Figure 2B),  $F(1,120) = 7.49$ ,  $p = 0.007$ ,  $p_{\eta}^2 = 0.06$ . Planned comparisons revealed that both age groups demonstrated a congruency effect ( $t = -15.92$ ,  $p < 0.001$ ;  $t = -11.89$ ,  $p < 0.001$ , for primary- and middle-school students, respectively). Most importantly, the congruency effect was larger for primary-school students than for middle-school students ( $t = 4.3$ ,  $p < 0.001$ ,  $d = 0.4$ ). See Figure 2. This result suggests that primary-school students presented lower cognitive control abilities.

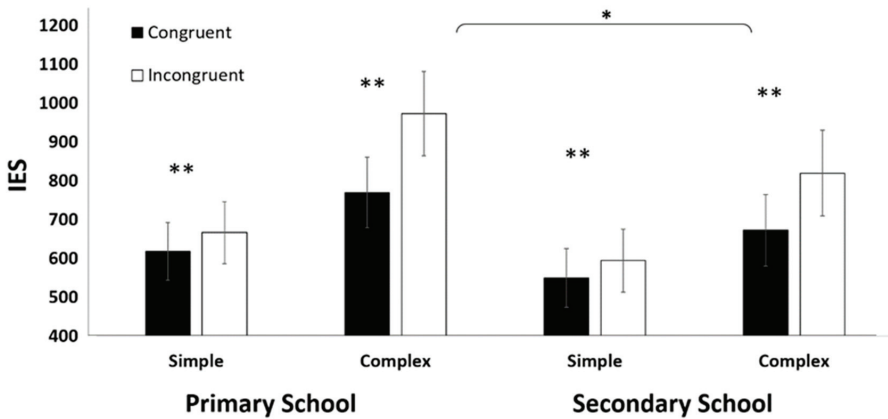
Third, the conflict level  $\times$  age group interaction was significant (see Figure 2C),  $F(1,120) = 7.3$ ,  $p = 0.008$ ,  $p_{\eta}^2 = 0.06$ . Planned comparisons revealed that the performance difference between conflict levels was larger for primary-school students than for middle-school students ( $t = -4.2$ ,  $p < 0.001$ ,  $d = 1.6$ ).

Fourth, the triple interaction of age group  $\times$  conflict level  $\times$  congruency was significant (see Figure 3),  $F(1,120) = 5.9$ ,  $p = 0.02$ ,  $p_{\eta}^2 = 0.05$ . Planned comparisons revealed significant congruency effects on all levels (primary school simple:  $t = -4.41$ ,  $p < 0.001$ ,  $d = -0.3$ ; primary school complex:  $t = -18.29$ ,  $p < 0.001$ ,  $d = -1.29$ ; middle school simple:  $t = -4.6$ ,  $p < 0.001$ ,  $d = -0.71$ ; middle school complex:  $t = -11.77$ ,  $p < 0.001$ ,  $d = -1.89$ ). In addition, performance differences between age groups in congruency effect appeared on the complex-conflict level, ( $t = 8.1$ ,  $p = 0.005$ ,  $d = 0.7$ ), but not on the simple-conflict level ( $t < 1$ , *n.s.*).

In addition, the congruency  $\times$  conflict level interaction was significant,  $F(1,120) = 131.08$ ,  $p < 0.001$ ,  $p_{\eta}^2 = 0.52$ . The congruency effect was larger in the complex conflict than in the simple conflict ( $t = -27.12$ ,  $p < 0.001$ ). This finding confirmed that the conflict resolution tasks used in the present study comprised two difficulty levels, as planned.



**Figure 2.** (A). Age group  $\times$  task interaction. (B). Age group  $\times$  congruency interaction. (C). Age group  $\times$  conflict level interaction. IES = inverse efficiency score. Note, lower IES indicates more efficient performance. \*\*  $p < 0.01$ .



**Figure 3.** Age group  $\times$  conflict level  $\times$  congruency interaction. Black bars = congruent trials. White bars = incongruent trials. IES = inverse efficiency score. Note, lower IES indicates more efficient performance. \*  $p < 0.05$ , \*\*  $p < 0.01$ .

The task  $\times$  congruency interaction was significant,  $F(1,120) = 8.08, p = 0.005, p_{\eta^2} = 0.063$ . As expected, significant congruency effects were obtained in both tasks ( $t = -17.14, p < 0.001$ ;  $t = -13.62, p < 0.001$ , for NST and PST, respectively), but the congruency effect was larger for the NST than the PST ( $t = 4.52, p < 0.001$ ).

The task  $\times$  conflict level interaction was significant,  $F(1,120) = 106.34, p < 0.001, p_{\eta^2} = 0.47$ . In both tasks, performance in the simple-conflict subtask was better than in the

complex-conflict subtask for NST ( $t = -22.1, p < 0.001$ ) and for PST ( $t = -9.5, p < 0.001$ ), with a greater difference for the NST than the PST ( $t = -2.8, p = 0.005$ ).

The task  $\times$  conflict level  $\times$  congruency interaction was significant,  $F(1,120) = 25.76, p < 0.001, \eta^2 = 0.18$ . Planned comparisons revealed that the complex subtasks revealed larger congruency effects than the simple subtasks,  $t = 6.8, p < 0.001$ . Moreover, in the simple subtasks, IES was more efficient for the NST than for the PST ( $t = -4.3, p < 0.001$ ), whereas in the complex subtasks, IES was more efficient for the PST than for the NST ( $t = 15.6, p < 0.001$ ).

The following three-way interactions did not yield significance (all  $F_s < 1$ ): age group  $\times$  task  $\times$  congruency, age group  $\times$  task  $\times$  level, and age group  $\times$  task  $\times$  congruency  $\times$  level.

Note, since the interaction of age group  $\times$  task  $\times$  congruency was a specific research question in our study, and aligning with the a priori hypotheses, a follow-up analysis comparing congruency effect in each task separately for each age-group.

Planned comparisons revealed that primary-school students presented a difference in the congruency effect between PST and NST ( $F = 5.55, p = 0.02$ ), but middle-school students did not ( $t = 2.78, p = 0.12$ ). Moreover, the differences between age groups in congruency effects were presented in both tasks,  $F = 4.44, p = 0.037$ ; and  $F = 4.87, p = 0.029$ ; for PST and NST, respectively.

See further figures of all the reported effects in the Supplementary Materials.

### 3.2. Correlations between the Cognitive Control Tasks

We calculated a general congruency effect for each task (i.e., PST, NST). The correlations between the IES in the two cognitive control tasks were significant among middle-school participants ( $r = 0.41, p = 0.001$ ) but not for primary-school students ( $r = 0.14, p = 0.3$ ).

### 3.3. Math Achievement Measures and Their Associations with Cognitive Control Tasks

#### 3.3.1. Math Fluency Test

The test was uniform for both grade levels. Middle-school students were more accurate in math fluency ( $M = 98.7\%, SD = 1.9$ ) and solved more exercises ( $M = 64.7, SD = 14.0$ ) than primary-school students ( $M = 97.9\%, SD = 2.1; M = 60.5, SD = 12.9$ ; accuracy:  $t(120) = 2.1, p = 0.04; d = -0.38$ ), number of exercises:  $t(120) = 1.7, p = 0.08, d = -0.3$ ).

#### 3.3.2. Curriculum-Based Math Test

The test differed between grade levels, as each grade had a test according to their curriculum. Both primary-school ( $M = 78.69, SD = 16.44$ ) and middle-school ( $M = 78.02, SD = 16.47$ ) students performed similarly on the tests,  $t(104) < 1$ . No differences were found between groups in the Z-score of the test,  $t(105) < 1$ .

#### 3.3.3. Correlations and Regressions

We estimated the contribution of each cognitive control predictor to math achievement measures (i.e., math fluency and curriculum math tests), using correlations and linear regressions. See Table 1.

Findings revealed differences between the basic and comprehensive math achievement tests and their relation to cognitive control tasks. The basic math fluency test correlated negatively with location and numerical congruency effects. The comprehensive math curriculum test correlated positively with the Raven and with the location congruency effect but did not distinguish between the two age groups. Fisher's  $r$  to  $z$  transformation revealed no differences between primary- and middle-school students. See further correlations and scatter plots in the Supplementary Materials.

**Table 1.** Correlations between cognitive control and math achievement measures by age group.

	Primary Students		Middle Students	
	Math Fluency	Math Curriculum	Math Fluency	Math Curriculum
Raven Z-score	0.22	0.49 **	0.14	0.40 *
PST				
Location-congruency effect	−0.27 *	−0.27 *	−0.25 *	−0.31 *
Direction-congruency effect	−0.16	−0.18	−0.14	0.11
NST				
Physical-congruency effect	0.03	−0.22	−0.03	−0.21
Numerical-congruency effect	−0.33 *	−0.10	−0.25 *	−0.13

Note. \*— $p < 0.05$ , \*\*— $p < 0.01$ . Curriculum math performance was reported as Z-scores.

The model that was tested by regression analysis was derived from the correlation coefficients; thus, it was an explorative analysis. We aimed to estimate the contribution of each cognitive control predictor (i.e., PST, NST) to math achievement measures using linear regressions. The predictors were the location congruency effect, numerical congruency effect, and Z Raven score. Table 2 presents models of main predictors.

**Table 2.** Summary of the predictors in the regression analysis for predicting performance in math achievement measures.

Predictors	Math Fluency			Curriculum-Based Test		
	Estimates	CI	<i>p</i>	Estimates	CI	<i>p</i>
(Intercept)	62.58	60.33–64.83	<0.001	−0.00	0.17–0.17	0.995
Location Congruency Effect	−3.21	−5.51–−0.90	0.007	−0.21	−0.37–0.04	0.015
Numerical Congruency Effect	−3.95	−6.23–−1.67	0.001	−0.08	0.24–0.09	0.378
Z Raven Score	1.21	−1.13–3.54	0.307	0.40	0.23–0.57	<0.001
Observations		122			106	
R2/R2 adjusted		0.166/0.144			0.249/0.227	

For math fluency, the regression model was significant,  $F(3,118) = 7.81$ ,  $p < 0.001$ , for the main effects model with the predictors of PST and NST, but in with the interactions. For the curriculum math test, the regression model was significant,  $F(3,102) = 11.29$ ,  $p < 0.001$ , for the main effects model with the predictors of Raven and PST, but in with the interactions. The predictors of each model and their  $\beta$  value and significance are reports in Table 2.

A regression model that included the interactions between age group and congruency effects revealed that these interactions were non-significant. See the full report in the Supplementary Materials. In the next section, we further discuss these results.

#### 4. Discussion

The current study examined math achievement in primary- and middle-school students using domain-specific and domain-general cognitive control tasks (i.e., numerical and perceptual Stroop-like tasks), with two levels of complexity (i.e., simple vs. complex conflict level) in each one. Administering two types of conflict resolution tasks in a single experimental design provided compelling evidence regarding the involvement of domain-specific and domain-general cognitive control mechanisms in math achievement in different age groups.

In conflict tasks, the congruency effect was measured. A larger congruency effect indicates a lower executive function ability. In each conflict task, we used the IES measure of performance, which combined both RTs and accuracy rates. Lower IES indicates more efficient performance. We found that sixth graders' performances were less efficient in the NST than in the PST. Moreover, sixth graders demonstrated larger congruency effects than the eighth and ninth graders in both cognitive control tasks. Importantly, a significant

triple interaction between age group, conflict level and congruency was found, as sixth graders demonstrated a larger difference between congruency effects in simple-conflict and complex-conflict levels of the examined cognitive control tasks compared to middle-school students, suggesting that the cognitive control is more efficient in middle school than in primary school, beyond the stimuli type in each Stroop task. This interaction demonstrated that older participants were less prone to being affected by a more salient aspect of the stimulus when it was irrelevant compared to the younger participants. This is an important indication of the enhanced cognitive control abilities of middle-school students, in line with previous research [39].

Note that our hypothesis regarding the differences between age group, task and congruency was not supported, as this interaction did not reach significant. However, planned comparisons did indicate that only for sixth graders did the notation (i.e., type of stimuli, arrow vs. Arabic numerals) of the Stroop task impact their performance. The primary-school students exhibited differences in congruency effects between the NST and the PST, with a larger congruency effect in the NST than in the PST. However, among the middle-school students, the congruency effect was similar in both Stroop tasks. Thus, our results hint that processing notation in the context of conflict tasks changes with age, yet further research is needed.

The classical conflict Stroop task involves information conflict, namely the conflict between the information conveyed by each stimulus dimension (e.g., word ink color vs. word meaning in the classical Stroop task, number's physical size vs. number's value in the NST, arrow's location vs. arrow's direction in the PST). The information effect was calculated as the difference in IES between congruent vs. incongruent conditions. However, previous research has suggested that the Stroop task also incorporates exposure to task conflict (e.g., [55]).

Task conflict relates to the need to respond to the different stimulus dimensions (e.g., color naming vs. reading, the number's physical size vs. value, and the arrow's location vs. direction). Thus, task conflict is also incorporated into the congruent condition. Importantly, task conflict occurs since stimuli are strongly associated with a specific task. Our findings suggest that for primary-school students, the nature of the stimuli in conflict resolution tasks might impact their performance. Younger students appear to be more affected by the nature of the stimulus, whereas older students are more affected by the comparison between congruent and incongruent conditions. Thus, the current research sheds light on the development of the response to information conflict and task conflict, though further research is needed.

The present findings align with the seminal model of EFs suggested by Friedman and Miyake [56], who examined several EF tasks that relate to different EF components. They found that different tasks assessing the same EF have shared and distinct aspects. Our results elaborate on Friedman and Miyake's findings, suggesting that the shared and distinct task aspects change with age. Specifically, our results may suggest that sixth graders process conflicts involving numerical information less efficiently than perceptual conflicts, whereas eighth and ninth graders perform equally well in conflicts involving numerical and perceptual stimuli. However, this suggestion should be considered carefully, as this difference appeared only in a planned comparison analysis. Importantly, we suggest that the saliency of the information plays a crucial role in responding to conflict tasks, specifically on a complex level. Taken together, we suggest that inhibitory control, a major component of EFs, consolidates during adolescence, paving the way for developing advanced controlled behaviors, especially when suppressing salient irrelevant information is required. One possible path that may allow adolescents to achieve that is through reducing contextual biases, which, in turn, leads to improved adjustment of their responses to the task requirements [56,57].

Interestingly, lower IES congruency performance presented by sixth graders in the current study was also reported for children with ADHD (Attention Deficit–Hyperactivity

Disorder) in primary and middle school [41,46]. Consequently, lower performance was observed in less developed populations.

Does cognitive control contribute to math achievements? Our findings indicated that the math fluency scores correlated with cognitive control as measured by the NST and the PST in both age groups, whereas the curriculum test scores correlated only with the PST. In the correlation analysis, the easy conflict condition (i.e., the location level) was correlated with both math-fluency- and math-curriculum-based tests. Since it seems that the location level in the PST is not too difficult for all participants, including the younger age group, it may be a relatively sensitive measure of cognitive control. Consistent with this explanation is the finding that there was no significant difference between the two age groups on simple conflict tasks. However, as the Fisher  $r$  to  $Z$  analysis did not yield significant difference, we conclude that the association between cognitive control and math achievements is similar across both age groups.

Note that in the regression analysis, we included only one measure of congruency from each task. The fact that the PST contributed to the prediction of performance on the curriculum test above and beyond the prediction of general intellectual ability (measured by the Raven) strengthens its unique role. Taken together, we suggest that domain-general cognitive ability contributes to both basic (i.e., math fluency test) and comprehensive (i.e., curriculum test) math achievements among both 6th and 8th–9th students. Our findings are consistent with a previous study conducted with undergraduate students, where congruency effect in the PST was associated with the ability to resolve semantic conflicts between metaphoric and literal meanings of words [58].

Our results emphasize that studying cognitive control mechanisms in the context of math achievements holds promise. EFs are important to math as they are responsible for inhibiting incorrect responses and actions. Specifically, they may play a vital role in inhibiting inappropriate mathematical operations, for example, when carrying or borrowing numbers, and may secure the correct use of common denominators in fraction addition or subtraction. Additionally, EFs can inhibit the use of unsuitable problem-solving strategies, can aid in suppressing related but incorrect number facts, and can prevent the retrieval of irrelevant prepotent number representations. Understanding and enhancing these cognitive control mechanisms are essential for improving math achievements [59,60]. Importantly, math demands increase from primary to middle school and become more complex. Thus, the involvement of EFs in math achievements can be even more significant with age.

The central role of domain-general factors in math achievement has been reported in previous research. Students with developmental dyscalculia (DD), who suffer from poor numerical processing, also presented deficits in aspects of attention [44,45] and, specifically, in executive functions (i.e., conflict resolution [61]). Also, EFs (switching ability) contributed uniquely to symbolic numerical skills among children [62]. However, whereas most studies have focused on early childhood (e.g., [26,63]), a recent study examining EFs across the life span (from age 10 to 86) highlighted their development [64], underscoring the value of incorporating adolescents and middle-aged adults in these studies. EF skills develop relatively rapidly during the preschool and early adolescent period [39]. Thus, our study enabled a glimpse into more mature children and adolescents, neglected in previous research. Specifically, the current study explored the end of elementary school and early middle school, extending the associations between math achievement and domain-general cognitive factors in this age range.

A second explanation for the association between cognitive control and math achievement relates to the two levels of the math task demands. For the simple math fluency task, requiring recall of math facts, cognitive control alone predicted performance in both age groups. It has been suggested that recall of math facts relates to verbal phonological abilities [65]. However, in the math curriculum test, requiring more high-level math skills and abilities, other predictors, such as non-verbal intelligence (e.g., as measured by the Raven test), play a role in performance. Our findings, aligning with previous reports (e.g., [50]), highlight the importance of measuring multiple components of math achievement, specif-



ically when examining middle-school students. Note, however, that both of our math achievement measures were paper-and-pencil tests. Future studies may use computerized math tests to increase the accuracy of RTs and duration measures of math performance.

Some limitations should be considered in the current study. First, we conducted a cross-sectional study, which limited our ability to examine developmental changes regarding the association between cognitive control abilities and math achievement. Future studies may conduct longitudinal designs to address the issue. Second, the current study focused on cognitive control mechanisms and math achievements and did not consider other factors that may influence math achievements, such as motivation, interest, socio-economic status, etc. Specifically, math anxiety, which also related to EFs and to math achievements [66], should be addressed in future studies. Note that our results indicate an associative relation between EFs and math achievements. However, only a direct intervention study may conclude of causal relationship between them. Another limitation in our study is that the durations of the fixation and the stimuli presentation in the two Stroop tasks were different. Future studies should examine whether similar presentation duration will influence congruency effects. Finally, while IES measures take into account the speed–accuracy trade-off, future studies also need to examine the influence of developmental changes in RT and control them.

The current results have important educational implications for teaching techniques. The 21st century educational skills set emphasizes applying metacognitive skills [67]. Thus, education policymakers should consider the implementation of cognitive control activities in mathematical education programs. Moreover, our results highlight the potential contribution of EF in math intervention programs. Nowadays, intervention programs for low math achievers focus mostly on young children and numerical domain-specific training (e.g., [68,69]). However, some difficulties may persist or even begin to appear in middle school due to the increased complexity of the material in math. Considering the involvement of cognitive control mechanisms in math achievement among adolescents, intervention programs in math may also incorporate EF training (e.g., [70–72]). It is crucial to recognize that math challenges may stem from cognitive sources beyond math itself, allowing for cognitive interventions, including cognitive control training, to improve math performance in certain cases. Hence, intervention designs should consider the student’s cognitive profile to provide personalized effective support. Further studies are needed to assess the effectiveness of interventions combining general cognitive abilities with math-specific training for different age groups. Interventions targeting EF skills have shown significant improvements not only in EF but also extended benefits in math and notable changes in brain function. By emphasizing metacognitive reflection and integrating EF training into math curricula, these interventions offer promising avenues to enhance math achievements [39]. Taken together, we call for strengthening the collaboration between researchers and educators. These thinktanks can yield theory-driven practical recommendations for teaching math and personalized support for both typical and low achievers.

## 5. Conclusions

Our study investigated the relationship between cognitive control mechanisms and math achievement in sixth-grade students vs. eighth- and ninth-grade students. The findings demonstrate that cognitive control mechanisms develop during the examined time window and are associated with both simple and comprehensive math achievements. These findings suggest that implementing cognitive control activities may enhance the development of math achievements in both primary- and middle-school students.

**Supplementary Materials:** The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/educsci14020159/s1>, Table S1: Descriptive statistics of accuracy rates and RTs for all Stroop conflict tasks. Figures S1–S8: Descriptive plots for the ANOVA. Figures S9–S20: Distribution and scatter plots of reported correlations. Table S2: Fisher  $r$  to  $z$  analysis between correlations of cognitive control measures and Raven score with math achievements between Age Groups.

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Article

# Mathematical Anxiety among Primary Education Degree Students in the Post-Pandemic Era: A Case Study

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**Abstract:** The study of the affective domain has grown in relevance ever since educators and researchers showed its influence in the process of teaching and learning, playing a fundamental role in the evolution of student learning. Anxiety is one component of the affective domain. The study of mathematical anxiety in pre-service primary teachers at university is the focus of this study. We analyse mathematical anxiety by examining specific data from the sample (age, gender, the subjects they studied in upper-secondary education, and academic performance). One hundred and nineteen students from the Primary Education degree completed the mathematical anxiety questionnaire, obtaining an average anxiety score considered negative (3.08 above the neutral value of 3). The results show a high anxiety toward examinations (3.68) and a negative relation with academic performance. Furthermore, the results show that women, 19-year-old university students, and those from a humanities-based upper-secondary education present greater levels of anxiety than men, older students, or students from other areas of upper-secondary education, respectively. All values of mathematical anxiety are higher than pre-pandemic levels. We can conclude from the studied sample that the students show low–medium global anxiety over mathematics, medium anxiety over problem solving, and high anxiety about exams.

**Keywords:** COVID-19; pre-service primary teacher; mathematical anxiety; university education

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## 1. Introduction

The affective domain plays a fundamental role in the teaching and learning process. This has begun to gain importance as educators have come to appreciate the influence it has on school learning [1].

The complexity of studying the affective domain is one of the problems we encounter when addressing this area in the teaching and learning of mathematics. This complexity arises in the sense that the research aims are to consolidate a satisfactory theoretical framework for the interpretation of the affective domain and to develop measurement instruments [2,3], i.e., the limitation of basic descriptors, the structuring of theoretical frameworks, and the connection between theory and practice. Authors such as [4] argue for the existence of three descriptors and define the affective domain as a wide range of mood states that are generally considered as somewhat different from pure cognition and include the set of belief systems, attitudes, and emotions as specific components.

Mathematical beliefs are a component of the subjective knowledge of an individual, based on their experience of mathematics and their teaching and learning process [5]. The belief system forms part of the cognitive component of the affective domain, having low intensity but great stability over time. Intensity is defined as the level with which the affective domain is manifested and stability as its duration over time [4].

In contrast, the emotions form part of the affective domain but possess high intensity and little stability, i.e., the emotions change from positive to negative (or vice versa) quickly and are shown at a high level [3]. They arise as an organised response to an internal

or external occurrence, with a positive or negative meaning depending on the case or experience for the individual [5]. Emotions are difficult to identify and demonstrate even for the person themselves and are part of a social construction (the situation in which the person finds themselves) [3].

In the medium state of intensity and stability, we find the attitudes toward mathematics [3,5]. This is the predisposition of the student to respond positively or negatively to mathematics, which determines their intention and influences their behaviour when faced with the subject. These attitudes have a cognitive component, as they are influenced by beliefs, and an affective component, since the emotions also affect them. As [6] says, if the student has a positive attitude, they will be able to learn and develop their knowledge and skills much better than if they have a negative attitude, since this negativity would mean that the student did not believe in themselves, with lack of autonomy and presenting difficulties in the learning process.

This study focuses on one of the main affective factors that intervenes in the teaching–learning process of mathematics: anxiety. Anxiety is a mood fed by qualities such as fear and terror, the feeling of insecurity and powerlessness that an individual can experience when they are required to perform in a subject [7]. Anxiety is an unpleasant emotion that is present in students above all when they are being assessed, such as in an exam, and arises when the student is faced with subjects that they find particularly difficult. Mathematics is commonly one such subject, and the affective factor is known as mathematical anxiety. The rejection of mathematics occurs through the undermining or elimination of a person’s feeling of well-being when confronted by a situation connected with the topic, whether at school or in daily life. Many studies have focused on the study of mathematical anxiety [7–12], including older and more recent studies, such as those by Sarah Buckley or Richard Daker and collaborators. Mathematical anxiety has been considered an important issue for many decades and continues to be so.

### 1.1. *Mathematical Anxiety*

The authors of [13] define mathematical anxiety as a series of feelings of anxiety, dread, nervousness, and associated physical symptoms that appear when doing mathematics. It also manifests through a series of symptoms like tension, nerves, apprehension, worry, irritability, impatience, confusion, fear, and mental block, which interfere in the calculation of numbers and the solving of mathematical problems in a wide variety of situations, both everyday and academic. Ref. [14] states that mathematical anxiety has its roots in the fear of encountering mathematics, which includes classes, homework, and exams. Similarly, ref. [15] found important connections between the manifestations associated with fear and those observed through the perspective of mathematics courses and examinations.

Along the same lines, authors such as ref. [16–18] define mathematical anxiety in the following way. Ref. [16] establish anxiety toward mathematics as the unease students experience when doing mathematical operations, as well as anguish at failing an exam. Ref. [17] describe mathematical anxiety as a feeling of nervousness that hinders the handling of numbers and the ability to solve mathematical operations in daily life and in academic situations. Lastly, ref. [18] describe mathematical anxiety as a state of anxiety caused by doing mathematical tasks, which manifests through feelings of apprehension, aversion, tension, worry, frustration, and fear. They also indicate that environmental (negative experiences in class) and intellectual (degree of thinking) factors and personality (self-esteem, learning style, attitude, and confidence) have an influence in producing this feeling in students.

All these authors relate mathematical anxiety to feelings and emotions, especially fear, tension, and nervousness. According to these authors, these emotions occur in different situations, whether doing mathematics in everyday life or in classes or during mathematical tasks or exams.

A recent study [19] differentiates between state and trait mathematics anxiety. State mathematics anxiety is transient and is defined as the type of anxiety an individual feels

while he is participating in mathematics. In contrast, trait mathematics anxiety is a more persistent feeling, connected to the level of fear that an individual associates with mathematics in any situation. The authors of [19] also suggest that trait mathematics anxiety is more stable and enduring and has an impact through its effects on learning-related choices. Students with higher levels of trait mathematics anxiety are less likely to choose to study mathematics or pursue careers that involve mathematics [19,20]. Additionally, ref. [19] suggest that techniques such as relaxation, mindfulness, cognitive reappraisal, and cognitive behavioural approaches may be effective in reducing mathematical anxiety.

Within the field of mathematics education, particular attention has been paid to the effects that mathematical anxiety can have in terms of gender, or regarding low academic performance, or mathematics course dropouts, or on the choice of university degrees that do not require a high level in the subject [8,13,21]. According to ref. [22] in her review study, many students showed worry, nervousness, and unease at dealing with mathematics, causing feelings of anxiety and, therefore, neglect of the subject and even dropping out.

Looking at the causes that bring about the rejection of mathematics, ref. [23] show that the main problem is found in the education system and in that there is no space for reflection in classrooms, where students learn to do mathematics mechanically without knowing why, what for, or how. Students cannot act or think when faced with a high-pressure situation such as a mathematics activity or exam. The teacher is responsible for reducing the stress that leads to rejection of the subject inside the classroom or during the mathematical activities.

Mathematical anxiety is an extremely common phenomenon among university students [9]. Amongst these students, anxiety is usual, along with issues concerning study techniques and emotional problems [24]. Although most individuals develop mathematical anxiety prior to university, 27% of them develop their first stressful mathematical situation in their first year of university. Ref. [9] defines different types of mathematical anxiety among university students: moderate and variable mathematical anxiety; mathematical anxiety that the student has had for a long time, and which began because of the action of a teacher; and that caused by the mechanical nature of the subject, focused on rules and procedures, and lack of comprehension when learning mathematical concepts.

There are significant differences between men and women, with the latter showing greater anxiety toward mathematics, either because they truly experience this to a greater degree or because they are more likely to admit their mood [25]. Ref. [13] analysed a sample of secondary-school students, with the female students being more anxious than their male counterparts. The literature review carried out by [26] reaches the same conclusion. Within the set of studies with university students, the literature reviews also show that female students suffer more mathematical anxiety than the men. One example of this is found in [24], in which an anxiety questionnaire was administered to psychology students at the University of Malaga and the women obtained higher scores than the men.

In the training of primary teachers, it is vital to consider this affective dimension, since they are students who tend not to like mathematics and who have low grades in the subject [27]. Despite the importance and transcendence of mathematics in all ambits of life, it is a discipline that tends to throw up a plethora of learning difficulties. Moreover, it has a negative social stigma, seen as a difficult and complicated subject [28]. This author stresses that good teacher training is essential for improving the quality of education and the academic performance of students, thereby reducing school failure. The sample in these two studies [27,28] are pre-service primary teachers, i.e., university degree students.

Several studies have demonstrated that mathematical anxiety decreases after undertaking mathematics courses during initial teacher education [29]. Learning to teach mathematics seems to reduce the anxiety through facilitating the conceptual understanding of mathematics. By improving skills, teachers in training express greater confidence in their teaching efficacy and more positive attitudes towards mathematics [29].

### 1.2. Impact of the COVID-19 Pandemic

Ref. [30] carried out a review of studies that analyse how the global pandemic has affected the mental and emotional health of individuals, along with self-care coping strategies in home lockdown. In the study carried out by [31], they concluded that the students surveyed had suffered from anxiety, lack of motivation, or frustration due to work overload, concern about their own training or learning success, as well as the same emotions brought about from the lockdown situation.

One study from before the COVID-19 pandemic [32], obtained a mean anxiety value of 31.52 (the same as 2.63 considering that the minimum is 12 and maximum 60), with 2.45 for men and 2.78 for women. All these values are lower than the neutral value of 3, showing a positive character of anxiety with medium-to-low values for university students. In another study, ref. [25] obtained a mean mathematical anxiety value of 2.66 for pre-service primary teachers. However, almost all of their participants did not feel calm during mathematics exams and showed insecurity in their ability to solve problems. On the other hand, ref. [33] concluded from a sample of pre-service primary teachers that anxiety levels were maintained between two consecutive academic years, showing medium-to-high levels, and that women had greater anxiety than men. The same conclusion was drawn by [34], with medium-to-low anxiety being higher among girls than boys from upper-secondary students.

During the home lockdown, the implementation of distance learning revealed a lack of digital devices among teachers and students, unreliable internet connections, and inadequate digital skills, which could have hampered the learning process and limited understanding of the mathematical content being taught online [35]. Furthermore, the lack of social interaction was a significant problem that affected student learning. Some students felt that they could not learn mathematics effectively without face-to-face teaching interactions [35]. These factors could have limited students' learning processes in mathematics and their understanding of mathematical concepts, which in turn might have led to greater mathematical anxiety. Studies such as [36,37] found that most participants showed moderate or high mathematical anxiety during the pandemic in online learning. Specifically, ref. [36] found that 55% of participants showed moderate (between 2.35 and 3.70) and 34% high mathematical anxiety (values between 3.70 and 5.00), with a mean value of 3.359 in the study.

### 1.3. Academic Performance

In the literature, one can find different definitions of academic performance, some more comprehensive than others. However, assessing the academic record and grades of a student is the most common method for evaluating the results of teaching and as a definition of academic performance [38]. The average of the grades obtained in objective tests through the teaching of a subject is a good indicator of academic performance [39].

In this regard, ref. [7,8,20,40] show that there is a strong correlation between mathematical anxiety and academic performance. They conclude that anxiety hinders a student's ability to carry out mathematical tasks and that a reduction in anxiety translates to better performance. Refs. [41,42] conclude that anxiety and performance are negatively correlated (the greater the anxiety, the worse the performance). In other words, high levels of mathematical anxiety are negative and are significantly related to low scores in performance tests. Likewise, ref. [34] obtain the same negative connection. However, ref. [43] concludes that students with superior performance are characterised by a high affective domain and high self-efficacy (confidence in themselves to achieve a goal).

### 1.4. The Present Study

Taking into account a preceding study on the change from in-person to online classes and the feelings or emotions related to it [31], and even though there has been extensive research on the impact of distance learning on the mathematical anxiety of university students during the COVID-19 pandemic in the recent literature, this study aims to study



the mathematical anxiety of university students with the return to normality—that is, to in-person classes. First, bearing in mind the aforementioned findings, we aim to analyse whether university students (pre-service primary teachers) have been emotionally affected and whether there has been a change—increase or decrease—in their levels of mathematical anxiety with regard to studies prior to or during the pandemic (the average anxiety of the individual participants in the study). Second, more specifically, we set out to analyse item by item the responses to the mathematical anxiety questionnaire of pre-service primary teachers. Third, we seek to analyse whether there are differences according to gender, age, and the subjects (science- or humanities-based) studied in upper-secondary education. Lastly, we aim to see whether there is a relation between the anxiety of university students and their academic performance.

We pose the following questions: 1. Is the mathematical anxiety of pre-service primary teachers higher (or lower) in the post-pandemic era than pre-pandemic studies? 2. Do women have higher levels of mathematical anxiety than men? 3. Do younger students and those coming from non-scientific upper-secondary subjects have a higher level of anxiety? 4. What is the relationship between anxiety and performance? All these questions will be answered regarding the studied sample.

## 2. Method

In the study of mathematical anxiety, as part of the affective domain of an individual, we have used a case study quantitative methodology for a specific group, conducting a survey through a multiple-choice questionnaire. Mathematical anxiety is usually identified through self-reporting surveys or questionnaires in which individuals are asked how they feel about specific situations involving mathematical tasks. Mathematical anxiety exists on a continuous spectrum ranging from no mathematical anxiety to paralysing fear when anticipating mathematical tasks [40].

### 2.1. Sample

The participants are 119 students from the 2021/2022 academic year, studying the Primary Education Degree at the University of Cádiz. This sample is divided into two groups, according to their year and subject. Specifically, 61 students belonged to the second year of the degree, studying the subject “Conocimiento Matemático 2” (“Mathematical Knowledge 2”) (CM2), while the remaining 58 were in the third year, studying “Didáctica de la Matemática 2” (“Teaching Mathematics 2”) (DM2). These two subjects are focused on: primary mathematics topics (CM2—geometry, measurements, and statistics) and how to teach these topics and knowing the state law and curriculum in order to teach and create a specific learning situation for a specific school as a real case, i.e., examples of activities or classes to teach by the future professional (DM2). These subjects correspond to the first four-month period of the second and third degree years, respectively.

### 2.2. Instrument

The instrument used in this study is the questionnaire from the Mathematical Anxiety Scale of [13]. The scale was validated when created and has continued to be so throughout the thirty years it has been applied and has also been confirmed with the data from this study, obtaining a Cronbach’s alpha reliability index of 0.93, which is considered highly acceptable. This Cronbach’s coefficient is recommended for instruments with more than two values in the item responses, representing the internal consistency of the scale as a whole.

The questionnaire uses a Likert-type scale and comprises a total of 12 items, each with 5 possible responses: from “completely disagree” to “completely agree”, including a central or neutral response corresponding to “neither agree nor disagree”. The coding of these possible responses takes values from 1 to 5, respectively. The items in Table 1 are part of the original questionnaire, are not adapted, and are in the original order. The negatively worded items have been assigned a reverse value so that a higher score on the scale really

means a higher level of anxiety. For example, item 1 in Table 1 is the original item of the questionnaire, and a high response (4 or 5) indicates low anxiety. For consistency of results, whereby a higher response corresponds to higher anxiety, we reversed the coding of negative items for the analysis where the value of 5 changes to 1.

**Table 1.** Items that comprise the anxiety questionnaire from the anxiety scale of [13]. The mean (M) and standard deviation (SD) are shown for each item. It also describes the average anxiety and the three categories defined by [44].

Items	M	SD
1. I do not feel any fear of mathematics. (CAT1)	3.05	1.07
2. I would not mind doing more mathematics courses. (CAT1)	2.94	1.21
3. I do not normally worry about whether I am capable of solving mathematical problems. (CAT2)	3.42	1.10
4. I almost never get nervous during a mathematics exam. (CAT3)	4.09	1.03
5. I am normally relaxed during mathematics exams. (CAT3)	3.87	1.07
6. I am normally relaxed in mathematics classes. (CAT1)	2.46	1.01
7. Mathematics normally makes me uncomfortable and nervous. (CAT1)	2.88	1.14
8. Mathematics makes me uncomfortable, uneasy, irritable and impatient. (CAT1)	2.82	1.15
9. I feel unwell when I think about trying to do mathematical problems. (CAT2)	2.74	1.16
10. When I do mathematical problems, my mind goes blank and I cannot think clearly. (CAT2)	2.71	1.03
11. I get frightened by the idea of doing a mathematics test. (CAT3)	3.08	1.20
12. Mathematics makes me feel worried, confused and nervous. (CAT1)	2.86	1.17
Average anxiety	3.08	0.84
CAT1	2.84	0.93
CAT2	2.96	0.86
CAT3	3.68	0.95

One danger with applying Likert-type questionnaires with a central value, as in our case, where the items can be valued from 1 to 5, is that the middle value of 3 can be taken as the “non-committal response” value. In order to examine this possibility, we undertook a recount of the response frequencies in each of the items and discovered that the middle response was not selected by the students more frequently than the other options.

Having rejected the possibility that the students opted for the neutral response discriminately and without criteria, this response has been taken as the one that denotes neutrality. It has therefore been taken as a neutral value of 3, which is utilised as a reference to compare the results obtained for the purpose of determining the tendency (positive or negative) of anxiety.

### 2.3. Procedure

The questionnaire was applied in university classrooms at the start of the 2021/2022 academic year, under the supervision of the researchers. We explained the purpose of the study, why it was important to collaborate, and the instructions for completing the online questionnaire, which had been created for this purpose. This online questionnaire included a first section where the students gave their consent to the use of their data. The anonymity of their answers was guaranteed, and no names, surnames, or email addresses were requested. The students were given sufficient time to answer all the items on the questionnaire. The researchers were present at all times to deal with any doubts that arose.

For each participant, we collected data corresponding to gender, age, type of subjects studied in upper-secondary education, and the anxiety questionnaire. We created a data matrix which was analysed using the Statistical Package for the Social Sciences (SPSS) version 24. Average anxiety was defined as the arithmetic mean of the anxiety of everyone, which took values between 1 and 5, with 3 being the neutral value. This variable identifies

the level of anxiety of the participants toward mathematics, according to the value recorded, being positive if below the neutral value of 3, negative if above.

#### 2.4. Data of the Sample

The data of the sample in our study are gender, age, subjects studied by the students in upper-secondary education, and academic performance. All these data were requested as the first questions on the online form, except the last. We collected this information in order to characterise the sample and analyse the level of anxiety with respect to all data of the sample. The variable of gender has two values—man and woman—which are coded with the value 1 for men and 2 for women (other options for ethical considerations were not offered). Age takes values between 19 and 25 years. The subject type studied in upper-secondary education takes six values that correspond to the different branches of knowledge as organised in the Spanish education system: humanities, health sciences, experimental sciences, social sciences, and technical studies. As well as these five upper-secondary educational categories, a small percentage of students originate from a different undergraduate degree or other higher-education studies. Lastly, we defined the academic performance through the final grade that the participants obtained in their subjects, considering the coursework and the final exam.

### 3. Results

The group under study comprises 119 students (30.3% men (36) and 69.7% women (83)) from the Primary Education Degree at the University of Cádiz during the academic year 2021/2022. Most of the students had recently graduated from upper-secondary education (the “bachillerato” in Spain) focused on social sciences (46.2%) and humanities (24.4%), followed by health sciences (11.8%). The rest had taken other upper-secondary courses or higher-education diplomas to enter into university (17.6%). The participants were aged between 19 and 25 years old, the mean being 20.65, whose distribution in percentages was: 30.3% (19 years old), 29.4% (20 years old), 13.4% (21 years old), 12.6% (22 years old), and 14.2% (23, 24, and 25 years old).

Table 1 shows the mean (M) and standard deviation (SD) for each of the 12 items that make up the questionnaire, and the average anxiety (arithmetic mean—values between 1 and 5). For the average anxiety, ref. [44] defined the level of the subjects’ anxiety from those who present no anxiety (value 1) up to a very high level (value 5) with intermediate scales of low (2), medium (3), and high (4). The 12 questionnaire items can be grouped into three categories according to [44]: global anxiety toward mathematics (CAT1), anxiety toward problem solving (CAT2), and anxiety toward exams (CAT3), which have been included in Table 1 with their mean values and standard deviation.

In Table 1, we can observe that the average anxiety variable takes the value 3.08, with a valid sample of 119 students. The value attained is slightly greater than the neutral value (3), which means it is negative. We checked this using the *t*-test with a confidence level of 95% for the sample, confirming that the difference between the mean value of the sample and the neutral value is significant ( $p = 0.00$ ).

Regarding the categories of anxiety, the results have been calculated as the average value of the corresponding mean for each item belonging to the category. The results show that the pre-service primary teachers show greater anxiety toward exams (CAT3), with a value of 3.68, above the mean anxiety (3.08). The global anxiety toward mathematics (CAT1) shows a level between low and medium, while anxiety toward problem solving (CAT2) is at a level that is almost the same as that of mean anxiety (2.96), and anxiety toward exams (CAT3) is at a level close to high (value 4). We therefore deduce that the students react affectively, from lesser to greater anxiety, when facing: a mathematics class, a problem, and an exam.

### 3.1. Item-by-Item Study of the Questionnaire

In order to check whether the items have a mean score significantly higher than the neutral value (3), and which differs significantly from it in obtaining a lower score, we carried out a *t*-test with a confidence level of 95%. The results indicate that items 3, 4, and 5 have a mean response score higher than the neutral value ( $p = 0.00$ ). However, the rest of the items differ in their mean, being below the neutral value, while only items 1 and 11 are close to the neutral value (3).

Items 4 and 5 (“I almost never get nervous during a mathematics exam” and “I am normally relaxed during mathematics exams”) have a higher mean score than all other items, which indicates that there is coherence in the students’ answers, since in both cases they are asked about the same thing, their nervousness in exams. The fact that the scores are significantly higher than the neutral value indicates that the students do indeed get nervous in mathematics exams. If we compare these results with those obtained in items 7 (“Mathematics normally make me uncomfortable and nervous”), 8 (“Mathematics make me uncomfortable, uneasy, irritable and impatient”), and 12 (“Mathematics make me feel worried, confused and nervous”), which are significant for being below the mean value and all with approximately the same value of 2.85, they are coherent since all are from category CAT1 and enquire about the same thing. It should be noted that item 6 (“I am normally relaxed in mathematics classes”), also in the same category because it asks specifically about classes and not about mathematics in general, is the item that has the lowest value of all (2.46).

Analysing each statement according to these results, we can see that in both item 2 (“I would not mind doing more mathematics courses”) and item 3 (“I do not normally worry about whether I am capable of solving mathematical problems”), the higher mean score of these items indicates a certain unwillingness to take mathematics in years to come and worry over their own ability to solve mathematical problems, with item 3 being one of those that attains a level significantly higher than the neutral value (3.42). However, doing mathematical problems does not create unease amongst the students, as the mean score for item 9 (“I feel unwell when I think about trying to do mathematical problems”) indicates, and neither does it cause a mental block, as can be seen in the mean of item 10 (“When I do mathematical problems, my mind goes blank and I cannot think clearly”), since both values are significantly lower than the neutral value.

### 3.2. Study by Gender

We analysed the mathematical anxiety of the students according to their gender, attempting to see whether there was any variation between them and if it could be concluded that, in this sample, men and women differ in their anxiety level when faced with mathematical tasks. To do this, we carried out a hypothesis contrast using the Mann–Whitney test, with a significance level of 0.05. The results of this test show that there are indeed significant differences according to gender ( $p = 0.00$ ). In order to examine how these differences present themselves, we analysed the descriptive statistics of the average anxiety variable, classifying the participants according to their gender (Table 2).

**Table 2.** Descriptive statistics of average anxiety according to gender, where N is the number of students in each category, M the mean value, and SD the standard deviation.

Gender	N	M	SD
Men	36	2.81	0.77
Women	83	3.19	0.84
Total	119	3.08	0.84

Table 2 shows that the men report less average anxiety than the women, with a score difference of 0.38 points, and with a value for the women above that obtained for the sample as a whole, whereas for the men the value is below. This indicates that the women suffer

from more mathematical anxiety than the men or that they are more willing to recognise that they suffer from it than the men.

### 3.3. Study by Age

We analysed the descriptive statistics of the average mathematical anxiety of the students according to their age (Table 3), attempting to see whether it varies or not between ages and if one can conclude that there are differences according to age in the anxiety level when faced with mathematical tasks. We studied the ages that were most represented in the sample by percentage: 19, 20, 21, and 22 years old.

**Table 3.** Descriptive statistics of the average anxiety according to age, where N is the number of students in each category, M the mean value, and SD the standard deviation.

Age	N	M	SD
19	36	3.28	0.85
20	35	3.08	0.69
21	16	2.92	1.06
22	15	2.84	0.66

We also carried out a hypothesis contrast using the Kruskal–Wallis test, with a significance level of 0.05, in order to check whether the ages differed significantly in anxiety. The results indicate that there are indeed significant differences ( $p = 0.00$ ).

From these results, we learn that the youngest students (19 and 20 years old) present the highest level of average anxiety, higher than the mid-value of 3, showing a negative character. In contrast, the 21- and 22-year-old students have a positive average anxiety, suggesting that the level of anxiety lessens as the person ages and/or advances in their degree studies. This result is also obtained in the data analysis according to the second or third year of the degree (Section 3.5).

### 3.4. Study by Subject Type in Upper-Secondary Education

For the study of the average anxiety of the students toward mathematics by subject type studied in upper-secondary education, they were grouped into three blocks according to the branches of knowledge that were most represented. We carried out a hypothesis contrast using the Kruskal–Wallis test with a significance level of 0.05, in order to prove whether the branches of knowledge studied differed significantly in terms of anxiety. The results indicate that there are significant differences ( $p = 0.00$ ).

The descriptive statistics of the average anxiety (Table 4) show that the values of the students from the humanities have anxiety values above the sample value and the highest of all branches of knowledge. In contrast, the lowest values of anxiety came from students from health sciences, followed by social sciences.

**Table 4.** Descriptive statistics of average anxiety according to subject type studied in upper-secondary education, where N is the number of students in each category, M the mean value, and SD the standard deviation.

Upper-Secondary Education	N	M	SD
Social Science	55	3.02	0.82
Humanities	29	3.52	0.67
Health Science	14	2.68	0.67

### 3.5. Study by Year of Degree and Academic Performance

To study the students' average anxiety toward mathematics according to the degree year they belong to, we grouped the data into two blocks, pertaining to the second and third years, respectively. The descriptive statistics of the average anxiety (Table 5) show

that the students in the second year have anxiety values above the sample value and the neutral value, showing a negative character. However, the lowest values of anxiety are reported by the third-year students, lower even than the neutral value, showing a positive character. These results thus show that the students lessen their average anxiety toward mathematics as their studies advance.

**Table 5.** Descriptive statistics of average anxiety according to the year of degree studied, where N is the number of students in each category, M the mean value, and SD the standard deviation.

Degree Year	N	M	SD
Second	61	3.20	0.89
Third	58	2.95	0.77

Seeing these values of average anxiety differing between second- and third-year students, we calculated all the variables as a function of these two groups. The results are shown in Tables 6 and 7, with descriptive statistics and frequencies, respectively.

**Table 6.** Descriptive statistics of gender (%), age, CAT1, CAT2, CAT3, and academic performance (AP) according to the year of degree studied, where N is the number of students in each degree year, M the mean value, and SD the standard deviation.

Degree Year	N	Gender	%	Age	CAT1	CAT2	CAT3	AP
Second	61	Men	31.1	M 20.43	M 3.00	M 3.05	M 3.73	M 4.2
		Women	68.9	SD 1.92	SD 0.99	SD 0.92	SD 0.99	SD 2.1
Third	58	Men	29.3	M 20.88	M 2.66	M 2.86	M 3.64	M 6.3
		Women	70.7	SD 1.39	SD 0.83	SD 0.80	SD 0.93	SD 1.7

**Table 7.** Descriptive statistics of subject type studied in upper-secondary education (%) according to the year of degree studied, where N is the number of students in each degree year, M the mean value, and SD the standard deviation.

Degree Year	N	Humanities	Social Science	Health Science	Other
Second	61	27.9	47.5	6.6	18.0
Third	58	20.7	44.8	17.2	17.3

Table 6 shows that the previously defined categories also present different mean values, which are significant. These values indicate that the mathematical anxiety in all categories is lower for the third year compared to the second-year students. Specifically, all the values for the second year are equal or higher than the mean value, representing a negative character. In contrast, for the third year, only the category of anxiety toward exams (3.64) is negative, while the rest have a value lower than the neutral value and so are positive.

Lastly, if we examine academic performance according to the degree year, we also find differences. For academic performance, we have taken into account the final grade given in the January 2022 exam, because the two subjects taken by the students (CM2 and DM2) correspond to the first term of the academic year (from September to January). The final grade corresponds to the summation of the average grade of the exam and the coursework handed in by the students throughout that term. The exam asked questions related to the content of each subject and coursework was practice worksheets done in groups or individually for studying the topics of each subject (CM2 or DM2). We can see that the second-year students have on average a grade that is below a pass (5), whereas the third-year students obtained a pass grade, nearing the equivalent of a B grade (7).

Even if we do a statistical study by grade intervals, we also obtain differences, shown in Table 8. Of the second-year students, 31.1% obtain a grade lower than 3 in the CM2 subject, whereas only 6.9% do so in the third year. Moreover, 37.9% obtain a B grade or higher in the third year, compared to 11.5% in the second. The grade intervals 4–5, 5–6, and 6–7 are achieved by 13.5%, 16.3%, and 11.5% of the second year, respectively, compared to 1.7%, 20.7%, and 31.1%, respectively, of the third year. Overall, 89.7% of the third-year students achieve a pass grade (higher than 5), compared to only 39% of the second year. There is thus a proportionally inverse relationship between academic performance and average anxiety, since when one increases, the other decreases.

**Table 8.** Grade intervals for academic performance and their percentage (%), according to the degree year.

Grades	0–3	3–4	4–5	5–6	6–7	7–10
Second Year	31.1	16.4	13.5	16.3	11.4	11.3
Third Year	6.9	1.7	1.7	20.7	31.1	37.9

It should be mentioned that, in the Primary Education degree at the University of Cádiz, there are four subjects related to mathematics: Mathematical Knowledge I (first year); Mathematical Knowledge II and Teaching Mathematics I (second year); and Teaching Mathematics II (third year). This means that the second-year students surveyed are in the middle of the training process regarding mathematics, while the third years are at the end of the process. Therefore, it is reasonable for the third-year students to feel less anxiety and have better academic performance than the second-year students, bearing in mind the low level in mathematics that the university students have when they begin their studies.

#### 4. Discussion and Conclusions

We can deduce from the results that the higher levels of anxiety are related to the nervousness that exams produce in the students and their capacity to solve mathematical problems. Taking into account the average anxiety, the level of these pre-service primary teachers is medium (3.08), in agreement with [44], but in our case negative while it was positive in the case of [44]. Likewise, ref. [25], who obtained the anxiety levels for 76 students in the first year of the primary-education teaching degree, concluded that the participants present a low-to-medium anxiety level (2.66). This result could imply that the level of the average mathematical anxiety of university students has increased, looking at studies from before or during the pandemic [32,33,36,37].

From the study of the results by item, we can conclude that there was a certain reluctance to study mathematics in previous years by the members of the sample, as well as some worry about their ability to solve mathematical problems (3.42). Nevertheless, the act of doing problems does not cause uneasiness or mental block in students. However, assessment situations do condition their mental state, because, although they declare that they do not get nervous in mathematics classes, they do get nervous when given an exam in the subject (4.09). The students do not come to feel fear when faced with mathematics, nor with exams, and neither do they feel uncomfortable, impatient, confused, worried, or irritable when doing the subject.

If we compare our mean values for each category with those obtained by [25], one sees that similar results are obtained, but with higher values, thus demonstrating that anxiety has increased after the pandemic, taking into account the studied sample. Global anxiety toward mathematics (CAT1) shows a level between low and medium (2.84), anxiety about problem solving (CAT2) is at a medium level (2.96), and anxiety about exams (CAT3) is at an almost high level (3.68). From the study of the categories of the sample participants, it is noteworthy that they go from a lower value, below the neutral value, to a higher value above the mean anxiety. This corresponds to the fact that the students feel less anxiety in a general way about mathematics, but their anxiety increases when talking about problem

solving and reaches a truly anxious state when the topic of mathematics tests or exams is mentioned.

Regarding the study by gender, the data show that there are significant differences between men and women in their mathematical anxiety, with men suffering less anxiety when faced with mathematical tasks (2.81 for men compared to 3.19 for women). These conclusions are in line with those by authors such as [13,24–26,32–34,45], according to whom the anxiety level is higher for women than for men in every knowledge branch and greater in health sciences and humanities. However, detecting gender differences in the collected data may have been brought about because women are more likely than men to admit to suffering from anxiety.

Looking at the branches of knowledge, we can conclude that there are significant differences between the branches in terms of students' mathematical anxiety, above all in the humanities and health sciences, which attained the highest (3.52) and lowest (2.68) values of average anxiety, respectively. If we order the branches from the highest to the lowest value for the variable of mathematical anxiety, it goes as follows: humanities, social sciences, and health sciences (which is the only branch with a level below the mean for the variable), the same as [32,46]. Thus, the students with a lower level in mathematics are those who have a higher level of anxiety over the subject. We can affirm that the students with greater anxiety over mathematical tasks have opted to study a degree in which a lower level of mathematics is required than in other disciplines, a fact that is in agreement with the assertions made by [7,20] referring to the tendency of anxious students to avoid taking courses with a high level of mathematics, thus constraining their options to access other degrees where there is greater involvement of mathematical knowledge at higher levels.

Regarding the study of anxiety according to the age of the participants, the analysis reveals that there are differences between younger and older ages. The 19-year-old students had higher average anxiety (3.28) than the 22-year-olds (2.84). One could therefore conclude that the anxiety level decreases with age (the same conclusion as [45]) or because the young students have recently emerged from upper-secondary education, beginning their university studies where the new level of social or family pressure to achieve a qualification is higher than when finishing a degree and when one has already taken the subjects corresponding to mathematics in the degree, thus having already overcome the "fear" or anxiety that they cause.

This can also be seen in the results of the study according to the degree year being studied. For the second-year students, we obtained anxiety values higher than the neutral value, indicating the negative character of this anxiety. For the third-year students, the opposite is the case: their mathematical anxiety is below the neutral value in almost all their categories, showing that the higher the cognition level, the lower the anxiety.

The same thing can be deduced from the results obtained according to academic performance. There is a negative correlation between this and mathematical anxiety, which concurs with the results from other previous studies [7,8,34,41–43,45,46]. Mathematical anxiety is related to academic performance via its influence on mathematical ability [20]. Reducing mathematical anxiety in students will have the potential of increasing confidence in their abilities, their interest and hence also their engagement with the subject. Poor or low self-concept of one's own mathematical ability has a stronger effect on increasing mathematical anxiety than mathematical anxiety has on self-concept [40]. Therefore, better performance implies less anxiety [45,46], as obtained from our study. The students that enjoy doing mathematics gain a positive effect on their confidence in their ability, and confidence and enjoyment are closely linked to student engagement with the subject which, combined with increased effort, will result in improved performance and further increases in confidence in their own ability [8].

By way of conclusion, these results about the studied sample subsequent to the pandemic show that university students (in our case pre-service primary teachers) have a medium–high level of mathematical anxiety, but this gradually diminishes during their time at university and studying different mathematics courses that form part of the teaching



degree. The results also highlight greater average levels of anxiety, being higher in women than in men and greater in students coming from humanities-based upper-secondary education. Lastly, the negative relation between anxiety and academic performance reveals the connection between them as stated by [20].

The present study has certain limitations. The results from the present study cannot provide evidence about the directionality of the relationship among variables. More complex designs, of an experimental or longitudinal nature, will be necessary to examine this aspect properly. Another limitation would be that, in order to improve knowledge of the determinants of mathematics achievement, other components such as prior achievement, subject, and environmental features must be considered in further studies. It would also be interesting to examine the extent to which the affective–motivational variables and approaches to learning analysed in the present study relate to academic achievement using another—and deeper—criterion and not just marks as a measure of academic achievement. Additionally, our findings are limited to the number of participants, the selected research methodology, and other potential factors specific to this study, such as the time period of collecting the data after the pandemic and the specific group studied.

Therefore, our conclusions and results are relative to the group studied, according to the particular characteristics analysed, and cannot be extrapolated to all university students, nor to all pre-service primary teachers. Further research would have to be done in this regard to know whether these high levels of anxiety correspond to the time studied after the pandemic and whether they decrease with the passage of time and return to those of the normal era.

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## Article

# The Role and Motivation of Pre-Service Teacher (PST) Mentors from Pro-Social to Cognitive-Effective Perspectives

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**Abstract:** The purpose of this quantitative descriptive study is to shed light on the driving forces of the mentor's positions in teacher training processes in Israel. The research is based on an exploratory cross-sectional study which included 170 preservice teacher mentors in the north of Israel. The mentoring position, despite its importance, is often unappreciated, even by the mentors themselves. It is barely rewarded, in money, status, or prestige. The current study focuses on the internal motivation of mentors for choosing to serve in this role in addition to their main role as classroom teachers. In this regard, the theory of cognitive-effective perspective can help us to understand the reasons behind these motivations. Our findings indicate that mentors exhibit internal motivation from the pro-social and cognitive-effective perspectives. The average score for attitudes was  $M = 2.92$  ( $SD \pm 0.42$ ). The total score was higher for the cognitive components than for the effective ones ( $M = 2.98$ ,  $SD \pm 0.44$ , and  $M = 2.85$ ,  $SD \pm 0.52$ , respectively). The main motivations of the mentors were based on their strong desire to improve the level of teaching in Israel. Contributing to the future of education was a dominant part of their personal educational philosophy. These insights depict the mentor as a pillar of the teacher training community in Israel. Our findings also indicate that, while a supportive school climate and autonomy in the mentor's role are factors that promote mentoring practices, a lack of theoretical knowledge about teacher training and a lack of clarity about the mentors' responsibilities are factors that hinder such practices. It is important to address these factors in order to enhance the desirable variables while decreasing the undesirable ones, in order to translate educational philosophy into stable and sustainable improved teacher training processes.

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**Keywords:** mentors; teacher training; motivations

## 1. Introduction

To be or not to be? This is a complex question that depends on human behavior, and on driving forces like internal and external motivations and other variables. Behaviors are influenced by a variety of personal and contextual motivational factors [1]. Since the COVID-19 epidemic and in the last two years, there has been extensive research in a variety of subjects involving education, teaching, and learning [2–5]. Still, however, there is a lack of research that has dealt with the mentoring of preservice teachers and their points of view in the “new routine.” The literature mainly focuses on the mentor's roles and functions rather than on their internal and professional motivation for mentoring. The past few years have seen an increasing research interest in the roles and characteristics of mentors [6,7], yet there are only a few studies on mentors' motivations and their decision to be a teacher's mentor [8,9].

The current study attempts to reveal the driving forces in the role, the motivations, and the reasons for choosing to be a mentor in the teacher training process in Israel. The character and the special role of the mentor in the teacher training processes is central. Due to the importance of mentors, this role requires in-depth examination and even reconceptualization within the field of teacher training processes [10,11].

The preparation of pre-service teachers is the opportunity to practice teaching in a real-life classroom with an experienced primary teacher. Ref. [12] raised the issue of challenges that teacher education programs (TEPs) face, as well as raised questions that are related to the effective preparation of mentor teachers with the appropriate knowledge and strategies from different mentoring approaches, as well as different theoretical approach regarding teacher learning and varies ideologies that are hard to change.

This study seeks to add to the existing research on preservice teacher mentors and their motivation to fill this position by applying a novel approach—i.e., through the lens of the cognitive-effective perspective. The aim of this study is to examine the motivations and attitudes of mentors, examined from two main perspectives: the cognitive-theoretical aspect and the effective-practical one. This study also attempts to reveal the reasons for choosing to become a mentor, as well as the factors that enhance or hinder the mentoring process.

### *1.1. Teacher Training in Israel*

Teacher training in Israel is an academic process based on theoretical and pedagogic studies and practicums. Students attain a bachelor's degree and a teacher's certificate within four years [12]. The program operates in 21 colleges and 9 universities. Practical experience is the core of the training and is carried out in actual classrooms and kindergartens [10]. Teacher education institutions attach great importance to the teacher educators, the lecturers, and the pedagogical counselors who serve as role models for the PSTs. The teaching staff also play an essential role in addressing the PSTs' social and emotional needs as teachers of the future [13].

During their studies, PSTs develop different teaching skills that increases their readiness for their future role [14]. In their practical training, throughout their studies, they are partnered with mentors—experienced teachers who strive to help their mentees become professional teachers [15,16]. According to Israel's Central Bureau of Statistics report, 19.7% of new teachers leave the profession in the first three years [17]. In this process, mentors have a central role as experienced teachers in preventing and reducing the dropout rate. Ronfeldt and McQueen (2017) found that the mentor-mentee process decreased teacher dropout by 35–50%, and continued to have an impact throughout the mentees' first five years of teaching [18].

However, the mentors do not belong to the institutions of higher education that train teachers, but serve as teachers in the schools. Moreover, there are no clear guidelines or role definitions for mentors, nor for the HEI (higher education institutions), regarding collaboration with the mentoring process. Deepening the knowledge and the growth mindset regarding the roles and motivations of the mentor is important for HEI in understanding their inner world, their motivations, and the importance to be given to this role in optimal teacher training processes.

### *1.2. The Mentor in the Teacher Training Process*

#### *1.2.1. The Mentor*

Mentoring is a process that mediates between contradicting yet complementary functions, and that entails the creating and maintaining of relationships between the experienced teacher (the mentor) and the preservice teacher (the mentee). In education the mentor is part of a framework that supports the future teacher's learning and professional development, and that encompasses a culture of nurturing, emotional support, and care [19].

In educational institutions in Israel, schools' and kindergartens' mentors are experienced and knowledgeable teachers who provide preservice teachers with guidance, advice, and knowledge [19]. Throughout the four-year program, preservice teachers undergo a process of personal and professional development and learning, building their identity while collecting practical experience and observing [15]. This is the most important stage in teacher training. The students learn about themselves, their knowledge, and their skills, and consolidate their identities and educational worldviews [10]. This expertise is formed

into a ‘profession’ that requires dedicated training, mentoring, and the mastery of complex knowledge. This has a meaningful impact on the teaching abilities of these future teachers [20,21].

Mentoring is a dialogical, social, and emotional relationship between a less experienced individual and a more experienced individual that involves regular contact over a period of time and is intended to promote mutual growth, learning, and development within the career context [22,23]. In light of this fact, mentoring plays a meaningful role in supporting preservice teachers in their professional development and clinical experience, contributing to the identity construction process of preservice teachers, while creating growth-enabling dialogue between them [24]. In striving to improve teacher training processes and professional efficacy in the teachers of tomorrow, the related processes place an emphasis on models of clinical training in the educational field that are based on collaboration and cooperation between the school (e.g., via the mentor) and the training institution (e.g., via the pedagogical instructor). These reciprocal relations are at the core of the teacher training process and combine theoretical and practical aspects to improve outcomes [25,26].

### 1.2.2. The Roles of the Mentorship

The mentoring practice involves cooperation between the preservice teacher and the mentor [27–30]. Studies have defined mentor competence as having the ability to create an interactive relationship with the student, develop characteristics and cooperation with stakeholders, provide goal-oriented mentoring, support students’ in their professional development, and support the student’s learning process [31]. Mentors fill both a professional and interpersonal role [32]. In addition to enhancing the mentees’ teaching experience, mentoring processes also impact the development of their professional identities [33].

Mentorship covers a wide spectrum of roles, from professional teacher, to critic and assessor, to instructor and supporter [34], that can be divided into three main categories: First, developing teaching skills. Here, the mentor serves as a role model for pedagogical and educational acts, providing the preservice teacher with concrete practical teaching experience, followed by analysis and reflection [35]. Next, developing a holistic outlook. In this category, the mentor introduces the preservice teacher to academic curricula, assessment methods, and classroom climates, as well as to interacting with parents. The mentor also introduces the mentee to the school as an organizational unit, enabling the preservice teacher to gain experience in developing and maintaining relationships between different position holders within the institution [36]. The third category relates to support and accompaniment, where the mentor serves as a personal counselor throughout the mentee’s practical experience [32]. The mentor’s containment and support of the mentee has great influence on the success of the latter’s practical experience.

The following three main working models can be seen in mentoring: (1) The mentor is the owner of the classroom and is the person who allows the preservice teacher into the classroom as an immediate teacher; (2) the mentor is also a pedagogical supervisor, observing and documenting the trainee teacher throughout the year; and (3) the mentor is perceived as a teacher trainer who is expected to be proficient in the field of teacher training [20]. Mentors are responsible for a large range of activities, including developing mentor–mentee relationships; support; exposing the preservice teacher to the teaching profession; providing the mentee with teaching opportunities and related feedback; overseeing and evaluating the mentee; supervising the completion of tasks given by the training institution; enabling teamwork and cooperation; managing the practical work environment; establishing a sense of connection between the preservice teacher and the school; and developing reflective capabilities in the mentee [20].

### 1.2.3. The Mentor as a Model for Professional Development

The mentors’ professional development continues throughout their career, enabling them to examine and rethink their professional beliefs and training methods. In addition,

mentoring offers opportunities to develop effective processes for training and mentoring preservice teachers, setting up learning communities for both teachers and preservice teachers from the school, and expanding both discipline-related and pedagogical knowledge, such as assessment methodologies [20,28,37].

Mentors are also responsible for the professional development of the mentee—in relation to teaching in general, and to their specific field of knowledge in particular—while enhancing the mentees’ professional growth and familiarity with the school, and serving as a role model [38]. The mentors’ contribution to the teacher training process can also be seen in their engagement in the joint construction of knowledge, becoming co-thinkers and co-learners together with their mentees, as they are a source of teaching knowledge and experts in knowledge construction [39]. Mentors can also benefit from receiving advice and assistance from the academic pedagogical instructor, as they work together to promote the success of their shared student-mentee [40].

Their contribution can also be seen in teaching their mentees to use their judgement and discretion, by exposing them to difficulties in teaching, helping them develop skills in the field of assessment and self-reflection, and encouraging them to implement new initiatives. Such contributions are based on the personal qualities that the mentor has to offer, such as warmth, generosity, and a love of teaching, as well as their teaching experience and constructive criticism [41].

#### 1.2.4. Mentoring and Pro-Social, Altruistic Motivations

Mentors contribute their time and efforts for the greater good [42]. Their motivations are to be a better support in volunteering for their role [43]. The work of mentors is often defined as pro-social, altruistic, and professional—aimed at enhancing the wellbeing of future teachers as a means to improve the teaching profession. Altruism in education relates to educational acts for the benefit of others [44]. Batson (2010) defines altruism as “a motivational state with the ultimate goal of increasing another’s welfare” (p. 16). As mentors are educators, they are motivated by their educational and social values [45]. Their main motivation for doing so reflects a “positive” social approach in their striving to promote the wellbeing of others [46]. Mentors are often goal-oriented, striving to help others while also satisfying their own needs or motivations [47]. Therefore, we hypothesize that the motivation behind choosing to serve as a preservice teacher mentor stems from altruistic, pro-social factors.

The terms pro-social and altruistic stem from a behavioral approach that reflects positive social actions in relation to the group or individual, often with the aim of promoting other people’s wellbeing [46] or serving society at large [48]. Indeed, altruism has been found to serve as a key motivational factor for filling the role of mentor [49]. The role of the mentor focuses on assisting the mentees in dealing with their “reality shock” as they enter the system, while providing a type of “quality control” to ensure that these future teachers comply with professional teaching standards [50]. Ronfeldt and McQueen (2017) [18] found that the mentor-mentee process decreased teacher dropout by 35–50% and continued to have an impact throughout the mentees’ first five years of teaching [18]. The difficulties experienced in teaching give rise to a feeling of personal incompetence, as reflected in a high dropout rate among novice teachers [51]. In Israel, the dropout rate is very high (about 30 percent) during the first five years, and especially the first two years, after entering professions in education and teaching [17]. This intensifies the valuable role of the mentor. Yet, despite the benefits and importance, this role is not without difficulties and complexities.

#### 1.3. Mentors’ Perceptions and Attitudes

In some cases, teachers take on the role of mentoring with insufficient knowledge and tools to provide their mentees with adequate training and support [52]. Others may perceive their preservice teachers as “classroom placeholders”, leaving the mentees to fend for themselves as the sole (inexperienced) classroom teacher, while the mentor spends the

lesson elsewhere—instead of invaluable working together as co-teachers [53]. Others may experience negative emotions such as frustration, as they are required to fill their mentoring role with insufficient time and resources, difficult work conditions, and low compensation—while feeling like “second-class citizens”, as they are not a significant part of the teacher training decision-making process [54] and mainly provide technical feedback about their mentees’ teaching skills. Their feedback also tends to validate the preservice teachers’ existing knowledge, rather than serving as a source of new knowledge construction. In general, studies indicate that mentors rarely provide feedback that enhances the preservice teachers’ ability to reflect on their practical teaching experience. As such, increasing the mentors’ involvement in the larger teacher training process, and offering suitable compensation, could be beneficial for all parties involved [20].

#### 1.4. Mentoring Difficulties

Filling the role of mentor is not without difficulties, as mentors must assist their mentees while also teaching their own classroom students to meet curriculum standards and requirements. At times, this dual commitment could lead to conflicts, dilemmas, and challenges for the mentor [53]. However, this role can also be beneficial for the mentors themselves, contributing to their own professional development, as they are required to cooperate with multiple factors, create a uniform conceptual-professional language with the pedagogical instructors from the mentees’ academic institution, and create and implement joint methodological planning and problem-solving procedures [55].

Mentor teachers invest great time and effort in mentoring preservice teachers, while continuing to perform their own teaching work. In some cases, these two roles may even lead to a conflict of interest, as the mentor strives to navigate between the mentee and the classroom students [56,57]. Moreover, mentors are minimally compensated for this role, and rarely receive praise, admiration, or even acknowledgement for their important work and dedication. As such, the question is why do teachers take on the role of mentor, how do they perceive their role, and what motivates them to do so?

#### 1.5. Factors That Hinder the Mentoring Process

When training preservice teachers, mentors often encounter difficulties in their attempt to combine their mentoring work with their regular classroom teaching—which could lead to difficulties relating to the mentor’s new position and place in the classroom, burnout from classroom routines, and the need to adapt their professional identity to encompass the new role of mentor. In turn, this could harm the mentors’ self-perception as a teacher of their own classroom [20]. An additional outlook addresses the “dual loyalty” conflict, i.e., loyalty towards the mentee versus loyalty towards the classroom children [27], which could result in negative emotions such as stress and tension, with the mentors feeling torn between their responsibility towards their mentees [28] and their responsibility towards their students [58].

Although compatibility may exist between the mentors’ classroom teaching abilities and their mentoring skills, enabling them to serve as both classroom teacher and mentor [28], this may not be the case for their professional identities as a mentor and/or as a classroom teacher, which could harm their positive self-perceptions [20]. Mentoring often also takes an emotional toll on the person who is filling this complex and demanding role [58], as they must deal with their excitement and anticipation on the one hand, and their self-doubt and criticism on the other [59,60].

Mentors report feelings of stress, overload, and lack of time for mentoring—which are intensified by the small financial compensation that they receive for this role [61]. Teacher mentors may also experience difficulties that stem from a lack of clear-cut definitions as to what their mentoring role should entail, thereby hindering their feelings of ability, increasing their vulnerability, and decreasing their self-efficacy [41].

Finally, the professional relationship between mentors and representatives of the teacher training institutions may also pose an obstacle in cases of inadequate communi-



cation, understanding, and agreement as to the mentors' role and scope of responsibility [41]—in turn taking a serious toll on the mentors [58]. Additional personal difficulties are related to the practical training of the future teachers, which often lacks a culture of documentation as a basis for conducting planning and feedback, lacks systematic and methodical feedback and assessment processes, and allows for minimal leveraging of opportunities for collaborative learning and enrichment between all parties involved [61]. Yet, when examining outcomes of feedback processes, studies tend to highlight aspects relating to dialogues and social actions, rather than dyadic feedback [62].

The professional and personal difficulties that teachers experience when mentoring, as described above, could harm the quality of the practical training that preservice teachers so desperately need.

Based on the literature review presented in this paper, the current study examines the following research questions: (1) What are the attitudes of teacher mentors towards the teacher training process in general? (2) What are the attitudes of teacher mentors towards the teacher training process from a cognitive and effective perspective? (3) Why do teachers choose to serve as mentors? And (4) which factors do they perceive as assisting or hindering their mentoring of the preservice teachers?

## 2. Methods

The study is a descriptive exploratory study with a cross-sectional design. It was conducted among mentors of preservice teachers (PST) studying at a teacher training college in Israel. This college trains teachers who teach in the northern region of the State of Israel. The study included 170 mentors. The research tool was a questionnaire that was sent for distribution through the college email system, while adhering to the principle of anonymity. All participants in the study were assured that their answers would be saved in the Google Form system anonymously and all results are for research purposes only.

### 2.1. Participants

The questionnaires were sent to 204 mentors in an extensive geographical area in the north of Israel (that are working in 300 different schools). A total of 170 responded, giving a response rate of 83%. Authors used representative convenience sampling. Gender, social, and religious aspects (Jews and Arabs) were in proportions that represent the population of the country, and the types of educational institutions to which the mentors belong. Background variables are presented both in raw numbers and as valid percentages.

Table 1 presents the demographic background characteristics of these teachers.

**Table 1.** Mentors' Background Demographics.

Factor	Frequency	%	
Teaching Experience (in years)	1–10	44	26.0
	11–15	29	17.1
	15+	93	54.5
	Unknown	4	2.4
	Total	170	100
School Level	Elementary	81	47.6
	Secondary	72	42.4
	Unknown	17	10.1
	Total	170	100

Table 1. Cont.

Factor	Frequency	%	
School Sector	Hebrew speaking state school	119	75
	Arabic speaking state school	44	25.9
	Unknown	7	4.1
	Total	170	100

## 2.2. Research Tool

For the purpose of this study, we developed a four-component questionnaire. Instrument development contained:

1. *Questions on background data.* The mentors were asked about their teaching experience (seniority and type of school), their main teaching subject, their school climate (open/not open to change), education, and experience mentoring preservice teachers.
2. *Questions on attitudes towards the mentoring process within the teacher training framework.* This aspect was examined via the following three questionnaires:
  - 2.1. Interval scale questionnaire on *attitudes towards the mentoring process* within the teacher training framework. This included the cognitive-theoretical aspect and the effective-practical one. Based on the literature, eight relevant items were devised, such as, “Teacher training should take place mainly in the school”, and “The mentor is the main person who is responsible for the student’s practical teaching experience.” The respondents were asked to address each item from a cognitive aspect, i.e., “To what degree do you agree with this statement?” and from an effective one, i.e., “To what degree do you identify with this statement?”—Rating their responses on a Likert scale from 1 to 7 for each participant, a score from 1 to 7 was calculated for the cognitive aspect and for the effective one—individually and joint. Reliability of this questionnaire was examined using Cronbach’s alpha, resulting in  $\alpha = 0.63$  for the cognitive aspect;  $\alpha = 0.71$  for the effective aspect; and  $\alpha = 0.82$  for the joint questionnaire.
  - 2.2. *Reasons for choosing to become a mentor.* The participants were asked to choose at least one reason for becoming a mentor out of the following six options: (1) Desire to improve the level of teaching in Israel; (2) desire to help advance the children in your classroom; (3) dissatisfaction with the current status; (4) pressure from the school principal; (5) pressure from the district supervisor; and (6) personal educational philosophy (principles and beliefs). For this part, we conducted an EFA (Exploratory Factor Analysis) of the factors operating in the processes of mentoring in PST training.
  - 2.3. *Factors that hinder/enhance the mentoring process.* From the large range of factors that are addressed in the literature as playing a role in the mentoring process of preservice teachers, 11 variables with high frequencies were chosen for this questionnaire [63]. Based on their experience, the participants were asked to rate the degree to which each factor assists in their mentoring practices, on a scale from 1 (does not help at all) to 6 (is very helpful). The 11 factors included: (1) collaboration with work colleagues; (2) collaboration with the preservice teacher’s pedagogical instructor; (3) ongoing guidance from the teacher training institution; (4) autonomy as a teaching mentor; (5) vast amount of time that teachers need to invest in their role of mentor; (6) burnout from teaching; (7) lack of theoretical knowledge on teacher training; (8) supportive school climate; (9) lack of clarity about the role of teaching mentor; (10) allocating time for mentor–mentee meetings; and (11) payment received for mentoring preservice teachers. To calculate mean scores, each factor was evaluated individually across all responses.

The complete questionnaire and data-producing sample was validated by five experts who hold PhD degrees in education and have vast experience in academic teacher training programs. Each reader was asked to rate the relevance of each item on the questionnaire to the work of the mentor, on a scale from 1 (not relevant) to 5 (very relevant). The reliability score of the questionnaire was  $\alpha = 0.86$ . In order to specify the factors and motivations, we carried out EFA (Exploratory Factor Analysis).

The questionnaires were sent to the participants via email (N = 170) and all data were collected via Google Docs. Data analysis was conducted via the SPSS 27—2019 software.

### 3. Findings

The findings of the study are presented in this chapter and are in line with the four research questions. Table 2 presents the findings relating to the first two questions which address the attitudes of teacher mentors towards the teacher training process—in general and from a cognitive and effective perspective.

**Table 2.** Attitudes Towards Teacher Training and Mentoring Processes (N = 170).

Item	Effective Score		Cognitive Score		General Score	
	SD	M	SD	M	SD	M
Teacher training should take place mainly in the school	3.11	0.81	3.47	0.68	3.30	0.66
Being a mentor is a good “recipe” for preventing burnout	3.00	0.88	2.70	0.87	2.83	0.81
The mentor is main person who is responsible for the student’s practical teaching experience	2.38	0.92	3.17	0.81	2.76	0.68
Training preservice teachers is a challenging part of the mentoring work	3.25	0.75	2.81	0.87	3.02	0.70
Preservice teacher training should be collaborative between the academic institutions, mentors, and teachers from the field	3.11	0.85	3.43	0.65	3.27	0.65
Teacher training should mainly take place in colleges and universities	2.38	0.98	2.53	0.90	2.62	0.84
The pedagogical instructor is the person who is most responsible for the preservice teacher’s practical training	2.21	0.92	2.99	0.89	2.62	0.72
The encounter between the mentor and the pedagogical instructor contributes to the mentor’s professional development	3.09	0.87	2.80	0.88	2.93	0.78
Total Score	2.85	0.52	2.98	0.44	2.92	0.44

Range: 1–4.

The findings show that the average score for attitudes was  $M = 2.92$  ( $SD \pm 0.42$ ). The total score was higher for the cognitive components than for the effective ones ( $M = 2.98$ ,  $SD \pm 0.44$ , and  $M = 2.85$ ,  $SD \pm 0.52$ , respectively). In the cognitive components, the highest score was seen for “Teacher training should take place mainly in the school” and “Preservice teacher training should be collaborative between the academic institutions, mentors, and teachers from the field.”

The next research question sought to understand why teachers choose to serve as mentors. Table 3 presents the main reasons that emerged from this study.

The findings show that the main reason for choosing to mentor preservice teachers, despite the difficulties entailed in doing so, is the desire to improve the level of teaching in Israel. Written by 73% of the participants, this factor was mentioned a total of 103 times and accounted for 44.8% of all reasons stated. The mentor’s personal educational philosophy was also rated highly as a reason for mentoring, with almost half the respondents stating this item. These findings indicate that mentors truly wish to contribute to future generations of teachers and students. Pressure from the school principal or from the district supervisor

were rarely mentioned as reasons for serving as a mentor. These findings, indicating a type of pro-social pyramid of motivation.

**Table 3.** Reasons for Choosing to Mentor Preservice Teachers (N = 170).

Reason for Mentoring	%	Frequency (n)	Respondents %
Desire to improve the level of teaching in Israel	44.8%	103	73.0%
Personal educational philosophy (principles and beliefs).	28.7%	66	46.8%
Desire to help advance the children in your classroom	15.2%	35	24.8%
Dissatisfaction with the current status	6.5%	15	10.6%
Pressure from the school principal	4.3%	10	7.1%
Pressure from the district supervisor	0.4%	1	0.7%
Total Score	100.0%	230	163.1%

In order to specify these factors and motivations, we carried out EFA (Exploratory Factor Analysis), as demonstrated in Table 4.

**Table 4.** EFA (Exploratory Factor Analysis) Varimax of the factors operating in the processes of mentoring in PST training.

	Effective Score	Cognitive Score	General Score
Cooperation of the mentor with the pedagogical guide	0.83	−0.02	−0.05
Support and training of the device institution	0.77	0.18	0.01
His autonomy as an instrument teacher	0.64	0.44	−0.01
The large amount of time I have to devote to performing its role as an instrument	0.58	0.16	0.09
Collaboration between colleagues and the profession	0.52	0.51	0.02
The salary I receive for the student's training work	−0.05	0.78	0.30
Allocating time for meetings between the instructor and the student	0.26	0.72	−0.05
A supportive school climate	0.43	0.67	−0.16
Lack of theoretical knowledge in the subjects of training for teaching	0.03	−0.01	0.88
Burnout from teaching	−0.09	0.17	0.78
Ambiguity about the role of the teacher	0.09	−0.07	0.77
$\alpha$ Cronbach	0.77	0.67	0.75
Average	4.64	4.72	2.51
SD	0.87	0.94	1.19

The final research question addressed in this study sought to identify factors that are perceived as assisting or hindering the participants' mentoring work. The related findings are presented in Table 5.

A supportive school climate, allocating time for mentor-mentee meetings, collaboration with work colleagues, and autonomy as a teaching mentor were found to be the factors which contribute the most to the mentors' work. On the other hand, the most hindering factors include lack of clarity about the role of teaching mentor, lack of theoretical knowledge on teacher training, and burnout from teaching. It should be noted that the vast amount of time that teachers need to invest in the role of mentor, or even the low payment, were not mentioned as hindering factors.

**Table 5.** Factors that are Perceived as Enhancing or Hindering the Mentoring.

Factor	M	SD
Supportive school climate	5.04	1.03
Allocating time for mentor-mentee meetings	4.91	1.09
Collaboration with work colleagues	4.85	1.16
Autonomy as a teaching mentor	4.80	1.05
Collaboration with the preservice teacher's pedagogical instructor	4.75	1.15
Ongoing guidance from the teacher training institution	4.45	1.36
Vast amount of time that teachers need to invest in role of mentor	4.32	1.29
Payment received for mentoring preservice teachers	4.16	1.46
Burnout from teaching	2.61	1.50
Lack of theoretical knowledge on teacher training	2.48	1.39
Lack of clarity about the role of teaching mentor	2.47	1.50

#### 4. Discussion and Conclusions

Mentorship in education is a worldwide role where a skilled teacher trains PSTs. The past few years have seen a growing research interest in the clinical training of PSTs, as well as in identifying teaching strategies and psycho-social variables that characterize such training [64]. This study directs a spotlight on teacher mentors and their motivation to fill this position by applying a novel approach, i.e., through the lens of the cognitive-effective perspective and through the effective practical lens. As such, this study examined the complex world of mentors, their motivation for choosing to serve as mentors, and the promoting and hindering factors that they encounter when doing so. The altruistic, pro-social approach served as a theoretical anchor for understanding why teachers choose to serve as mentors. Their main motivation for doing so reflects a “positive” social approach in their striving to promote the wellbeing of others [46]. In other words, their main goal is to serve society in the broadest meaning of the word [48], contributing their time, energy, and knowledge to improving teacher training in Israel. Altruism has been found to serve as a key motivational factor for filling the role of mentor [49].

The findings of this study sought to examine the perspectives of mentor teachers by assessing their motivation for filling this role. As stated, pro-social motivational factors were found to be dominant in their decision to conduct teacher mentoring. These are presented from a cognitive perspective that relates to the ability to draw conclusions about the thoughts and beliefs of others, and from an effective perspective that expresses the ability to draw conclusions about the emotions of others and of oneself [65]. Agreeing to serve as a mentor also expressed the teacher's goal for personal and professional development [66].

Furthermore, the current research's findings are in line with previous research that has demonstrated that PSTs' capacity to succeed in a professional placement is closely linked to the quality of the mentoring relationship [65]. We would like to emphasize and indicate that, through the identification of factors that are essential for the personal and professional development of PSTs, the mentor's role in the teacher preparation programs can provide guidelines for the training teacher's processes. Another, current study suggested that PSTs are exposed to and aligned with the desired characteristics of a mentor and a mentoring relationship [67].

The findings of this study also indicate a need for rethinking the collaboration between mentors and teacher training institutions, in relation to the type of interaction between the various parties involved in the teacher training, including mentors and preservice teachers, and mentors and training institutions. Similar findings were also seen in Hall et al. (2008) [41].

The growth and development of the mentors themselves may be related to how they perceive their role of training and instruction [68]. Quality mentoring should include

discourse and the practicing of key skills and capabilities that teachers need to possess, content knowledge and pedagogy, classroom management, and self-ability in relation to classroom students and study plans, as per the teacher's field of discipline. Such skills should be applied for ensuring academic development and improving the classroom students' achievements [69].

As to the reasons for choosing to serve as mentor, our findings indicate two main reasons that were highly rated by the participating mentors: the desire to improve teaching standards in Israel, and their personal educational philosophy. Mentoring that strives to expose mentees to current professional knowledge, and opportunities for conducting in-depth examination of their teaching, stems from the mentor's desire to improve their own teaching level while contributing to improving the overall level of education and teaching [70]. These findings clearly convey a pro-social approach, with mentors contributing their time and efforts for the greater good. As mentioned by Shier et al. (2020) [42], organizations which support this process can benefit from direct insights from mentors on their motivations to be a better support in volunteering for their role. Bolino and Grant (2016) [43] also presented the organizational advantages embodied by pro-social mentors.

The high scores seen in the mentors' desire to improve teaching levels in Israel, combined with their personal educational philosophy, indicate their strong desire to contribute to the teachers of tomorrow and to their students. Translating personal philosophy into stable and sustainable teacher training processes, the lecturers and pedagogical counselors as well as the mentors serve as role models for the PSTs. The teaching staff also play an essential role in addressing the PSTs' social and emotional needs as teachers of the future [71]. On the other hand, inadequate collaboration between colleagues, teacher autonomy, and ongoing instruction throughout the mentoring process were all found to be factors that hinder these teachers' desires and ability to provide optimal mentoring services [72].

It is important to address these factors in order to enhance the desirable variables while decreasing the undesirable ones. School principals, as well as teacher training institutions, should work together to create a more supportive and positive ecosystem, as the mentors' internal pro-social motivation alone does not suffice. Instead, there is room and a need for additional support from the school and the institution in order to continue to improve teacher training processes. Sokhulu (2021) argued that experience refers to one's participation in various events during their life [73]. People can engage in specific behaviors, portray certain skills, and be involved in various situations as part of their life experiences. In this regard, the mentor's role shapes the teacher training eco-system and contribute to its stability and sustainability [13].

Yet, mentors do not receive the acknowledgement or cooperation that they are worthy of, nor are they adequately positioned in educational hierarchies. A shared vision must be defined, based on comprehensive collaboration between the mentors and the academic institution throughout the teacher training process [28].

#### *4.1. Recommendations*

It is important to build professional training programs for mentors, as part of the teacher training array. Teachers who undergo professional mentoring training have a better understanding of the meaning of educative mentoring that highlights the combination between the mentors' expertise and the preservice teachers' knowledge. Focusing on three main aspects, collaborative planning, observation and investigation, and analysis of students' papers, was seen to lead to a change in the perceived and practical role of mentor [74]. Finally, specializing in the training of preservice teachers, including instilling in them relevant and important knowledge, is an ongoing process in mentors throughout their career—one that is greatly driven by pro-social motivational aspects. Yet, efforts should be made to improve and enhance the professional development and work of the mentor, as well as the status and perception of this important role—to create a balanced academia-field ecosystem for the benefit of future teachers and their students. The insights

of this study shed light on the role of the mentor, who is deserving of acknowledgement, praise, and compensation in return for their investment in the teachers of tomorrow.

#### 4.2. Limitations

This study contributes to the literature on preservice teacher mentors. Yet, the research limitations should be addressed. Future studies should address the issue of mentoring motivation from additional aspects and perspectives, and in relation to additional geographic areas. We also propose examining the issue of mentoring from the mentees' perspectives, i.e., the preservice teachers.

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Article

# Arab Teachers' Well-Being upon School Reopening during COVID-19: Applying the Job Demands–Resources Model

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**Abstract:** Once the major threat of the COVID-19 pandemic diminished, schools reopened, and teachers once again had to cope with unprecedented challenges. The impact of these challenges on the emotional well-being of Arab teachers, who have a unique set of challenges within the Israeli school educational system, has received little attention in the recent literature. In this cross-sectional study, we examined 300 Arab teachers' well-being in Israel in May 2021, three months after schools were reopened. All study hypotheses were confirmed. Findings indicate the need to promote a sense of well-being among Arab teachers in stressful conditions and to design solutions specifically tailored to support them in accordance with their cultural and social characteristics. Israel's Ministry of Education should encourage school administrators to seek ways to provide a supportive environment for Arab teachers in school environments in order to improve their performance and retention, and maintain their well-being.

**Keywords:** Arab teachers; well-being; school reopening; COVID-19; job demands–resources model; job resource

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## 1. Introduction

Teachers' well-being (i.e., physical, emotional, mental health) can directly impact their ability to effectively engage and teach their students [1,2]. Poor well-being can lead to burnout, absenteeism, and decreased job satisfaction, which can negatively impact students' engagement and academic performance [3]. Conversely, teachers prioritizing their well-being and maintaining good health are better equipped to provide high-quality education and support students' success [4].

Recent reports on teachers' well-being during the COVID-19 pandemic indicated that their health was impaired [5–7]. According to a study in China, the impact of COVID-19 on teachers' psychological health was associated with factors such as age and gender as well as with the type and location of the school [8].

Once the spread of COVID-19 was under control, governments worldwide began to lift restrictions and allow schools to reopen to reduce the pandemic's negative impact on teachers and students [9]. In Israel, schools reopened in September 2021, amidst adherence to social distancing and mask wearing. After two years of distance teaching, teachers returned to face-to-face interactions with their students while taking precautionary measures to prevent contracting or spreading COVID-19 [10]. However, the return to face-to-face instruction had an impact on teachers' psychological well-being e.g., [11,12]. Educators were confronted with the task of readjusting to in-person, interactive classroom instruction, while simultaneously upholding behaviors designed to prevent the transmission of COVID-19 [13]. Educators were additionally apprehensive regarding the possibility of discrimination if they contracted the virus [14]. Furthermore, instructors had to address

the needs of pupils experiencing emotional and academic disparities [9]. Under such circumstances, educators were susceptible to psychological and emotional pressures, such as depression and loneliness [9,14]. A study conducted in Spain six months after schools reopened there, among 1633 teachers, found that almost half of the teachers had anxiety symptoms and about one-third had symptoms of depression [11]. Anxiety and depression can harm instruction quality as well as teachers' interactions with students; they can also negatively impact teachers' turnover [9]. To sum up, teachers experiencing anxiety and depression brought on by COVID-19 dynamics and conditions made teachers more vulnerable and susceptible to pressures pertinent to their role.

Nevertheless, the impact of school closures as a result of COVID-19 on teachers' emotional well-being has not been widely studied, and only a handful of studies have examined coping among Arab teachers in particular e.g., [15,16]. A cross-sectional study conducted in Jordan during the pandemic, which examined the psychological well-being of 382 Arab teachers, revealed that 69.6% of the participants faced various degrees of psychological distress and disruptions in their psychological well-being [14].

In Israel, only a few studies have examined the Arab teacher minority, in particular, during the pandemic. One study investigated the challenges faced by Arab and Jewish school principals, teachers, and students (N = 579) under distance teaching conditions [16]. However, this descriptive study did not address the well-being or the psychological challenges experienced by the teacher participants. Another recent study examined 929 teachers during COVID-19 in Israel, focusing on cultural differences in stress responses between Arab and Jewish teachers [17]. The study revealed moderate levels of stress among participants related to personal and work-related factors, with Arab teachers experiencing significantly higher degrees of stress compared to their counterparts [17]. Yet these studies did not examine the impact of school reopening on the well-being of Arab teachers upon their return to teaching. Examining this topic is of importance because the reopening of schools after a long closure may have significant consequences for the mental well-being of teachers.

It is vital to acknowledge the various national and minority groups that constitute a society [18]. As such, when examining the effects of the COVID-19 crisis on teachers, especially upon schools reopening, it is crucial to give special attention to the Arab teacher subgroup within the wider educational context in Israel. Doing so will enable the design of culturally sensitive intervention programs for this specific teacher population. Therefore, in the current study, we aim to fill the gap in the literature by examining Arab teachers' well-being in Israel upon the reopening of schools during the COVID-19 pandemic.

## 2. Literature Review

### 2.1. *The Education System in Arab Society in Israel*

Arabs in Israel comprise an ethnic minority constituting about 21.1% of the total population, standing at approximately 1,957,270 people [19]. The majority of Arab citizens in Israel are Muslim (82.9%), with the remainder being either Druze (9.2%) or Christian (7.9%) [19]. Arab society in Israel has undergone a process of modernization in recent years, yet it is still considered predominantly collectivist, male-dominated, and culturally and religiously conservative [20,21].

Overall, public education in Israel includes two major separate systems: the Arab system and the Jewish system [20,22]. The majority of Arab teachers teach mostly in Arab schools under the Ministry of Education's supervision [23,24]. This segregated education system is characterized by discriminatory practices in governmental budgeting, investment, resources, allocations, and outputs [25]. Furthermore, the low economic status of local Arab municipal councils in Israel does not allow for their generous support of Arab schools [26]. Due to these inequalities and the Arab community's marginal status in Israel, a number of challenges for the Arab education system have emerged [26,27]. These challenges include social gaps, inadequate school infrastructure, and lack of eligibility among high school students to take matriculation tests in some areas of the country [20].

The aforementioned disadvantages and disparities experienced by Arab teachers in Israel place additional pressures and demands on them compared to their Jewish counterparts [20,28]. Feelings of alienation, frustration, burnout, and stress are predominant among many Arab teachers in Israel [20,27]. It is reasonable to suggest that these characteristics are related to the functioning and well-being of Arab teachers in Israel and add to the stressors that were evoked by the COVID-19 pandemic, when teachers had to perform under unfamiliar conditions.

## 2.2. The Current Study

In this study, we examine the well-being of Arab teachers in Israel upon schools reopening during the COVID-19 pandemic by employing the Job Demands–Resources Model (JD–R model) [29], given its suitability for examining teaching contexts and teacher’s professional well-being [30,31]. The JD–R model suggests that demands and resources (both professional and personal) can predict workers’ well-being and performance [32]. Examining the salient job demands and job resources pertinent to teachers’ well-being during the COVID-19 crisis is important for improving teachers’ working environments and well-being in future challenging emergencies, pandemics, and crises affecting educational contexts.

The JD–R model has been found applicable in the context of teaching. A teacher’s career entails job demands including emotionally caring for students, lesson planning, and grading, while job resources include professional development, feedback from peer observations, availability of resources that support teaching and learning, teacher autonomy, and professional development [30]. In recent studies, job resources and job demands were associated with teacher well-being [6,31,33]. Teacher burnout and declining mental health and well-being during the COVID-19 pandemic has been associated with increasing rates of teacher attrition [3]. Studies focusing on early childhood education contexts have found that job demands are a prominent cause of psychological pressure, energy depletion, and high levels of burnout among teachers [34]. A more recent study across Canada indicated that teachers suffered from higher anxiety and distress levels and decreased mental health compared to before the pandemic and compared to non-teachers [35].

According to the JD–R model, working environments and conditions can be categorized as job demands and job resources. Job demands comprise physical, psychological, social, or organizational requirements of the job that can have physical or psychological consequences [32]. Job resources comprise material, psychological, social, or organizational resources that the organization provides to enhance personal ability, learning, work enthusiasm, and work involvement. These two components can result in positive and/or negative implications for employees’ well-being [30]. Individuals experience strain when there is an imbalance between job demands and job resources. A person’s well-being at work is often the result of a balance between these two constructs.

In the coming section, the variables that construct the JD–R model used in this study are introduced and defined in the following order: work–home conflict, resilience, self-efficacy, job support, and over-commitment.

*Work–home conflict.* An individual’s home life and work life mutually affect each other, and the roles of the individual at home and work can sometimes result in conflicts leading to professional, mental, and physical consequences (i.e., fatigue, underperformance, feeling less qualified and not good at one’s job, job dissatisfaction) [36]. Work–home conflict is defined as the conflict that arises when the demands in one’s work domain are incompatible with the demands in one’s home domain [36]. Opposing work and home pressures make participating and performing in both domains challenging [37]. Work–home conflict may be affected differently by one’s work life vs. one’s private life, and that the context of individuals’ private lives can inform and help explain work–home conflicts [37]. Inexperienced teachers, female teachers, and teachers with babies have more conflicts than other teachers [38]. A study involving 640 teachers revealed that positive reciprocal interactions between work and family, as well as their correlation with

organizational support, were identified. Gender differences were noted, with women exhibiting a more pessimistic outlook on the family's well-being [39]. It was observed that individuals who were able to establish a work–family balance had a more positive perception of their work, indicating that their organization allowed them to manage their work and family demands effectively. Consequently, it is crucial to establish organizational policies that promote the reconciliation of work and family responsibilities [39].

*Resilience* is broadly defined as the ability to bounce back from stressful events, adversity, or trauma. Recent research on resilience has broadened its focus beyond the personal characteristics of individuals to include the complex dynamic, or “choreography”, between them and their changing personal and external contexts (i.e., community and culture) [40]. According to a recent study on resilience in the age of COVID-19, culture plays a central role in clarifying common belief systems and positive accommodation patterns [41]. Furthermore, individuals' resilience exists on a continuum; namely, it can change during one's life depending on biological, developmental, and cultural factors as well as scientific interventions and purposeful practice on the part of the individual [42]. A recent survey conducted among teachers during COVID-19 examined the impact of the pandemic on their resilience to continue taking part in teaching and learning processes, and mapped teachers' resilience according to internal, interpersonal, and external factors. Resilience in this model was a composite trait that encompassed the people, the socioeconomic system, and the relationships [14]. Resilience is a psychological resource that has the potential to provide long-term benefits, including the ability to recover from life stressors, increase work and life satisfaction, build social capital, foster better relationships, and promote the pursuit of life goals. It is also a positive mechanism that helps prevent harm, compensates for risks, facilitates effective recovery from stressful experiences, and enables individuals to adapt to adversity positively. The resilience theory, [43], is a necessary tool for everyday skills, all age groups, and all psychological situations. Furthermore, the broaden-and-build theory of positive emotions, presented by [44], argues that resilient individuals use positive emotions as fundamental resources to bounce back and find a sense of purpose during stressful situations. According to this model, resilience as an intervention strategy, by cultivating positive emotions, is more than a technique for healing and protecting oneself from distress [45].

*Self-efficacy* is defined as individuals' perceived belief in their ability to succeed at a particular task in a particular situation [14]. Perceived self-efficacy can affect an individual's goals and commitment to the performance of certain tasks. It can also have cognitive consequences for peoples' responses to failure or their patience in the face of difficulties. In the context of the teaching profession, teachers' self-efficacy is their perceived belief in their capability to encourage and stimulate learning [46,47]. There has been ample research examining teachers' self-efficacy during the COVID-19 pandemic, which has found technology use and virtual instruction to influence teachers' self-efficacy [7,47]. A recent study investigating 150 teachers from six Arab countries during COVID-19 revealed that teachers' self-efficacy in online teaching and learning environments was high. Further, the study revealed that two main factors (receiving support to design online instruction and receiving professional development and support in online teaching), significantly predicted teachers' sense of self-efficacy [48].

*Job support* is defined as the helpful social interaction available at work from colleagues and supervisors [49]. Recent studies conducted among teachers have found that characteristics of the work environment such as job demands and job support play a vital role in the mental health of early childhood education teachers [50,51]. Studies that examined teachers during COVID-19 found that when they had job support, such as higher agency in their work environment, they experienced better mental health and were likely to report fewer symptoms of depression [52].

*Over-commitment* is defined as a set of emotions, attitudes, and behaviors that reflect excessive striving, combined with a strong need to receive approval and esteem [53]. Over-committed employees in work situations that demand a great deal of effort and few

rewards are more prone to experiencing strain than less-committed peers, as they respond inflexibly to such situations. Over-commitment is viewed as a dysfunctional motivational pattern and a coping mechanism that has maladaptive consequences, such as emotional exhaustion, and can jeopardize individuals' well-being and performance in stressful and high-workload situations [53,54]. A recent study among French teachers revealed that over-commitment could adversely impact teachers due to a perceived imbalance between effort and reward. Workload and over-commitment were positively associated with emotional depletion and presenteeism (i.e., being present even when ill) and negatively related to job satisfaction and performance [55]. Research indicates that over-commitment serves as a mediator for psychological variables and overall well-being [56,57]. This implies that individuals who invest considerable effort, in terms of time and energy, may be prone to experiencing negative emotions. If extrinsic effort surpasses intrinsic reward, it can have detrimental effects on physical and mental health, ultimately resulting in burnout and decreased psychological well-being [58].

Several cross-sectional studies have been conducted to examine the correlations between psychological factors and the level of well-being experienced by teachers. In a study conducted in Germany, a sample of 5163 respondents was analyzed, revealing significant associations between self-efficacy, work-related stress, health and anxiety, and work–family conflict [59]. Furthermore, a correlation analysis was conducted among a population of 42,412 teachers in China, indicating that work–family conflict, burnout, and resilience were significant predictors of well-being [60]. Work–family conflict has been identified as a significant social determinant of mental health, with bidirectional interference between work and family responsibilities. Previous research has highlighted the influence of work and family stressors, as well as psychosocial variables that affect well-being among teachers [37]. In a study aimed to explore the potential impact of COVID-19-related job demands on the psychological well-being of teachers in Finland and Norway, there was no evidence of increased workload affecting the well-being of teachers [61]. Research acknowledges the cumulative impact of remote work and the subsequent reopening of schools on the mental health of teachers. This effect is attributed to the significant workload and frequent changes that teachers encountered, as well as technological challenges and health concerns. Teachers were required to balance their commitments towards their families and students, resulting in an accumulation of tasks and responsibilities [62].

### 2.3. Aim of the Study

The aim of the present study was to examine Arab schoolteachers' well-being in Israel upon schools reopening during COVID-19 by applying the JD–R model.

### 2.4. We Hypothesize the Following

**H1.** *Home–work conflict and over-commitment among Arab teachers will be negatively associated with well-being.*

**H2.** *Resilience, self-efficacy, and job support among Arab teachers will be positively associated with well-being.*

**H3.** *Over-commitment will mediate the association between resilience, self-efficacy, and well-being.*

## 3. Method

### 3.1. Procedure

The present study was approved by the Ethics Committee of the chief scientist at Israel's Ministry of Education (Approval no. 11606) and by the first author's university's Ethics Committee (Approval number 011202). A convenience sampling method was used to recruit the study participants, who were invited to take part in a study focused on Arab teachers' coping upon schools reopening during Israel's third wave of COVID-19. The teachers were recruited mainly through internet forums and social media outlets

(i.e., Facebook pages for teachers). A note on these websites contained a short explanation about the study and a link to the questionnaire. To preserve anonymity, participants were not asked to provide any identifying information.

A total of 300 teachers completed the online survey in May 2021. This sample size allowed multiple hierarchical regression for 9 predictors, with low-medium effect size  $f^2 = 0.10$ ,  $\alpha = 0.05$ , and power of 0.95 (G \* Power version 3.1.9.7) [63].

### 3.2. Measures

#### 3.2.1. Dependent Variable

*Well-being* was measured via the 14-item Mental Health Continuum-Short Form (MHC-SF) [64]. Respondents were asked to rate the frequency of their feelings of well-being and feelings of distress during the past month on a 6-point Likert scale from 1 (never) to 6 (every day) (e.g., “During the past month, how often have you felt that people are basically good?”). A mean score was calculated; higher scores indicated higher levels of well-being (Cronbach’s  $\alpha = 0.91$ ).

#### 3.2.2. Independent Variables

*Resilience* was measured via the six-item Brief Resilience Scale (BRS) [65]. This scale taps the individual’s ability to recover from stressful situations. Respondents were asked to rate the extent of their agreement with each item on a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree) (e.g., “I usually come through difficult times with little trouble”). After reversing the negative statements, a mean score was calculated; a higher score indicated greater levels of resilience (Cronbach’s  $\alpha = 0.78$ ).

*Self-efficacy* was measured via the new general self-efficacy scale [66]. Respondents rated the extent of their agreement or disagreement with each of the eight items on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) (e.g., “I can meet many challenges successfully”). A mean score was calculated; a higher score indicated greater levels of self-efficacy (Cronbach’s  $\alpha = 0.93$ ).

*Job support* was measured via the eight-item Job Content Questionnaire (JCQ) [49], tapping the psychological demands, decision latitude, social support, physical demands, and job insecurity pertaining to the social and psychological qualities of the job. Respondents were asked to rate the extent to which they agreed or disagreed with each item on a 4-point Likert scale ranging from 1 (strongly disagree) to 4 (strongly agree) (e.g., “My supervisor is good at getting people to work together”). A mean score was calculated; higher scores indicated higher levels of job support (Cronbach’s  $\alpha = 0.74$ ).

*Over-commitment* was measured by a six-item over-commitment subscale of the short version of the effort–reward imbalance (ERI) questionnaire [54]. Respondents rated the extent of their agreement with each item on a 4-point Likert scale ranging from 1 (strongly disagree) to 4 (strongly agree) (e.g., “People close to me say that I sacrifice too much for my job”). A mean score was calculated; a higher score indicated higher levels of over-commitment (Cronbach’s  $\alpha = 0.73$ ).

*Personal and professional background:* Participants were asked to indicate their gender, age, education, marital status, number of children, scope of position, and seniority in teaching.

The study investigated health-related factors and exposure to COVID-19, including participants’ self-reported subjective perception of their health status, adherence to home isolation following a COVID-19 exposure, and feelings of protection against COVID-19 in the workplace.

### 3.3. Statistical Analyses

Data were analyzed using SPSS and AMOS (ver. 27). Descriptive statistics were used to describe the participants’ demographic characteristics and the research variables. Pearson correlations were calculated to assess the associations between the research variables. The research model was examined with path analysis using AMOS 27. Model fit was assessed



in terms of five indices. Chi-square and normed chi-square ( $\chi^2/df$ ) tests were used to assess the model's overall fit and parsimony. Normed chi-square values of  $\leq 2.0$  indicate a good fit. We also used the comparative fit index (CFI), the Tucker–Lewis Index (TLI), and the normed fit index (NFI), which are incremental fit indexes. In addition, we employed the root mean-square error of approximation (RMSEA and its confidence interval), which measures the discrepancy per degree of freedom and indicates the model's absolute fit. CFI, TLI, and NFI scores of  $>0.95$  and RMSEA values of  $<0.05$  indicate a good model fit. In addition, indirect effects were evaluated with bootstrapping of 5000 samples, and 95% bias-corrected confidence intervals (95%CI), in order to evaluate the statistical significance of the indirect paths.

## 4. Results

### 4.1. Participants

A total of 300 teachers working in Arab public schools throughout Israel participated in the study. Of them, 227 were women (75.66%), and 73 were men (24.33%). The participants ranged in age from 23 to 65 (mean = 40.58, SD = 8.18). Most of the participants were married ( $n = 263$ , 87.66%) and most of them had children under the age of 18 ( $n = 237$ , 79%). Most of the teachers ( $n = 171$ , 57%) had a master's degree, had a two-thirds time position or more ( $n = 244$ , 81.33%), and had a mean of 16.28 years of seniority in teaching (SD = 8.56, range 1–41). During the study period, the majority of the participants (92%) underwent testing for COVID-19, and more than half of them (56%) indicated they had undergone quarantine since the outbreak of COVID-19. At the time of data collection, approximately 38% of the participants reported feeling unsafe from contracting the virus at their workplace. Additionally, about 64% of the teachers reported caring for elderly parents who needed their assistance (Table 1).

**Table 1.** Demographic characteristics of the participants ( $N = 300$ ).

		N (%)
Age M (SD)	40.58 (8.18, range 23–64)	
Teaching Seniority M (SD)	16.28 (8.56, range 1–41)	
Gender	Women	227 (75.66)
	Men	73 (24.3)
Marital Status	Married	263 (79)
	Single	23 (7.66)
Children	Divorced/Widowed	13 (4.33)
	Yes. Minors	237 (79)
Education	Yes. Adults	29 (9.66)
	None	31 (10.33)
Employment Status	Teacher certificate	12 (4.0)
	Undergraduate (bachelor's degree)	115 (38.33)
Health Status	Graduate/Post-Graduate	173 (57.66)
	Up to two-thirds time	44 (14.6)
Disease History	Two-thirds and more	244 (81.3)
	Reasonable/Bad	17 (5.66)
Disease History	Good	65 (21.66)
	Very Good/Excellent	218 (72.66)
Disease History	Yes	35 (11.66)
	No	264 (88)

SD = standard deviation.

### 4.2. Descriptive Statistics and Correlations between Study Variables

Table 2 summarizes the means, SDs, ranges, and correlates of the study's variables. As can be seen, the means of well-being and self-efficacy were higher than mid-range. The means of resilience and job support were found to be at the center of the range. That is, participants reported moderate-to-high levels of well-being and self-efficacy and moderate

levels of resilience and job support. According to Table 2, positive significant associations were found between well-being, resilience, self-efficacy, and job support, and a negative significant association was found between well-being and over-commitment. That is, the higher the levels of resilience, self-efficacy, and job support, and the lower the levels of over-commitment, the greater the well-being.

**Table 2.** Correlates, means, SDs, and ranges of study variables ( $N = 300$ ).

Variables	1	2	3	4	5
1. Well-being	-				
2. Resilience	0.26 **	-			
3. Self-efficacy	0.25 **	0.28 ***	-		
4. Job support	0.24 **	0.19 **	0.30 ***	-	
5. Over-commitment	-0.19 **	-0.32 **	0.09	-0.09	-
Mean	4.11	3.16	3.48	3.28	2.91
SD	0.93	0.49	0.65	0.58	0.61
Possible range	1–6	1–5	1–5	1–5	1–5
Actual range	1–6	1.67–5	1.63–5	1.80–5	1.50–5

\*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$ ; SD = standard deviation.

In addition, the correlation between seniority in teaching and well-being was significant ( $r = 0.15$ ,  $p = 0.012$ ). Thus, these two variables were included in the model.

#### 4.3. Path Analysis Model for Well-Being

A path analysis model was calculated (Table 3) to assess the various relationships of well-being with seniority in teaching, resilience, self-efficacy, and job support. All continuous variables were standardized. The model was found to fit the data:  $\chi^2(9) = 10.22$ ,  $p = 0.333$ ,  $\chi^2/df = 1.14$ , NFI = 0.955, NNFI = 0.981, CFI = 0.994, RMSEA = 0.021.

**Table 3.** Path analysis for the relationships between seniority in teaching, resilience, self-efficacy, job support, and well-being among Arab teachers ( $N = 300$ ).

DV ( $R^2$ )	IV	B	SE (B)	p
Over-commitment (0.18)	Resilience	-0.31	0.06	<0.001
	Self-efficacy	0.20	0.06	<0.001
	Job support	-0.08	0.05	0.149
	Seniority	0.14	0.05	0.007
	Resilience	0.12	0.06	0.047
Well-being (0.18)	Self-efficacy	0.16	0.05	0.005
	Job support	0.12	0.05	0.036
	Over-commitment	-0.12	0.06	0.047

Note. Bold values indicate a significant result. DV = dependent variable; IV = independent variable;  $R^2$  = percent of explained variance.

The investigation of variations in the research variables based on gender, marital status (married/unmarried), parental status (having minors/adults or no children), and education level (bachelor's degree and teaching certificate/advanced degrees) did not yield any statistically significant results. Among the research variables, only work seniority was found statistically significant and was therefore included as a control variable.

As can be seen in Table 3, 18% of the variance in teachers' well-being was explained in the model. Negative associations were found between resilience and over-commitment, and a positive association was found between self-efficacy and over-commitment; namely, the lower the self-efficacy, the lower the over-commitment. In addition, positive associations

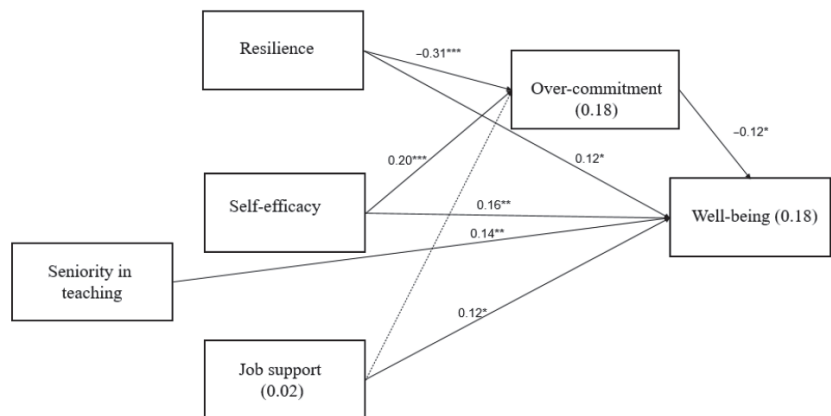
were found between resilience, self-efficacy, job support, and well-being. Namely, the higher the resilience, the greater the self-efficacy, and the higher the job support, the higher the well-being. A negative association was found between over-commitment and well-being, namely, the lower the over-commitment, the greater the well-being. There is a positive association between teaching seniority (i.e., length of teaching experience and employment) and the mental well-being of teachers, where increased seniority is linked to improved mental health outcomes.

As shown in Table 4, several indirect relationships were found to be significant, involving resilience and self-efficacy as independent variables and over-commitment as a mediator. Higher resilience was associated with lower over-commitment, which in turn was associated with higher well-being. However, higher self-efficacy was associated with higher over-commitment, which in turn was associated with lower well-being (Figure 1).

**Table 4.** Indirect relationships between resilience, self-efficacy, and well-being ( $N = 300$ ).

DV ( $R^2$ )	IV	Standardized Indirect Effect	SE	$p$	95%CI
Well-being (0.18)	Resilience	0.04	0.02	0.037	0.01, 0.09
	Self-efficacy	−0.02	0.01	0.029	−0.06, −0.01

Note. DV = dependent variable; IV = independent variable.



**Figure 1.** A path analysis model path analysis for the relationships between seniority in teaching, resilience, self-efficacy, job support, and well-being among Arab teachers. The model was found to fit the data:  $\chi^2(9) = 10.22$ ,  $p = 0.333$ ,  $\chi^2/df = 1.14$ , NFI = 0.955, NNFI = 0.981, CFI = 0.994, RMSEA = 0.021. \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

## 5. Discussion

The aim of the present study was to examine Arab school teachers' well-being in Israel upon schools reopening during COVID-19 by applying the JD–R model. The findings provide support for the three hypotheses of this study. First, the hypothesis that home-work conflict and over-commitment among Arab teachers negatively associated with well-being was confirmed. In addition, our study confirmed the hypothesis that resilience, self-efficacy, and job support among Arab teachers is positively associated with well-being. Finally, the findings support the hypothesis that over-commitment mediates the association between resilience and self-efficacy and well-being among Arab teachers.

The findings from the current study provide insight into the JD–R model that influenced Arab school teachers during the initial COVID-19 reopening of schools in Israel. Specifically, the results found that increased demands faced by Arab teachers had an impact

on work–home conflict. In addition, the results suggest that teaching demands have led to an increase in Arab teachers overcommitting to job-related tasks. Both work–home conflict and overcommitting to job-related tasks had a negative impact on teacher well-being. Previous studies have found that most Arab teachers often feel stressed due to the pressures and demands on them compared to their Jewish counterparts [20,28]. Feelings of alienation, frustration, burnout, and stress are predominant among many Arab teachers in Israel [20,27]. The Arab community ideals of solidarity, cooperation, commitment, mutual trust, support, and a sense of belonging which they hold [67] may lead them to view their work and family as an integrated entity [68]. Moreover, since Arab teachers come from a collectivist-oriented society, they idealize social commitment and benevolence, even at their own expense [67,69]. The importance of family and community, including the schools in which they work, may very well explain Arab teachers' over-commitment at work in this study. In a previous study, Arab female teachers were found to view their commitment to work at school as an extension of their commitment and loyalty to their home [70]. Hence, one can argue that they might experience an exacerbated sense of work–home conflict, which could in turn, have a negative impact on their sense of well-being. With teachers taking on more challenges upon returning to face-to-face instruction, the current results come as no surprise as they align with previous studies focused on teacher over-commitment [55] and work–home conflict [38].

Furthermore, returning to working at the school may have met Arab teachers' socio-emotional needs, to which they responded with increased willingness to over-commit and give more to their jobs [71]. Indeed, Israeli Arab teachers' cultural background, community support, and strong family bonds were found to be a resource when coping with increasing work demands and stressful conditions during COVID-19 [17]. In addition, Arab teachers' resilience may have led them to give more to their teaching fueled by internal and cultural factors to support their students [42].

Additionally, the current results found that self-efficacy and job support were positively associated with teacher well-being. This aligns with previous studies, which found job support to be a critical aspect of teachers experiencing better mental health and fewer symptoms of depression [51,52]. Arabs in general are described as having a communal culture and thereby hold the expectation to share responsibilities and rewards [71]. Therefore, returning to schools may have provided the teachers with a sense of communal job support and heightened self-efficacy which have positively impacted their sense of well-being. Furthermore, it is unsurprising to find a positive connection between self-efficacy and teacher well-being, as higher teacher self-efficacy may make teachers feel better about their teaching and more committed even when facing challenges e.g., [72].

The psychological well-being of educators displays a positive correlation with the level of seniority in their teaching experience, as heightened seniority is associated with a beneficial impact on mental health outcomes. Teachers with lower seniority are usually younger, are generally in the initial phases of creating a family and have younger preschool or young school-aged children [73]. The burden of childcare substantially constrains their capacity to allocate time to alternative pursuits [73]. In addition, studies indicate that advanced teaching seniority has its virtues in that more experienced teachers report more overall contentment and enthusiasm, lower levels of anxiety and depression, stronger professional identity, greater sense of adaptability, and higher levels of commitment [74].

Finally, the results found that over-commitment mediated the relationship between teachers' resilience, self-efficacy, and well-being upon schools reopening during the pandemic. This means that the over-commitment of Arab teachers in Israel plays a significant role in other psychological variables such as resilience, self-efficacy, and well-being especially when coping with stressful times. This comes as no surprise, as it is in line with previous findings that focused on teacher well-being during COVID-19 through factors such as their resilience and self-efficacy. For example, teachers' resilience to continue to be involved in teaching and learning processes was found to encompass the people, the socioeconomic system, and the relationships [42]. Similarly, recent studies that focused on

teachers' self-efficacy during the pandemic found that teachers' self-efficacy decreased and was associated with overall stress and burnout [14,31].

### 5.1. Implications

Before the COVID-19 pandemic, Arab schools faced limited resources that included inadequate school infrastructure and inequitable funding [26,27], which often led to an increase in frustration, burnout, and stress [20,26]. As Arab teachers returned to frontal classroom teaching during the COVID-19 pandemic, they faced increased and new job demands with limited resources, which may have influenced teacher well-being. It is important to note that teacher self-efficacy and resilience positively impact teacher well-being; thus, school leaders in Israel should focus on these aspects when supporting teacher well-being. Arab teachers who experience home–work conflict should receive training in developing and practicing coping strategies and tools to separate work and their personal lives. To support teacher self-efficacy, Arab school leaders may consider providing formative feedback on their performance, asking teachers about resources needed, including time management skills and supporting teachers through relevant professional development opportunities [48,70].

Additionally, Arab school administrators may provide time for teachers to observe and talk with each other to support vicarious learning or offer peer coaching opportunities that may include formative observations, modeling lessons, and co-teaching lessons. Lastly, school leaders can support teacher well-being as teachers continue to feel high stress levels and burnout. This may be due to the lack of support received through the pandemic or the increase in workloads [12,30]. School leaders must remember this when determining the required tasks asked of teachers.

### 5.2. Limitations and Future Directions

The current study had some limitations to consider when interpreting the results. First, the current investigation was conducted during the pandemic, and relied on an online self-reported data, leading to subjective descriptions of the participants' health status and their underlying medical conditions. Thus, the findings may not be generalizable to all teachers. Future research should be supplemented with objective measures, such as medical records, to provide a more comprehensive evaluation. Second, this study was cross-sectional and thus represented only one point during the pandemic for a specific group of teachers. More studies are needed to understand the different perspectives of all teachers and situations. Moreover, the impact of the COVID-19 pandemic on the reopening of schools is influenced by various psychological and health-related factors. Therefore, future research should consider a broader examination of variables related to the pandemic, and address them accordingly. Additionally, because the study is cross-sectional, we cannot make inferences about causality. Therefore, more research with cohort study design is required to infer relationships and confirm the stability of our findings. Finally, our findings may be limited to Arab teachers in Israel and may not be generalizable to other teacher population groups. Although the findings of this study aligned with research conducted in common Western cultures, we would encourage future research to explore the constructs of over-commitment, job support, and self-efficacy with a larger and more diverse set of teacher participants.

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**Data Availability Statement:** Not applicable.

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

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Article

# Pre-Service Teachers' Attitudes toward Integrating Digital Games in Learning as Cognitive Tools for Developing Higher-Order Thinking and Lifelong Learning

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**Abstract:** The purpose of this study is to examine how pre-service teachers' training influences the integration of digital games into teaching. In a quantitative and qualitative study, pre-service teachers' perceptions of their techno-pedagogical knowledge were examined along with their attitudes about games as effective cognitive tools for developing higher-order thinking and lifelong learning. A sample of 108 pre-service teachers followed a 2 × 2 research model distinguishing between those who had or had not received training and those who did or did not teach using digital games. Results showed that teaching with digital games and attitudes toward integrating them into the classroom were positively correlated. Additionally, a higher level of techno-pedagogical knowledge was perceived by those with direct experience with digital games. Teaching with digital games enhances students' thinking processes and lifelong learning skills, according to pre-service teachers. Theoretical knowledge about lifelong learning and higher-order thinking, accompanied by hands-on experience in implementing digital games, should be applied to pre-service teacher training programs.

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**Keywords:** digital game-based learning; teachers' education; cognitive skills; higher-order thinking; lifelong learning

## 1. Literature Review

### 1.1. Digital Games in Education

The term edutainment describes a variety of media-based tools that provide information, cognitive and emotional learning opportunities along with enjoyment and entertainment [1]. One such tool is educational digital games that are integrated into educational plans [2]. The benefits of educational digital games are well known to educators and researchers [3], and they have been successfully incorporated as learning and training tools across a broad range of areas [4]. They especially enable context-based, collaborative, and interactive learning. Digital games present innovative pedagogical approaches that leverage these advantages to develop more effective literacy skills and language proficiency. A key idea highlighted is that games and digital tools allow exploratory, experiential learning and problem-solving, facilitating cognitive development [5].

Game-based learning is a teaching approach integrating gamified elements into the learning process, containing elements of competition, involvement, and immediate reward. Through the playing/learning process, player-learners receive immediate feedback, enabling them to compete with a computer or other player-learners to achieve educational goals. A game-based environment invokes a sense of challenge and is characterized by high levels of intrinsic motivation [6], including a narrative framework that helps the

player–learner in the educational activity while simultaneously facilitating skill-building and knowledge growth [7]. The digital game-based learning (DGBL) approach arises from the continued use of computer games and applications of educational value [8]. Studies report strong educational potential using digital game-based learning, citing the enjoyment and interest they inspire, enhancing concentration, critical thinking, and academic achievement [9]. As well, game-based learning can enhance student engagement, and improve overall experience [10]. Additionally, it was discovered that the interest levels of students who utilized games were higher compared to their conventionally trained counterparts, except for students who performed poorly [11].

Although games are supposedly separate from reality, they nonetheless enable learners to acquire lifelong learning skills and 21st century skills. Through digital learning games, one can develop digital literacy and learning skills, learn skills relevant to the job market, develop social and interpersonal skills, and even develop personal cognitive skills such as creativity, self-discovery, and critical thinking. Indeed, digital games have considerable potential regarding lifelong learning skills [12]. However, to realize this potential, it is important to distinguish between two types of digital education games: those developed specifically for educational purposes and those initially designed for entertainment and then adapted for educational purposes. In this article, we focus on the former. In addition, a distinction is needed between games created by professionals and those created by teachers or students [13]. This research studies games created specifically for educational purposes and implemented by teachers.

There are two approaches to integrating games into learning systems to encourage cognitive development: In the first, the instructionist approach, students play a game developed by a teacher/professional to practice and assimilate information on a certain subject. Some teachers prefer to use the game solely as an introduction for the class, others use it as the main element of the class, while others use it to conclude the class or assign it as homework. Games can be integrated into an individual or group setting, inside the classroom or outside [14,15]. In the second, the constructionist approach, students design games themselves in a creative, authentic and personal manner, as part of the learning process, exploring and understanding the learning material through designing and playing the game [16,17] thereby developing and enhancing their thinking skills.

This categorization is important due to the level of cognitive thinking it encourages in students. Bloom's Taxonomy of cognitive skills [18] provides a helpful model in this context. The original model proposed six categories of cognitive skills ranging from lower-order skills requiring less cognitive processing to higher-order skills requiring deeper learning and more cognitive processing. Responding to findings of cognitive science, the order of the cognitive processes was later changed, repositioning synthesis rather than evaluation at the highest level of the hierarchy [19]. In this revised version, the levels are remembering, understanding, applying, analyzing, evaluating, and creating. Moreover, this revision adds a new dimension across all six cognitive processes, defining four types of knowledge that can be addressed by a learning activity: factual (terminology and discrete facts); coherence (categories, theories, principles, and models); procedural (knowledge of a technique, process, or methodology); and metacognitive (including self-assessment ability and knowledge of various learning skills and techniques). Bloom's Taxonomy has been used to create and align objectives, lessons, and assessments to achieve all cognitive levels in the traditional classroom [19,20], and has been validated in e-learning [21] and virtual learning environments [22,23]. Bloom's Taxonomy provides a valuable tool for educators to enhance students' performance and learning outcomes in various academic disciplines [24,25].

We posit that a constructionist approach includes higher levels of thinking, unlike an instructionist approach that results in lower levels of thinking. In constructionist teaching, learners construct their own experiences to produce understandings that make sense to them, while in the instructionist approach, learners practice what they were taught.

Online game generators can now quickly and easily create games with high levels of functionality and design using existing digital platforms [14]. These require no prior coding knowledge since they are editing tools for generic templates into which different types of content can be entered. These generators enable the swift creation of simple yet accessible and streamlined games, that include low-order strategic practice and, more importantly, data recall and basic understanding. The transfer of the creative process to the learners allows them to use higher-order strategic thinking for strategic planning, decision-making, comparison, data presentation, problem-solving, critical thinking, and collaborative learning [26]. Additionally, the use of game generators generates high engagement of learners in the learning process, as found in the study by Deater-Deckard (2013) and her colleagues. They examined the relationship between students' engagement levels in educational games and their learning outcomes. The researchers analyzed how different game features and challenges influence cognitive thinking based on Bloom's Taxonomy. They found that higher engagement was associated with higher-order thinking skills required to solve complex in-game tasks. The authors concluded that thoughtful game design, which promotes sustained engagement, curiosity and regulates difficulty appropriately, can foster the development of critical thinking and problem-solving abilities. This provides insights into how educational games, when optimized effectively, can tap into deeper learning processes [27].

### 1.2. Teacher Education and Digital Games

Teacher preparation for the knowledge society demands workers who can think critically, pose and solve problems, and work collaboratively—abilities not readily developed in classrooms [28]. As well, teaching with games requires adaptive expertise that is not necessarily intuitive for all teachers [29]. According to the Technical Pedagogical Content Knowledge Framework (TPACK) model, in order to guide students through this complex technologically-inclined educational process, teachers must combine pedagogical-content knowledge and technological knowledge suited to the learning plan and educational requirements [30,31]. Specifically, teachers need a clear vision of teaching and learning [32], a positive attitude towards the subject of digital games, and technical-pedagogical capabilities, including familiarity with digital games platforms. Examining the principles emerging from teacher education in game-based learning [33] identified six principles for guiding research and practice in teacher education for game-based learning (GBL): (a) teachers play an active role in GBL environments; (b) games are an integral part of the curriculum; (c) GBL is a way of facilitating learning; (d) games are not contextually or pedagogically neutral; (e) teachers' knowledge of GBL evolves over time; and (f) teachers' professional identities have an impact on GBL practice.

Considering these findings, we argue that pre-service teachers must undergo the appropriate training processes. Teaching with games would include examining practices involved before, during, and after game-based interventions [33,34]. Teachers should be able to educate and cultivate self-learning, and need to draw on numerous skills when embarking on developing student games: familiarity with numerous game-generating platforms; the ability to instruct and guide group educational processes; and the ability to guide students to make decisions regarding the game application best suited to their needs.

There is a wide gap between prevailing policies promoting educational technology-related reform and classroom reality, and it appears that teachers have largely not embraced the use of technology [35]. Usually, teacher education programs lack modules dedicated to the process of creating digital educational games. [36] find that, on average, what is often called "planning, organization, management, and appraisal of learning" in education colleges comprises just 18% of the curriculum, noting that any references to developing online games are haphazard and result from initiatives of a particular lecturer. Commonly, this important aspect of pre-service education may be merely an appendage to courses about study planning or integrating digital tools into teaching. Previous research has found

a correlation between the education student's practical experience in this field, and their initiative in practically integrating digital games into their classes [37].

This study aims primarily to contribute to the existing theoretical and practical knowledge in the context of teacher training to cultivate lifelong learning skills and 21st century skills, which, we argue, will develop much-needed higher-order thinking skills through task-based learning. We further suggest encouraging teachers to approach these aspects of their practice positively to achieve these goals.

## 2. Research Questions

This study examines the influence of pre-service teachers' training on teacher attitudes toward integrating digital games into education. We examine the attitudes of pre-service teachers possessing technological–pedagogical knowledge (TPACK), including their views on games as tools for potentially developing cognitive higher-order thinking and lifelong learning. We also analyze whether educational experience in integrating digital games affects these variables. We hypothesize that those pre-service teachers who have *learned* about integrating games in education will present more positive opinions concerning all variables than pre-service teachers who have not. Likewise, we hypothesize that pre-service teachers who have *taught* using the development of digital games in the classroom will have a more positive opinion about all variables than those who have neither *learned nor taught* games instruction.

This study seeks to answer the following research questions:

- A. Technological–Pedagogical Knowledge and Attitudes Towards Digital Games
  - A.1. What are the connections between the perceived TPACK regarding digital games, opinions about using digital games, cognitive higher-order thinking, and lifelong learning skills of pre-service teachers?
  - A.2. What are the differences between pre-service teachers who have learned about digital games and pre-service teachers who have not regarding technical–pedagogical knowledge, beliefs about thought development, and life skills in the context of integrating digital games into the classroom?
- B. Knowledge and Experience Teaching with Digital Games
  - B.1. What are the differences between pre-service teachers who have taught using digital games and those who have not regarding technical–pedagogical knowledge, beliefs about thought development, and life skills in the context of integrating digital games into the classroom?
  - B.2. What are the differences between those who have learned about incorporating games into their teaching and those who have taught using games regarding their attitudes about whether digital games develop higher or lower thinking skills? What are their attitudes regarding games as tools for developing cognitive higher-order thinking skills?

## 3. Methodology

This study adopts a mixed methods research approach, drawing upon a quantitative method with several complementary qualitative questions. Using a  $2 \times 2$  research array between participants, they could have learned or not learned about digital games, or taught or not taught the subject. Data for all research questions were collected from an online questionnaire distributed to groups of students. For the answers to the open-ended questions dealing with the description of the characteristics of the lesson-incorporated digital games by the pre-service teachers, a content analysis was carried out. Then, in order to reveal the ranking of components reported as significant, we coded and counted prevalence after thematic mapping [38].

### 3.1. Sampling

Participants included 108 pre-service teachers from the Regev Excellence Program, 44% from the program and 56% from standard education teacher training programs. The survey answer rate was 83%. Eighty percent of the participants were women and 69% were aged between 18–25, 20% between 26–30, and 11% over the age of 30. The sample showed that 28.1% *had not learned* about digital games at all, while 71.9% *had learned*, either through several classes or a full course about digital games. Among participants, 59.3% *had taught* digital game development during their teaching practicum while 40.7% *had not*. No differences were found between those that *had learned* about digital games and those that *had not learned* about digital games regarding their age group ( $\text{Chi}^2_{(4)} = 1.17, p = 0.88$ ) and gender distribution ( $\text{Chi}^2_{(1)} = 1.10, p = 0.32$ ). In addition, no differences were found between those that *had taught* using digital games and those that *had not taught* using digital games regarding their age group ( $\text{Chi}^2_{(4)} = 7.51, p = 0.11$ ) or gender distribution ( $\text{Chi}^2_{(1)} = 1.38, p = 0.24$ ).

### 3.2. Research Tools

The survey included open and closed questions; the latter were divided into several clusters:

- (1) Demographic questions—six items were asked about the demographic background of the participants: age, gender, sector association, college, and specialization.
- (2) Teacher knowledge level—Seven items estimated personal knowledge levels based on the TPACK model of the pre-service teachers themselves [39,40]; i.e., “I know how to choose online games that contribute to my students’ learning”; “I know how to teach integrated online games lessons in my field of teaching.”. Previous studies found the TPACK questionnaire valid for measuring teachers’ self-perceived technological competence in teaching and their knowledge in incorporating technology tools [41]. Studies showed high content validity for measuring the knowledge tested [42], and high face and content validity [43].
- (3) Attitudes—Eleven items asked about the attitudes of the pre-service teachers to use digital games for teaching and learning, e.g., “The use of digital games improves my teaching.” This questionnaire was developed specifically for the current research and its content and face validity was checked prior to the research by academic experts.
- (4) High-order thinking strategies—Thirteen items represented the importance of digital games in developing a variety of higher-order thinking strategies, including comparison, asking questions, representing knowledge, argumentation, and more. This questionnaire was developed specifically for the current research and its content and face validity was checked prior to the research by academic experts.
- (5) Cognitive level—Six items aimed at measuring attitudes toward digital games’ ability to develop higher and lower thinking levels according to Anderson and Krathwohl [44] taxonomy. Three items measured attitudes towards the ability of digital games to develop lower thinking levels, e.g., “remember” and three items measured attitudes towards the ability of digital games to develop high thinking levels, e.g., “create”. The questionnaire was developed for the current research.
- (6) Lifelong learning skills—Thirteen items asked about acquiring lifelong learning skills defined by the OECD [45], i.e., teamwork, problem-solving, and creative thinking. The questionnaire was developed and validated by [46] and had been found suitable for research.

All the close-ended items were on a 7-point Likert scale. For each construct, an average of the all the items was calculated. The internal reliability measured by Cronbach’s alpha presented in Table 1 is satisfactory.

**Table 1.** Correlation between perceived TPACK, attitudes about using digital games, and their influence on lifelong learning skills among all participants ( $n = 108$ ).

Dependent Variables	1	2	3	4	5	6	7	8
Attitudes (1)	0.67							
Knowledge (2)	0.33 ***	0.90						
Thought Processes (3)	0.41 ***	0.47 ***	0.81					
Ways of Working (4)	0.37 ***	0.40 ***	0.71 ***	0.70				
Life Skills (5)	0.38 ***	0.36 ***	0.78 ***	0.66 ***	0.64			
Tools (6)	0.22 ***	0.43 ***	0.59 ***	0.42 ***	0.43 ***	0.76		
Lower-order Thought (7)	0.36 ***	0.32 ***	0.59 ***	0.53 ***	0.53 ***	0.43 ***	0.74	
Higher-order Thought (8)	0.35 ***	0.34 ***	0.62 ***	0.49 ***	0.62 ***	0.39 ***	0.65 ***	0.84

Note: The reliability of research variables according to Cronbach’s alpha is presented on the diagonal. \*\*\*  $p < 0.001$ .

The survey also included eight open-ended questions allowing for descriptions of attempts to integrate digital games in teaching, including challenges faced and examples of lesson plans.

#### 4. Results

To answer the first research question, correlations were calculated for the study variables. Table 1 presents the correlations between the research variables: perceived TPACK, opinions about using digital games, and lifelong learning skills.

Table 1 shows positive correlations between the research variables. Higher technological-pedagogical variables correlate directly with higher results in opinions concerning digital games and their contribution to lifelong learning skill development.

The second and third research questions examined differences between pre-service teachers who *learned about* digital game integration and those who *had not*, as well as differences between pre-service teachers who had *taught* using digital game integration and those who *had not*. To answer these questions, nine 2-way ANOVA analyses were conducted concerning the relevant variables. Table 2 presents these analyses.

**Table 2.** Differences between pre-service teachers who learned or did not learn, and those who taught or had not taught using digital games, concerning perceived TPACK, attitudes about using digital games, and their influence on lifelong learning skills development.

Research Variables	Taught	Did Not Learn	Learned	Total	Main Effect-Learned F(1,104) (Eta <sup>2</sup> )	Main Effect-Taught F(1,104) (Eta <sup>2</sup> )	Interaction Effect F(1,104) (Eta <sup>2</sup> )
Attitudes	Did Not	3.19	3.67	3.53	7.65 ** (0.07)	14.98 *** (0.13)	5.41 * (0.05)
	Teach	(0.48)	(0.38)	(0.46)			
	Did Teach	3.77	3.81	3.80			
	Total	(0.44)	(0.45)	(0.45)			
Techno-pedagogical Knowledge	Did Not	2.88	3.41	3.25	3.99 * (0.04)	37.50 *** (0.27)	2.04 (0.02)
	Teach	(0.71)	(0.86)	(0.85)			
	Did Teach	4.04	4.13	4.10			
	Total	(0.54)	(0.65)	(0.63)			
Thought Processes	Did Not	3.55	3.84	3.76	0.52 (0.05)	9.42 ** (0.08)	3.22 ^ (0.03)
	Teach	(0.84)	(0.82)	(0.83)			
	Did Teach	4.08	3.95	3.99			
	Total	(0.49)	(0.73)	(0.67)			
Thought Processes	Did Not	4.23	4.54	4.45			
	Teach	(0.48)	(0.47)	(0.49)			
	Did Teach	4.17	4.30	4.26			
	Total	(0.48)	(0.66)	(0.61)			

Table 2. Cont.

Research Variables	Taught	Did Not Learn	Learned	Total	Main Effect-Learned F(1,104) (Eta <sup>2</sup> )	Main Effect-Taught F(1,104) (Eta <sup>2</sup> )	Interaction Effect F(1,104) (Eta <sup>2</sup> )
Ways of Working	Did Not Teach	3.75 (0.76)	3.65 (0.87)	3.67 (0.84)	0.37 (0.01)	13.69 *** (0.12)	1.58 (0.02)
	Did Teach	4.11 (0.54)	4.39 (0.59)	4.31 (0.59)			
	Total	3.96 (0.65)	4.09 (0.80)	4.05 (0.76)			
	Did Not Teach	3.88 (0.58)	3.76 (0.83)	3.80 (0.76)			
Lifelong Learning Skills	Did Teach	4.03 (0.78)	4.41 (0.69)	4.30 (0.73)	0.67 (0.01)	6.35 * (0.06)	2.61 (0.03)
	Total	3.97 (0.69)	4.15 (0.81)	4.10 (0.78)			
	Did Not Teach	4.27 (0.70)	4.37 (0.86)	4.34 (0.53)			
Tools	Did Teach	4.36 (0.48)	4.66 (0.54)	4.57 (0.53)	1.93 (0.02)	1.74 (0.02)	0.45 (0.01)
	Total	4.32 (0.57)	4.54 (0.69)	4.48 (0.66)			
	Did Not Teach	4.10 (0.57)	4.02 (0.64)	4.04 (0.61)			
Lower-order Thinking	Did Not Teach	4.10 (0.57)	4.02 (0.64)	4.04 (0.61)	2.17 (0.02)	5.45 * (0.05)	4.48 * (0.04)
	Did Teach	4.13 (0.53)	4.58 (0.56)	4.45 (0.59)			
	Total	4.12 (0.53)	4.36 (0.65)	4.29 (0.63)			
Higher-order Thinking	Did Not Teach	4.03 (0.74)	3.80 (0.80)	3.86 (0.78)	1.81 (0.02)	1.82 (0.02)	7.75 ** (0.07)
	Did Teach	3.80 (0.88)	4.46 (0.63)	4.27 (0.76)			
	Total	3.89 (0.82)	4.19 (0.77)	4.10 (0.79)			

<sup>^</sup>  $p < 0.1$ , \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

#### 4.1. Differences between the Pre-Service Teachers Who Had and Had Not Learned about Teaching with Digital Games

There was a significant difference in the attitudes toward the use of technology and in techno-pedagogical knowledge between pre-service teachers who had and those who had not learned about teaching with digital games. The pre-service teachers who did learn about the use of digital games in instruction displayed a more positive attitude towards the use of games and possessed more techno-pedagogical knowledge than those who had not learned.

There were no remarkable findings of other differences in variables between the pre-service teachers who did and did not learn about the use of digital games for instruction.

#### 4.2. Differences between the Pre-Service Teachers Who Had and Had Not Taught Their Subject Using Digital Games

The findings indicate many differences in several variables between pre-service teachers who had taught their subject matter through the use and development of digital games compared to those who had not. The pre-service teachers who had taught their subject matter using digital games self-reported positive attitudes, self-perception of high knowledge of techno-pedagogy, and a positive attitude toward the potential of digital games to cultivate lower-order thinking skills and to cultivate ways of working and lifelong skills.

Their attitudes contrast with those of the pre-service teachers who had not taught their subject through the development of digital games.

The findings reflect differences within the groups that believe that the integration of digital games can cultivate lower-level thinking. However, there were no differences detected in the group that believed that digital games can cultivate higher-level thinking.

#### 4.3. The Combined Influence of Learning about the Integration of Games and the Teaching of the Subject through Games

**Attitudes towards the use of digital games:** Our research indicates that the pre-service teachers who learned through the direct experience of using digital games displayed more positive attitudes toward their integration into the classroom, regardless of whether they had undergone a course on the topic. Pre-service teachers who took a course on the integration of games in education, but who did not themselves integrate games into their teaching, exhibited less positive attitudes than those who had learned through first-hand experience. Pre-service teachers who did not learn about education using digital games and did not teach themselves the topic displayed the most negative attitudes toward digital games' use.

**Lower- and higher-order thinking:** The pattern of interaction between learning the topic (as a student) and teaching it actively (pre-service teachers who taught using games) indicates that those who both learned and taught using digital games believed more strongly that integrating such games into learning facilitates the ability to practice both lower- and higher-level thinking compared to pre-service teachers who had learned but had not taught, those who had taught but not learned, and those who had neither learned nor taught. Regarding the fourth research question, all questions on the questionnaire were open-ended. Respondents who taught using digital tools were asked to comment on the advantages and challenges they faced when doing so. In order to gain a better understanding of how future teachers experienced the lesson, we isolated the description words. We then categorized them into two main themes, one focusing on the lesson climate and the other on cognitive factors. Lastly, we calculated the frequency of the descriptive words used to characterize the experience of the learners in the lessons in which the pre-service teachers integrated digital games, which resulted in the findings presented in Table 3.

**Table 3.** Frequency of words describing learners' positive experience in the integration of digital games.

Category	Words Used to Describe a Lesson that Integrated Games	Frequency of the Answers (64)	Percent
Classroom climate factors	Fun/experience/enjoyment	13	20.3
	Dynamism/enthusiasm/liveliness	11	17.2
	Motivation/willingness	10	15.6
	Participation/active learning	8	12.5
	Collaboration/group work	8	12.5
Cognitive factors	Curiosity/interest/light in their eyes	6	9.40
	Challenge/creativity	3	4.67
	Understanding	3	4.67
	demonstration/focus	3	4.67
	Independent learning	2	3.12

Table 3 shows that most of the words (87.5%) that the pre-service teachers chose to describe their experience relate to the classroom climate and a small number (12.5%) to the positive contribution to the cognitive factors in learning.

## 5. Summary and Discussion

The purpose of this study was to investigate the influence of elements of pre-service teacher training in order to learn about integrating digital games in teaching and practice



teaching, as well as the attitudes of pre-service teachers toward the connections between teaching with digital games and cognitive higher-order thinking and lifelong learning. A mixed method was used of quantitative together with a qualitative component that provided additional details.

### 5.1. Attitudes and Experience Regarding Digital Games

The experience of pre-service teachers in integrating digital games into subject matter teaching is more meaningful than learning about digital games in training or a course. Consistent with the study of [47], that sets the basics for the enhancement of experiential learning in higher education and suggest how it can be applied throughout the educational environment. Through direct experiences and personal meaning, learners construct their own knowledge. However, the combination of learning about the topic and applying it in their teaching showed the most positive influence on respondents' attitudes. This finding is supported by the qualitative analysis in which respondents used positive words to describe lessons integrating games (such as fun, motivating, and liveliness).

### 5.2. Techno-Pedagogical Knowledge

Pre-service teachers who took a course that specifically taught game integration reported a higher level of techno-pedagogical knowledge than those who did not. Similarly, pre-service teachers who incorporated digital games into their teaching reported higher levels of TPACK [39] than their counterparts who had not used these techniques. However, no association was found between teaching and learning about integrating games. Those who integrated games into their lessons showed higher techno-pedagogical knowledge regardless of learning about the subject or not. This may indicate that it is not necessary to both take a course and to teach it using digital games to obtain TPACK—either will suffice. Pre-service teachers who taught using games believed that they could design lessons and lead their colleagues in integrating digital games into their lessons and that they had the knowledge necessary to widely integrate digital games into teaching.

### 5.3. Lifelong Learning

There was a difference regarding the attitudes towards the ability of digital games to promote lifelong learning skills between those who had and had not taught using digital games. Those who had taught using digital games reported that they believed that the lifelong learning skills of their students improved as a result. The perception of the significance of teaching accompanied by digital games as promoting lifelong learning skills is essential for implementing those skills in the lessons, rendering the teaching visible [48]. Thus, a teacher who believes that digital games promote decision-making processes will dedicate time to teach pupils which digital platform is optimal for a game's purpose.

### 5.4. Lower- and Higher-Order Thinking

No significant differences were found in attitudes towards developing lower- and higher-order thinking skills between those who learned to incorporate digital games into teaching and those who did not. However, teachers who integrated digital games into their teaching reported that, while the games developed lower-order thinking skills, they did not necessarily contribute to the development of higher-order thinking skills. This finding should be interpreted with caution, as cross-sectional data present only a snapshot, versus demonstrating causality over time. Nevertheless, analyzing the pattern of interaction between learning and teaching revealed that those who both learned and taught believed more strongly that the use of games in learning develops higher- and lower-order thinking skills than did the pre-service teachers who had learned but not taught, taught but not learned, or neither.

Therefore, to encourage pre-service teachers to believe that digital games develop higher-order thinking skills, they need to learn how to incorporate games into teaching and have the opportunity to practice applying that knowledge [27,49].

In summary, the findings highlight the importance of pre-service teachers receiving training on how to incorporate digital games into their teaching practices. The findings further indicate that pre-service teachers should undergo general and specific training on how to use digital games as an effective teaching tool that promotes cognitive higher-order thinking and lifelong learning skills. As a result, improving cognitive higher-order thinking and lifelong learning skills will improve students' performance and learning outcomes.

Based on these findings, in order to assess the effectiveness of the training, it is recommended to conduct evaluation research and follow-up on how trained teachers integrate digital games during practicum and later as active teachers. To strengthen the required skills for optimal implementation, digital games should be integrated throughout the curriculum, including the clinical experience, and not just in one dedicated course. The establishment of professional learning communities that enable sharing of knowledge and experience between active teachers and teachers-in-training is advised.

## 6. Research Limitations

In this study, pre-service teachers expressed whether they would teach with digital games. Future research should investigate the extent to which the choice to undergo training creates a more positive attitude about integrating digital games into teaching among pre-service teachers. An experimental research paradigm, wherein the participants are divided into four groups, may result in a causative inference, deduction, or conclusion regarding the connection between the pre-service teachers' training and their attitudes regarding integrating digital games into instruction.

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Article

# Parents' Involvement in Choosing Extracurricular Sports Activities: A Gendered Perspective from Israel

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**Abstract:** This study explores the multifaceted motivations behind parental decisions to enroll their children in organized sports, with a focus on how these decisions intersect with gender norms and values. Through qualitative interviews with mothers and fathers in Israel, this research uncovers a complex interplay between societal expectations, personal values, and the gender identities of both parents and children. A thematic analysis of the interviews revealed that despite a societal shift towards more gender-neutral perspectives, traditional gender roles persist, particularly in the attitudes of fathers towards the sports participation of their sons. This research identifies a paradox where girls are encouraged to participate in a broader range of sports, including those traditionally viewed as masculine, while boys face more restrictions, particularly against engaging in sports perceived as feminine. Mothers generally exhibit more flexibility in challenging gender norms, suggesting the potential for gradual change in future generations. This study's findings contribute to the understanding of how parental guidance shapes children's sports involvement and the perpetuation or challenging of gender norms within this context. Future research could benefit from a broader, more diverse sample and a mixed-methods approach to enhance generalizability and reduce potential biases.

**Keywords:** parental guidance; gender norms; sports participation; children; societal expectations

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## 1. Introduction

Selecting extracurricular sports for children involves a complex interplay of societal norms, cultural traditions, and gender roles, as supported by prior studies [1,2]. Gender, as a social construct, often acts as a determinant in these choices, influenced by societal and cultural narratives [3,4]. While there is abundant research on the topic, there is a noticeable gap in studies that examine this issue through both a gendered and a cultural lens. The current study aims to address this by focusing on Israel, a society characterized by a unique blend of traditional and modern elements [5,6]. To achieve this, this study poses two main questions: first, are parents willing to enroll their children in sports clubs traditionally associated with the opposite gender, and second, are there gender differences between fathers and mothers in their sports enrolment preferences? By delving into these questions, we seek not only to fill a gap in the existing literature, but also to offer practical implications for policy makers and educators interested in promoting more inclusive sports programs.

### 1.1. The Developmental Impact of Extracurricular Activities on Children

Childhood and adolescence are pivotal developmental stages characterized by profound changes both physically and mentally. Extracurricular activities, particularly sports, are instrumental in shaping children's characters, instilling values, and promoting physical well-being [7]. These activities cultivate essential life skills such as teamwork, resilience, and

the pursuit of excellence [8]. Empirical evidence supports that active engagement in sports activities not only improves cognitive functions, but also enhances academic achievements, emotional stability, and overall physical health [9]. Moreover, involvement in athletics is linked to positive peer relationships and heightened self-esteem, which, in turn, lead to improved academic performance and a more enriching school experience [10–12].

Parents serve as critical agents in their children’s initiation into sports [13]. Their role extends beyond mere facilitators; they are influencers and primary decision-makers [14,15]. Choosing a sport that aligns with a child’s interests, physical capabilities, future opportunities, and temperament is a complex task that often falls on the parents. This complexity arises from the need to balance societal expectations, cultural norms, and their own aspirations [16,17]. Gender norms, deeply ingrained in cultural narratives, considerably influence these parental decisions. As a result, parents frequently find themselves navigating traditional gender roles and societal views on what are deemed appropriate sports for boys versus girls, adding layers of complexity to an already intricate decision-making process [18].

### *1.2. The Gendered Lens of Sports Selection—Tradition vs. Modernism: A Cultural Perspective*

The way society labels sports as either ‘masculine’ or ‘feminine’ has a profound influence on children’s athletic choices and their psychological well-being [3,4]. Such gender categorizations do not just act as labels; they also guide parents in selecting what they consider to be ‘gender-appropriate’ sports for their children [19]. As we understand the limitations set by these gender-based categories, it is crucial to delve into another significant influencer: the role of parents in these selections. Parents frequently nudge their children towards sports that conform to societal gender roles. This trend is not confined to family decisions alone; it is further perpetuated by educational institutions and community centers, which often present a more limited set of options to girls compared to boys [19]. These choices are not made in isolation; they are heavily influenced by the cultural settings in which they occur, especially when the focus shifts to the limited sports options for girls.

In countries with traditional value systems like India, prevailing cultural narratives often act as deterrents to girls’ active participation in sports. However, some parents buck this trend, encouraging their daughters to take part in sports and thereby helping them break free from these societal limitations [20]. It is worth noting that even in societies known for their progressive stances, similar gender-based disparities in sports selection exist. In seemingly progressive Western societies, such as Scandinavia, parents’ attitudes continue to sustain gender-based disparities in sports activities [21]. Particularly conservative parents may even discourage their daughters from participating in sports considered ‘masculine’, raising concerns about how such participation could affect their femininity and physical appearance [22].

### *1.3. Parental Gender Differences in Sports Preferences*

Parental attitudes towards children’s participation in sports are notably influenced by gendered perceptions, often aligning with traditional roles [23]. Fathers are frequently oriented towards the competitive aspects, viewing sports as a medium for teaching discipline and life skills [24]. Mothers, conversely, prioritize the health and emotional well-being of their children, focusing on sports as a platform for physical fitness and social development [25]. These generalized roles, however, are not universally applicable and can be influenced by various factors, including culture, socio-economic status, and individual beliefs [26]. Recent societal shifts towards more egalitarian gender roles have also been found to result in more balanced parental approaches to children’s sports involvement [27].

### *1.4. The Israeli Tapestry: Navigating Multifaceted Influences in Sports Selection*

Israel presents a dynamic sociocultural tapestry that deeply influences the process of sports selection [28,29]. For instance, while soccer enjoys widespread popularity across various Israeli demographics, the choice to enroll a child in Krav Maga—a martial art of

Israeli origin—might stem from a blend of national pride, a sense of self-defense, and community encouragement [30]. Parental choices are shaped not only by religious directives, but also by community norms and the influx of contemporary global perspectives. Different regions within Israel, characterized by their unique cultural nuances, further diversify the spectrum of sports preferences. Consequently, Israeli parents grapple with the intricate task of harmonizing tradition with modernity and aligning community norms with individual desires. This study delves into this intricate context, offering insights into the multifarious factors Israeli parents consider when selecting extracurricular sports for their children. Israel was chosen as a case study as it is a microcosm that juxtaposes tradition and modernization, offering a unique vantage point for understanding how these complex cultural dynamics influence parents' decisions in selecting extracurricular sports activities for their children [31].

### *1.5. Study Objectives and Research Questions*

To gain an in-depth understanding of the complex factors influencing parental choices in the selection of extracurricular sports activities for children in Israel—a culture that blends both traditional and modern influences—this study adopted a qualitative research methodology. Semi-structured interviews served as the primary method of data collection, facilitating the capture of comprehensive perspectives and experiential narratives from Israeli parents. These interviews aimed to elucidate not only the explicit rationales underpinning such decisions, but also the subtle societal and psychological factors that might not be immediately apparent.

The acquired qualitative data were subsequently subjected to thematic analysis to discern patterns and latent motivations. The objective was to construct an exhaustive understanding of the multifaceted societal, cultural, and psychological elements that factor into parents' decision-making processes. The current study has two main goals: firstly, to examine gender perceptions regarding children's enrolment in sports clubs, specifically, the parents' willingness to encourage or allow children to participate in activities associated with the opposite gender; and secondly, to explore the differences in gender perceptions between mothers and fathers regarding preferences for enrolment and participation in organized sports activities.

## **2. Methods**

This research was conducted within a qualitative philosophical paradigm, focusing on the nuanced social and cultural determinants shaping parental gender perceptions toward their children's participation in after-school sports clubs. The study's objectives were to delve into the motivations behind parents' decisions to enroll their children in these activities, assess the impact of gender perceptions on such choices, and discern any potential differences between mothers' and fathers' viewpoints.

### *Research Participants and Procedure*

This study engaged a purposive sample of 30 parents, comprising an equal distribution of 15 mothers and 15 fathers, whose ages ranged from 27 to 45 years. Table 1 provides a list of study participants, along with the mean age and gender of their children and their sports involvement. Initial recruitment capitalized on the research team's networks, with subsequent participants identified through snowball sampling. Ethical approval was secured from the institutional review board, and participant consent was obtained and documented, aligning with the ethical principles delineated by the American Psychological Association [32].

**Table 1.** Demographic data of participants.

Mothers	Fathers
Sally—mother of 2 daughters aged 10 (floor gymnastics and hip-hop) and 6 (floor gymnastics and classical ballet).	William—father to a 16-year-old daughter—combat training instructor; a 13-year-old son—robotics; and a 10-year-old daughter—dance.
Aily—mother of 4 sons aged 15, 12, 10, and 8 (all in basketball) and 2 daughters aged 13 (adventure climbing) and 5 (not participating in a club).	Mike—father to an 18-year-old son (football) and a 16.5-year-old daughter (swimming).
Tammi—mother to a 6-year-old son (football).	Greg—father to daughters aged 8, 6, and 4 (all in horseback riding clubs).
Linn—mother to a 6-year-old son (swimming and capoeira).	Gil—father to a 19-year-old son, 16-year-old daughter, and 13-year-old daughter (all in tennis clubs).
Emily—mother of 3 (a 21-year-old daughter—sports instructor; a 20-year-old son—soldier; a 10-year-old daughter—dance club).	Sam—father of 2 daughters aged 10 and 6 (floor gymnastics and dance).
Lucy—mother of a 13-year-old son, 11-year-old daughter, and 6-year-old son (all in basketball club).	Eric—father to a 15-year-old daughter (gymnastics and fitness club); an 11-year-old daughter (dance); and a 7-year-old daughter (non-sport club).
Grace—mother of a 12-year-old daughter (basketball), 10-year-old son (football), and an 8-year-old daughter (dance).	Michael—father to sons aged 16 and 12 (football).
Alex—mother to a 15-year-old son and a 12-year-old son (basketball and boxing); a 7-year-old son (boxing); and a 6-year-old daughter (dance).	Guy—father to an 18-year-old son (basketball) and a 15-year-old daughter (dance).
Sophia—mother to a 15-year-old daughter (basketball); a 13-year-old daughter (floor gymnastics); a 9-year-old son (football); and an 8-year-old son (football and ballroom dancing).	Phil—father to a 16-year-old daughter, a 13-year-old son (football), and a 6-year-old daughter (dance).
Emma—mother of 2 daughters aged 16 and 14 (both in dance).	Joe—father of 3 daughters aged 6 years (acrobatics and hip-hop), 2.5 years, and a 1 month.
Milly—mother of 3: a 16-year-old daughter (volleyball); a 14-year-old daughter (swimming and surfing); and an 11-year-old son (karate).	Micha—father to a 10-year-old son (karate).
Gail—mother to 2 daughters aged 12 and 10 (both in floor gymnastics and apparatus).	Rick—father to a 17-year-old daughter (self-defense).
Betty—mother to 2 daughters aged 17 and 16 (dance and horseback riding).	Ben—father to an 8-year-old son and a 10-year-old daughter (both in ballet clubs).
Anna—mother of 3: a 15-year-old son (swimming) and two daughters: 12-year-old (floor gymnastics) and 10-year-old (capoeira).	Bob—father to a 6-year-old daughter (dance).
Jessy—mother to an 11-year-old son (Jiu-Jitsu) and a 9-year-old son (football).	John—father to an 18-year-old son (basketball) and daughters aged 10 and 14 who do not participate in clubs.

Data were gathered through semi-structured interviews, aligned with theoretical underpinnings of gender perception and socialization [33–35]. Interviews were orchestrated by experienced social science researchers at convenient times during the children’s sports



club activities, lasting between 30 and 45 min each. All interviews were audio-recorded and transcribed verbatim for subsequent analysis.

The collected data were subjected to a reflexive thematic analysis, adhering to the guidelines set forth by [36]. The first stage involved an independent reading of the interview transcriptions by two researchers, both well-versed in the theoretical frameworks pertinent to our study. This was followed by the identification of sub-themes, including 'gender rigidity', 'motives for activity', and 'gender differences'. These sub-themes were reflective of the intricate narratives related to autonomy, competence, and relatedness, alongside psychological flexibility and value-based action, which were core to our interpretative analysis within the constructionist paradigm [36,37]. These sub-themes were then grouped into three main themes: perceptions concerning the motives and objectives behind the activities, limitations imposed by gender perceptions on the choices available for boys and girls, and differing perspectives between mothers and fathers. A comparative review of the identified themes by the two initial researchers, who followed inter-coder reliability guidelines [38], showed no significant disagreements. To further validate these findings, a third researcher conducted an independent analysis, achieving a Cohen's kappa coefficient of 0.74, indicating a reasonably good level of agreement [39].

In pursuit of methodological rigor, this study employed a multifaceted approach to validation that adhered to established academic standards, incorporating a relativist orientation and a reflective practice to ensure credibility [40,41]. Notably, member reflections, rather than member checking, served as a cornerstone strategy, wherein participants were invited to engage in discussions about the research findings, enhancing mutual understanding and fostering dialogue [42]. Complementing this, iterative questioning was pivotal during the interview process, allowing the researchers to refine and deepen lines of inquiry in response to participant feedback, thereby capturing a richer understanding of the subject matter [43]. This dynamic and responsive approach to data collection underscored the study's adaptability and thoroughness, ensuring the alignment of our research with the intricate dynamics between participants and researchers [40].

### 3. Findings

The current research identifies three distinct themes that collectively paint a comprehensive picture of gender perceptions in non-formal sports activities among children and adolescents. The first theme, motivation and activity goals, highlights a discrepancy between parents' attitudes towards the gender-specific nature of these activities and the individual goals they aspire for their children to achieve. Interestingly, these goals—whether related to personal development, skill acquisition, or social benefits—are not influenced by gender distinctions, nor do they have an impact on existing gender perceptions. This nuance is further elaborated upon in both the varying attitudes among parents, as discussed in the second theme, Limitation of Choice and Gender Perceptions. Finally, how these attitudes correlate with their children's experiences is the focus of the third theme, Parental Guidance and Gender Norms.

#### 3.1. Motivation and Activity Goals

From the interviews, parents identify a broad spectrum of motivations for their children's engagement in physical activities within the framework of non-formal education settings. These motivations fall under three primary categories: physical benefits, social benefits, and personal benefits. Some of these goals not only relate to the children, but also echo the personal aspirations of the parents. These were, however, framed as objectives set for their children and are discussed in that context.

The most frequently cited goal by parents, both mothers and fathers alike, pertains to the potential benefits of the activity for their children's health and physical well-being. This includes aspects like body strengthening, weight management, discouraging a sedentary lifestyle, and fostering a habit of regular, effective physical activity. While most interviewees mentioned these aspects, some mothers specifically emphasized that they want their

daughters to maintain a healthy weight, contrasting it with their own experiences. For instance, Sally states “I want to prevent my daughter from gaining excessive weight. I don’t want her to undergo the challenges I faced at her age and continue to face”.

Another common motivator revolves around enhancing the children’s personal image and boosting their self-confidence. Parents focused on two dimensions: The first relates to improvements in physical appearance or shifts in body perception due to enhanced physical capabilities. The second aspect is oriented towards social and self-perception. For instance, Gil remarks “To instill in them a sense of capability, to provide an environment for growth, and to enable them to confront and overcome challenges. Success in these areas is fundamentally contingent on sound judgment and effective management”. It is important to note that sports, especially competitive ones, also present the risk of failure and consequent damage to self-esteem. However, this concern was notably absent in the participants’ responses, suggesting either a lack of awareness or a strong belief in their child’s potential and the supportive role of the sporting environment.

Another motivation cited by parents is the social enrichment derived from participating in these activities. Notably, even if the child is involved in individual sports such as athletics or climbing, these often occur in a group setting. While the research did not delve into the dynamics of internal competition within sports teams, this topic was also notably absent from the responses of the interviewees. Across the board, parents highlighted the valuable social interactions that occur in these settings. In this regard, there was no discernible difference in attitudes between parents of sons and daughters, or between mothers and fathers. It appears that all parents generally appreciate the genuine social encounters facilitated by these sports clubs.

The motives parents articulated also extended to the promotion of achievement as a vehicle for empowerment and personal development. For example, Micha says “My son has grown immensely in the club. His self-esteem has risen, and he experiences a sense of accomplishment and satisfaction. I see the sport as a stepping stone for future successes. Even when failure occurs, it becomes an opportunity for further growth”. Anna focuses on personal development, stating “It’s more than just an activity; it’s a lifestyle, a heightened awareness, and a nurturing environment. All these factors give the child the security to take on subsequent challenges. There is a continuous developmental journey that meets specific needs at every stage”. Parents seem to view the improvement in social and psychological aspects as a foundational step for realizing their children’s potential.

The final significant motive that emerged centers on the alignment of the selected activity with the parents’ own values and personal experiences in sports. For instance, Aily outlines three key values that her family’s involvement in a basketball club fulfills. First, due to their traditional lifestyle which precludes Saturday activities, basketball becomes a more viable long-term option than soccer. Second, she values physical fitness and skill development, which align directly with participation in sports. Third, she appreciates that the sport exposes her son to diverse social groups and languages in Israel, particularly since the activities are organized by a regional council with a varied population.

It is worth noting that various values, such as discipline, independence, and group belonging, were cited by parents, adding another layer to their motivations. Some parents even saw their children’s activities as a continuation of their own athletic history or as an opportunity for their children to succeed where they could not. Interestingly, some responses implied that these might be the aspirations of other parents, rather than their own, an observation that could have implications for the perpetuation of gender-specific perceptions of certain sports.

Contrary to what one might expect, parents did not report significant gender differences in their motives for enrolling their sons or daughters in these activities. There was no specific focus on encouraging traits considered masculine in sons, such as competitiveness, or traits considered feminine in daughters, such as grace or aesthetics. Even in the social context, despite the perception of sports as a traditionally masculine domain, there were no significant differences in views about the social benefits of sports clubs.

### 3.2. *Limitation of Choice and Gender Perceptions*

The interviews revealed that children's choices for extracurricular activities generally stem from five main sources. First, some children develop a preference for specific activities through early exposure via television or personal experiences in early childhood settings. This influence does not necessarily display distinct gender preferences but can create initial leanings towards certain activities. Second, peer groups often exert social pressures, which may sometimes reinforce traditional gender roles in sports selection, though this varies from case to case. Third, choices can be made after engaging in trial sessions across various sports, offering a more experimental approach to selection. Fourth, geographical considerations, especially for those living in more peripheral areas, can limit the range of available options. It remains an open question whether such limitations tend to reinforce traditional gender roles due to a lack of diverse choices.

Lastly, parental guidance frequently emerges as the most influential factor, particularly as most children start sports activities between the ages of 5 and 8, a period when external influences are relatively minor compared to parental guidance. While parents' influence is strong, it is not yet clear how this correlates with traditional gender perceptions. Do parents guide children towards activities that align with traditional gender roles, or are choices becoming increasingly neutral? The importance of each factor varies by individual circumstance, but parental guidance seems to hold the most sway, potentially setting the stage for reinforcing or challenging traditional gender perceptions in sports.

These research findings illuminate the nuanced ways parental guidance shapes children's involvement in sports, often reinforcing traditional gender norms. Several key sub-themes emerge within this context. Firstly, collective registration plays a pivotal role in shaping these early choices. As John, a father of two boys and a girl, succinctly puts it, "For me, I didn't think about it; all the boys registered for soccer at the community center, and I also registered my son". Emily, a mother, echoes this sentiment: "My daughter is in a ballet class. In my opinion, it was early, but all the girls in her kindergarten registered. Why wouldn't I register her as well?".

These comments reveal that the initial selection of an activity often aligns with a broader social consensus rather than individual preference. For young children, peer influence becomes a significant factor; they are likely to follow their classmates, reinforcing gender-specific trends. Secondly, parents often tailor activities to align with their own perceptions of gender-appropriate sports. In this vein, Michael observes: "There are male sports and there are female sports. Physical contact might be the distinguishing factor. Soccer and basketball, for example, are masculine because they involve confrontations. Volleyball may attract more females because it is less confrontational, while swimming seems gender-neutral".

### 3.3. *Parental Guidance and Gender Norms*

By underscoring the weight of parental guidance and the significance of collective decision-making, these findings provide a lens through which we can scrutinize the perpetuation of gender norms in youth sports. While the prevailing approach among parents suggests a preference for gender-conforming sports, a nuanced divergence is observed in attitudes toward sons and daughters. The data indicate that girls are more likely to venture outside traditional gender norms by engaging in sports often categorized as masculine, such as soccer, basketball, or judo. Conversely, boys seem less inclined to participate in activities commonly perceived as feminine, such as gymnastics, volleyball, or dance forms like ballet, jazz, or modern dance.

William, a father of both boys and girls, shared his perspective: "If my son wanted to enroll in a dance class, that's fine by me. But the idea never originated from him, nor did I propose it". He added "Soccer has always been his passion, making it the obvious choice for everyone".

Sophia chimed in: “We have an open-minded approach. My daughter Emily expressed interest in joining a soccer class at the community center, and she has been attending for six months now, thoroughly enjoying herself”.

Emma, a mother of two daughters and a son, echoed these sentiments: “I hold no gender-specific reservations when it comes to my children’s involvement in sports. My daughters participate in triathlons, which some might label as a male-dominated sport. They excel in cycling, swimming, and running, and compete nationwide throughout the year. We couldn’t be more supportive”.

Parents maintain accepted social perceptions in which men are subject to more criticism than women for adopting the behavior and appearance of the opposite gender. One of the interviewees even explicitly stated this in relation to clothing, saying that there is no clothing that is exclusively masculine. In other words, there is nothing a woman could wear that would be considered a significant breach of accepted perceptions. On the other hand, clothing such as dresses, skirts, or even bodysuits are considered feminine and therefore not acceptable for men.

Societal norms shape parental attitudes in gender-specific ways, with men often facing harsher scrutiny than women for breaking gender norms, particularly in attire. As one respondent explicitly stated, “There’s no such thing as ‘men-only’ clothing, meaning a woman wouldn’t be considered to be breaking any norms based on her clothing choices. In contrast, dresses and skirts are labelled as ‘feminine’, making them socially unacceptable for men”.

Given these norms, it appears that parents may be more willing to let their daughters explore outside traditional gender roles than their sons. As far as athletic pursuits are concerned, the intent to uphold these norms exists despite the universal motivations for sports participation, which do not inherently differ by gender. In essence, daughters are subtly encouraged to believe they can pursue the same activities as sons, but the reverse is rarely promoted.

This inclination to challenge or uphold gender norms also seems influenced by the parents’ own gender identity. According to the findings, fathers displayed greater cognitive rigidity than mothers when it came to selecting sports for their children. Mike, a father to children of both genders, said “As far as I’m concerned, the choices are pretty clear-cut in terms of gender. If one of my sons wanted to take ballet, I’d be like, ‘What? That’s unimaginable; my sons are men!’”.

Likewise, Alex reinforced traditional gender roles, stating “My sons made their own choices, but those choices also happen to be what I’d consider natural”.

In contrast, Lucy responded to her husband’s rigid stance by saying “My husband would never approve of our son taking a jazz dance class. He just couldn’t accept it”.

Mothers, however, seemed to take a more flexible approach. Sarah, a mother of two daughters, said “Gender doesn’t factor into our decisions regarding sports selection. What really matters is what my daughter wants to do”. She added “It’s time to break free from these pointless stereotypes. Who says soccer is just for boys? Look around; there are all-girl teams everywhere”.

Similarly, Emily emphasized the irrelevance of societal norms, stating “Sports are for everyone, regardless of gender”.

The second theme posits that societal constraints on breaking gender boundaries may disproportionately affect men. This not only shapes how fathers guide their children, but also reflects their own adherence to social norms. Fathers, perhaps more sensitive to social repercussions, tend to be more conservative in their views—not only toward their sons, but also their daughters. Conversely, mothers often enjoy a degree of latitude when it comes to gender norms, a freedom they are more willing to extend to their children. While they may be generally more open than fathers in this regard, it is noteworthy that they, too, tend to lean more toward flexibility for their daughters than for their sons.

#### **4. Discussion**

Sports and physical activities have long been acknowledged for their comprehensive contributions to emotional well-being, physical health, and the cultivation of social skills among youth. This recognition has led a substantial number of parents to pursue organized sports programs for their children outside the educational provisions of schools. Echoing and extending previous research [7,8] this study has illuminated a spectrum of parental motivations for involving their children in organized sports and the multifaceted benefits they perceive as a result. The intricate and personal narratives of the participants of this study have enriched our understanding of these motivations.

The scholarly literature offers details of the contrast in how fathers and mothers perceive their children's participation in sports, revealing distinct differences in the anticipated benefits of such activities. Fathers tend to regard sports as a means to cultivate competitiveness and discipline in their children [24], whereas mothers are more likely to highlight the roles of sports in promoting physical health and social skills [25]. Our research adds complexity to this dichotomy by identifying a shift towards more unified parental perspectives, implying a movement toward the intersection of traditional gender-specific motivations. Recent investigations into parental motives for enrolling their children in sports underscore the relevance of a constellation of factors—socioeconomic conditions, personal belief systems, and cultural nuances [26]. Additionally, the fluidity of gender roles within contemporary family structures is increasingly influential in how children's sports participation is shaped [44]. Understanding these evolving parental impulses is imperative, as they can profoundly impact child development and the dynamics within families.

When we situate our study within the broader spectrum of research, the evolving landscape of gender norms in both society and family units becomes prominent. Coakley [45] suggests that large-scale societal transformations are often reflected in the microcosm of the family. Yet our research uncovers a more intricate dynamic: although societal shifts influence family practices, a perceptible adherence to traditional gender roles persists, particularly among fathers. This complexity prompts an examination of the degree to which family units mirror or resist societal movements toward the liberalization of gender norms.

Comparative studies across cultures further elucidate that while some parental motives and perceptions regarding their children's participation in sports are widespread, they are also shaped by unique cultural and socioeconomic factors. Investigations from regions like Australia and Portugal [46,47] demonstrate how parental views are sculpted by these influences, underscoring the imperative of cultural awareness in addressing the manifestations of gender norms within the arena of sports. Our investigation delves into the persistent gender-based views shaping parental decisions in enrolling their children in sports clubs. Despite acknowledging the universally beneficial aspects of sports participation, societal conventions continue to assign particular sports to specific genders. Parents, therefore, are tasked with promoting their children's engagement in sports for its inherent advantages while also maneuvering through the maze of societal expectations and their children's personal preferences. This situation demands a critical approach to challenging and dismantling the deep-seated gender stereotypes entrenched in our culture [18].

Our study also presents a salient paradox: societal gender perceptions appear to guide the selection of sports, yet a contrary trend emerges when it comes to participation restrictions. Girls, historically limited to a narrow range of "appropriate" sports, are surprisingly afforded fewer parental constraints on their sporting endeavors [19]. In settings where sports are typically gender-segregated, such as in Israel, parents display a readiness to sign up their daughters for a wide variety of sports, including co-ed and contact sports like soccer or rugby. Boys, in contrast, may face discouragement from participating in sports that are deemed culturally feminine. This contrast raises two points for consideration. Firstly, the historical underrepresentation of girls in sports might prompt parents to support any athletic pursuit their daughters show interest in, potentially bypassing any traditional limitations. Secondly, the social permissiveness regarding girls crossing traditional gender boundaries in sports does not seem to extend to boys, suggesting an imbalance in societal

tolerance that could mitigate the challenges boys confront when they step outside these traditional roles.

It is feasible to deduce two reasons from this contradiction. Firstly, considering the traditionally lower rates of sports engagement among girls, parents might be inclined to support any athletic interest their daughters demonstrate, intentionally laying aside any preconceived constraints. On the flip side, boys, who are generally more inclined towards sports provide parents with the opportunity to channel their participation towards sports that align with traditional masculine norms [18]. Secondly, society tends to be more permissive of girls transgressing traditional gender boundaries in sports than it is of boys, suggesting a societal tolerance imbalance that might act to offset the repercussions boys face for defying these norms.

To conclude, our research highlights a gradual societal shift towards relaxing traditional gender norms in the realm of sports. However, it also demonstrates how parents—fathers in particular—frequently uphold conventional gender expectations, especially with regard to their sons, which is a reflection of their own views on gender roles. Traditionally, fathers have taken a more conservative approach than mothers, more stringently reinforcing established gender distinctions. Mothers, on the other hand, are typically viewed as being more liberal. As mothers become more influential in decisions about sports participation and as women’s autonomy continues to rise, there is a greater possibility for the ongoing attenuation of gender-specific roles for future generations.

## **5. Limitations and Future Research**

This study, while methodologically thorough, is not without its limitations. The choice of purposive and snowball sampling, although common in qualitative research, is susceptible to selection bias. To address this, future research might consider using a more diverse range of sampling techniques, such as stratified sampling, to ensure a broader representation of parental perspectives. This non-random sampling method constrains the external validity of the results, as the sample might not encapsulate the diversity of the entire parent demographic. Expanding the recruitment to a wider demographic through various channels could mitigate this limitation.

The initial recruitment through the researchers’ networks might amplify this effect, favoring a more homogenized sample reflective of the researchers’ immediate social milieu. The semi-structured interviews, while beneficial for deriving deep insights, are vulnerable to interviewer influence, potentially skewing responses towards social desirability. In future studies, implementing structured interviews or anonymous surveys could help in reducing this potential bias. Furthermore, the application of reflexive thematic analysis, despite stringent inter-coder reliability checks, cannot completely neutralize the subjectivity that accompanies qualitative analysis. Incorporating quantitative measures alongside qualitative analysis could provide a more balanced view and help validate the findings.

For future inquiries, a mixed-methods approach or a quantitative study on a broader scale could offer enhanced generalizability. Incorporating a larger and more diverse sample, possibly through national surveys or longitudinal studies, would provide a deeper understanding of the trends and patterns in parental attitudes towards children’s sports participation. Employing a randomized sampling strategy would mitigate selection biases and afford a more representative snapshot of parental attitudes. A more inclusive participant demographic could provide a richer tapestry of perspectives. Utilizing different recruitment channels, such as schools, sports clubs, and online parenting forums, could also contribute to this diversity. Additionally, implementing varied recruitment techniques to reach beyond the researchers’ networks could bring forth a more diverse array of insights. Further methodological enhancements, like using multiple data sources and triangulating findings with existing literature, would add robustness to the research. Introducing further methodological safeguards, such as data triangulation and employing multiple interviewers for cross-comparison, could reduce potential biases in data collection and analysis.

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Article

# Beyond the Game: The Influence of Varying Degrees of Sports Involvement on College Students' Self-Perceptions and Institutional Affiliation

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**Abstract:** This research investigates the impact of varying levels of sports participation on college students' self-perception and their sense of connection to their educational institution, with a specific focus on an Israeli context. Recognizing the gap in the existing literature regarding the nuanced effects of different degrees of sports engagement, this study aims to offer insights into how sports involvement shapes students' academic, social, and psychological experiences. Utilizing a qualitative approach, the research involved conducting 26 semi-structured interviews with undergraduate students from a northern Israeli college, encompassing a diverse range of sports participation levels, from occasional involvement to committed varsity athletes. The findings reveal that sports participation significantly enhances students' perceptions of their academic and social abilities, fosters a sense of belonging to the institution, and cultivates institutional pride, regardless of the level of involvement. Particularly noteworthy is the positive correlation between sports engagement and heightened self-esteem and self-efficacy. This study contributes to the understanding of the broader impacts of sports in higher education, highlighting its role in personal development and institutional affiliation. The research underscores the need for further studies in varied cultural contexts to deepen the understanding of these dynamics. Additionally, the study's focus on an Israeli sample provides a unique perspective on the role of sports in a culture where collegiate sports are less academically explored. This research serves as a stepping stone for future quantitative investigations to objectively measure and enhance the understanding of the relationship between sports participation and student development in higher education.

**Keywords:** sports participation; college students; self-perception; institutional pride; higher education; student development

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## 1. Introduction

The transformative college years offer myriad opportunities for young adults. Among these, sports participation emerges as a significant and multifaceted experience. While sports culture varies across countries, it remains an essential aspect of university life, providing opportunities for physical, emotional, and social development [1,2]. The existing literature has highlighted the positive impacts of sports participation on academic performance, social integration, and mental well-being [3]. However, there is a gap in understanding how varying degrees of sports involvement influence college students' perceptions and experiences, particularly regarding school identity, self-efficacy, and institutional affiliation [2,4]. This study, focusing on an Israeli sample, aims to fill this gap and potentially provide insights applicable to a broader context.

Unlike previous studies primarily focused on the general effects of sports participation [5], this research delves into the nuanced impacts of varying degrees of sports involvement on college students' attitudes toward their university experience. Our study considers unique cultural elements and the role of sports within universities, exploring

the formation of social connections, overall satisfaction, and perceived academic abilities among students engaged in different levels of sports participation [6,7]. Additionally, we examine the role of sports involvement in fostering institutional pride and a sense of belonging within the university community [8]. We also investigate how the cultural significance of sports, local traditions, and the university's role in promoting sports engagement influence students' identification with their institutions, including the impact of distinct features associated with varsity sports [9,10]. Given its diversified cultural and sports landscape, the Israeli context provides a rich backdrop for this investigation.

## **2. Defining College Sports Participation and Its Forms**

College sports participation is a multifaceted concept encompassing a range of physical activities in which students engage within their university environment. These activities typically fall into two categories: occasional sports participation, such as engagement in intramural or club sports, and the highest level of involvement—playing varsity sports as part of the college's teams [9]. Occasional sports participation often involves less commitment and offers students an opportunity to engage in physical pursuits in a less competitive, more inclusive environment [11]. These activities provide diverse benefits, including physical health enhancement, social interaction facilitation, and potential improvement in academic performance through refined time management skills and discipline [12].

In contrast, playing varsity sports represents the highest level of sports involvement. It entails a substantial commitment to a particular sport, often under the aegis of the college's official teams. Varsity athletes adhere to rigorous training schedules, compete regularly against other universities, and may receive sports scholarships, potentially providing a more competitive and high-profile sports experience [13]. This heightened level of engagement often leads students to identify strongly with their athletic roles, significantly influencing their academic, social, and personal experiences [14].

## **3. Social, Psychological, and Well-Being Outcomes of College Sports Involvement**

The literature has consistently emphasized the significant impact of sports participation on social, psychological, and well-being outcomes among college students. Sports involvement fosters enhanced social integration by encouraging interaction, teamwork, and a sense of purpose, thus cultivating a sense of belonging and cohesion within the college environment [15,16]. From a psychological standpoint, sports participation is positively correlated with increased self-confidence and enhanced time management skills [17,18]. Soulard and colleagues [19] provide evidence that student athletes generally display higher levels of self-confidence compared to their non-athlete peers.

Additionally, the structured nature of sports activities necessitates the development of efficient time management skills, a critical component for balancing academic and non-academic responsibilities [20,21]. In terms of overall well-being, sports involvement has been linked to improved mental health outcomes, with students reporting lower stress levels, fewer depressive symptoms, and generally improved mental health [22]. This aspect may be particularly significant within the cultural context of Israel, where mental well-being and holistic development are highly valued [23,24].

## **4. Institutional Loyalty and Belonging: The Role of College Sports Participation**

The relationship between college sports participation and students' sense of institutional loyalty and belonging has attracted significant academic attention. As an integral part of college culture, sports profoundly shape students' emotional bonds and overall experiences with their institutions [25]. Substantial research, including that of Hausmann, Schofield, and Woods [26], supports the idea that involvement in sports nurtures a deep sense of belonging among college students. Students who actively participate in sports or are members of athletic teams typically experience heightened feelings of connection to their universities. Furthermore, sports involvement has been associated with increased institutional loyalty. Students who are deeply engaged in college sports often demonstrate

higher levels of loyalty, a sentiment likely rooted in their strong identification with the university—a bond that is strengthened through their participation in sports [27].

### **5. College Sports Participation and Self-Esteem and Self-Efficacy**

Self-esteem and self-efficacy, crucial facets of an individual's self-concept, may be significantly influenced by sports participation [28]. Self-esteem relates to an individual's overall subjective emotional evaluation of their worth, while self-efficacy pertains to the belief in their capability to execute tasks and achieve goals [29]. Both constructs are fundamental for personal development and mental well-being in students, playing a vital role in shaping their academic and non-academic performance in a university setting [30,31].

Research has consistently demonstrated that sports participation can significantly influence both self-esteem and self-efficacy. Engagement in sports activities is positively related to increased levels of self-esteem among college students [32]. Similarly, students involved in sports often exhibit higher levels of self-efficacy than those who do not participate [33]. However, the prevailing literature does not adequately differentiate between the effects on self-esteem and self-efficacy among students who participate in sports regularly versus those who engage occasionally. This distinction is important, considering that the intensity, commitment, and competitive nature inherent in these two modes of sports involvement can shape self-perceptions differently. Addressing this gap, our study will explore how varying degrees of sports involvement impact self-esteem and self-efficacy among college students, taking into account the nuances of these different levels of engagement [34].

### **6. Research Methodology**

The current research aimed to examine students' attitudes toward the contribution of sports participation in higher education. In pursuit of this goal, the research investigated the perceptions, challenges, and impact of physical activity on students' lives. To achieve this, a qualitative approach was adopted, found to be most suitable for the in-depth exploration of subjective feelings within the phenomenon under investigation [35].

Twenty-six semi-structured in-depth interviews were conducted with undergraduate students from various departments at a college in northern Israel. Participants were recruited through three methods: The first method involved direct outreach to all student athletes who regularly trained with the college's teams. In parallel, an approach was made to students who had participated in specific competitions throughout the year but were not part of the first group (Patch Recruitment). These were students who participated only in competitions but did not regularly engage in team training. The third method was a general call to all students at the academic institution through the college's Facebook page to volunteer for the research. In total, twenty-six students participated in the study: six who regularly participated in college teams, ten who had participated in one or two competitions during the academic year but were not part of the first group, and ten students who did not participate in college sports at all during their studies.

All participants in the study were single, aged between 18 and 27, and resided in various northern Israeli towns, including Kiryat Shmona, Metula, Katsrin, Kfar Yuval, and Ma'ayan Baruch, among others. Most interviews were conducted face-to-face, while some were conducted via the Zoom platform. Face-to-face interviews were held in quiet, isolated locations, allowing participants to freely share their thoughts. Each interview lasted between 30 and 45 min. Subsequently, the interviews were transcribed and underwent thematic analysis conducted independently by two researchers.

The analysis process included the initial coding of meaningful data units, followed by the development of sub-themes and overarching themes. Among the secondary themes that emerged were self-confidence, social relationships, social standing, personal beliefs, competitiveness, commitment, and academic support. These were consolidated into two main themes: perceptions of academic and social competencies, and levels of satisfaction and institutional pride. The findings were analyzed along two primary dimensions: differences among the participant groups and the personal meanings attributed to sports

participation's impact on the broader student experience. Regarding the first dimension, significant differences between the groups were evident, indicating that the extent of sports participation influenced the attitudes and perceptions of the students. In general, occasional sports participation in college improved the students' perception of their abilities, their satisfaction with their studies, and their perceived contribution of sports to these aspects. Furthermore, it should be noted that the research did not examine the objective relationships between the extent of participation and academic achievements or quantitative measures of satisfaction. However, these perceptions were expressed in the interviews as detailed below. Additionally, it is possible that the perceptions described by the participants were what led them to engage in sports as part of their studies. In other words, the aspiration to improve their social situation also included participation in competitive social sports activities.

## 7. Findings

### 7.1. Perception of Abilities—Academic and Social

The research highlights several key findings regarding the impact of sports participation on students' perception of their abilities, both academically and socially. Participants who regularly trained and competed emphasized various aspects, such as motivation and skill development. For instance, Avishai shared his perspective, stating, "I've been training since a young age, I love sports, and it has a central place in my life. Even on a moral level, in terms of competition, and in the importance of the effort to succeed, I've learned to push myself harder, to strive for victory. I don't see any other environment like this". Another notable point in this context is the recognition of the link between investment and success. Tom, for example, articulated, "In sports, you can't cut corners. You can pretend, but not in terms of your results. Those who invest more succeed. It's a thousand times more important than talent. Once you understand that, you bring it to your studies too. Investment in wisdom or knowledge is better".

Interestingly, even among students who participated in sports only once, there was a more positive attitude toward academic success. Mohammad's perspective exemplifies this: "Everyone who makes it to the competition wants to win. The attitude is, you're already here, so give it your maximum. When you return home, you continue. You're learning anyway; at least you'll get good grades". However, it is essential to note that the positive attitude presented by these students may not solely result from sports participation itself but rather from a general perception of it as a positive factor. The differences observed among the groups mainly stem from the fact that students who did not participate in sports at all perceive it as a negative and hindering factor. Uriyah explained this by saying, "They (the athletes in my class) are not here half the semester. One time they play there, another time it's a national championship. So, there's no question that they lack the material and knowledge they need to catch up on. They made a decision that they're involved in sports instead of studying. In the end, they're here for the degree; otherwise, they could have played in professional clubs, it seems like a waste". Interviews with non-sporting participants reveal their difficulty in understanding the potential contribution of sports, viewing it as an extracurricular activity that does not align with higher education goals. Additionally, sports participation requires resources, primarily time, which may not appear, at first glance, to be dedicated to academic efforts.

Another noteworthy aspect that emerged during the interviews was the more positive perception of students engaged in sports regarding their student societal experience. In these cases, the extent of involvement in sports correlated with a more positive attitude towards their student experience and social integration. Tal, for instance, mentioned, "All my closest friends in my studies are from the team (indoor soccer). Add to that the fans who come to the games, all the students who read my name on Facebook and Instagram posts. I'm not just a student". Maya added, "I studied for two years at the college and only knew the girls who studied with me. Then I went to the student tennis competition in Eilat, suddenly I'm part of a group of 40 students. Suddenly, people from other departments in the college are coming to cheer me on, from another campus altogether".

Participants who engaged in sports occasionally or once also highlighted that competitions allowed them to connect with other students at the institution and expand their social circles. Furthermore, they noted that representing the college made them more recognizable to both students and faculty members, fostering a sense of belonging within the institutional framework. However, it is essential to emphasize that students who did not participate in sports struggled to comprehend the potential benefits of sports and, in some cases, perceived it negatively.

Moreover, the research findings suggest that students involved in sports, regardless of the extent of their participation, place greater importance on their social lives as students, in contrast to those who do not participate in sports and primarily prioritize the academic aspect of their studies. For instance, Gil pointed out, "It's not an American movie here. I'm not on vacation for four years of my life. I came to study. In the United States, students are 18-year-old kids, so they come to celebrate and party, and so on. In Israel, it seems to me, people come to study. To get a degree".

From the interviews, it became evident that involvement in sports offers students a fresh perspective on higher education, fostering a more holistic view of their entire college experience. Eilon, a member of the college's running team, noted, "They tell us that the school's role is a high school diploma, the bachelor's degree's role is the diploma. But you can look at it differently. If sports are part of the process, and it's not directly related to my diploma, then maybe we should see this as a broad perspective of experiences". Notably, other students also discovered various aspects of their studies through sports that were connected to their overall student life.

However, students who did not engage in sports, while acknowledging the social aspects of their studies, did not perceive sports activity as an integral or inseparable part of it. When Michal was asked about it directly, she responded, "I don't see how it's really part of the studies. It's like a league for workplaces. It's not part of the work. It's a leisure activity that doesn't really affect the studies". This disparity in their responses and their perception of sports as a separate or non-integral part of the learning process influenced their connection to the institution and their appreciation of the activity within it, as evident in the following section.

## *7.2. Satisfaction and Institutional Pride*

Another significant finding emerging from the research pertains to two subthemes: students' satisfaction with the institution and their learning experience. Additionally, the theme of institutional pride emerged, primarily due to their participation in the college's representative sports. As previously discussed, involvement in higher education sports plays a crucial role in shaping students' attitudes towards themselves and the society to which they belong. There was a clear enhancement in both personal and social aspects among students engaged in sports in terms of their overall satisfaction with their studies. For instance, Tom expressed, "It's an experience. It's a wonderful time. I had a dilemma between two educational institutions, and I think I made the right choice. There's a different atmosphere here. I'm also earning a degree, and I'm doing other things". Dror also added, "There are people here who are completely broken. They spend the whole day stressed and looking for what's not good. I don't understand them; maybe it's because their studies are just studies. You can't live just half of the experience. Where are the student days, the sports, the parties?"

It is worth noting that participants in this group expressed overall satisfaction, both with the institution and their student experience, regardless of the extent of their sports involvement. In contrast, those who only participated once during the year did not exhibit significantly different attitudes from those who did not participate at all. It should be emphasized that, in general, the research participants did not express dissatisfaction. Despite differences in their general outlook based on the extent of their sports involvement, they did not express overall dissatisfaction with their degree program. This may be attributed to the relatively low number of hours students invested in occasional events

compared to their investment in courses and exams. Consequently, the group that regularly participated in sports seemed to significantly impact their overall satisfaction, both with the degree and their sporadic experiences within it.

Another subtheme related to the students' connection to the institution is their sense of belonging and a specific focus on their institutional pride as students or graduates of the college. This subtheme encompassed various expressions related to the concept of institutional pride, including recommendations for the institution and wearing clothing adorned with the institution's emblem. It became evident that participation in sports, to some extent, significantly contributes to the development of students' institutional pride. Roni, who participated twice in a soccer competition during his studies (without regular training with other students), shared his perspective: "I didn't think I'd feel anything, but suddenly it's you and your friends with the same clothes, the same color, the same emblem, and there are other teams representing different places. So, the college sending me created some commitment. But even more than that, victory generates pride, and losses make me think that maybe I disappointed someone". In addition to these statements, other interviewees connected their feelings to the nature of sports. The research participants noted that sports create a distinction between groups, and sports affiliation with the college team necessarily leads to affiliation with the college itself.

## 8. Discussion

This research intricately examines the influence of sports participation on holistic aspects of a student's higher education experience and the varied experiences of different participant groups. A significant theme emerging from our findings is the complex relationship between sports engagement, which requires a substantial investment of personal resources, particularly time, and its potential impact on academic success. This dynamic, highlighted by our research, aligns with previous studies that have demonstrated the positive effects of sports on academic achievements through the development of skills such as goal setting and discipline [12]. However, the increased allocation of resources to sports involvement, such as in training and competitions, can lead to a decrease in the time devoted to academic studies [36]. This juxtaposition accentuates the dual nature of sports participation as a facilitator of success and a potential obstacle to academic progress.

Our research indicates that perceptions of sports' effects largely depend on the extent of participation. Students who actively participate often develop an identity associated with the potential benefits, both personally and socially. The findings suggest that extensive sports involvement significantly influences self-perception and the student's role within the institution [13]. Notably, most research on sports in higher education, particularly in the United States, contrasts with other Westernized countries like Israel, where collegiate sports primarily function as recreational extracurricular activities [37]. Our findings propose that students, regardless of their level of participation, perceive sports involvement differently, not viewing it as a potential conflict with academic pursuits. This differentiation reduces the commitment to teams and competitions and mitigates any negative impact on academic aspects. Thus, the absence of significant adverse effects on studies highlights the role of sports as a tool for personal and social development beyond professional sports.

Our study corroborates previous research emphasizing the social, psychological, and well-being benefits of sports among students [15,38]. It indicates that sports encourage social interactions, foster a sense of belonging, and instill important behavioral habits [39,40]. Therefore, participants engaging in sports at any level experience these benefits, contributing to their overall college experience. The self-confidence characteristic of these students [41,42] empowers them to invest more effort in their tasks and strive for success. Importantly, our research focused on students' subjective perceptions rather than objectively measuring the relationship between sports and academic success, reflecting the significance of these perceptions in shaping both their motivation for success and their holistic student experience.

Exposure to sports during their studies leads students to a more comprehensive understanding of the purpose of education [43]. They perceive their studies not just as a means to acquire professional knowledge but as a period for personal development, engagement in recreational activities, and socialization. The extensive involvement in sports, including representing the college at various levels, broadens their perception of education. These students view their studies not merely as a functional path to professional knowledge but as a phase of personal growth, recreational engagement, and social interaction [44]. This perspective underscores the importance of extracurricular social activities in higher education.

#### *Social Identity and Group Dynamics*

Incorporating Social Identity Theory [45] provides a critical perspective on the impact of sports participation on college students' sense of belonging and institutional affiliation. The theory suggests that part of an individual's self-concept arises from their membership of social groups. In the college context, sports teams and activities represent these groups, offering a shared identity that significantly influences students' self-perceptions and their place within the educational institution. Our study demonstrates that participation in sports, whether casual or competitive, enables students to align with distinct groups within the college community, fostering a deeper sense of belonging and identity. Being part of a sports team or regularly engaging in sports activities often becomes integral to their college identity, consistent with Social Identity Theory, which asserts that group membership enhances self-esteem and belonging [46,47].

The group dynamics in sports, characterized by teamwork and unity, play a crucial role in strengthening institutional affiliation [48]. Students engaging in sports not only interact with their immediate teams but also identify themselves as part of the larger college community [49]. This identification is especially significant in our study, which includes a diverse range of sports participation levels, from occasional club sports to dedicated varsity teams. Each level of involvement contributes to the collective identity and social fabric of the institution.

In Israel, where collegiate sports are less prominent than in countries like the United States and Australia, sports participation assumes a unique role as a unifying social group. The diverse range of sports participation mirrors a multifaceted sports culture within the college, catering to various interests and commitment levels. This diversity is vital in providing multiple avenues for students to engage with and contribute to the college community, reinforcing their sense of belonging and institutional pride [50]. By considering the implications of Social Identity Theory and the dynamics of group membership in sports, we gain a comprehensive understanding of how sports participation influences students' self-perception and institutional affiliation. This theoretical framework enriches our interpretation of the findings and highlights the broader significance of sports as a vehicle for social and psychological development in higher education settings.

## **9. Conclusions**

This research delved into exploring the diverse impacts of sports involvement on the self-perception and institutional connection of college students within an Israeli context. Our investigation revealed that regardless of the intensity of sports participation, there is a consistent positive influence on students' perceptions of their academic and social capabilities. Moreover, this involvement cultivates a profound sense of belonging and institutional pride. Notably, we observed that the depth of these benefits in self-esteem and self-efficacy is contingent upon the degree of commitment to sports activities. This highlights a nuanced interplay between sports engagement and personal development, enriching the discourse on the pivotal role of sports in enhancing the higher education experience. Our findings underscore the importance of sports as a catalyst for student growth, weaving a strong fabric of connection with their academic environment.

While our study provides meaningful insights, it is bounded by several limitations. The qualitative nature of our approach, though rich in narrative detail, restricts the breadth of generalizability beyond the 26 participants from a single Israeli college setting. While valuable for understanding personal perspectives, the reliance on self-reported data may introduce subjective biases and limit our capacity to establish definitive causal relationships. Furthermore, the unique cultural nuances of the Israeli academic context might not translate seamlessly to different educational environments, warranting cautious application of our findings in broader contexts.

Our study lays a foundational framework for a range of future research endeavors. We advocate for expansive quantitative research with diverse and larger sample sizes to corroborate and extend our findings. Longitudinal studies would be invaluable in tracing the evolving influence of sports participation throughout a student's academic tenure. Comparative research across various institutional sports cultures could illuminate the differential impacts of sports on student experiences. Additionally, integrating insights from psychology, sports science, and educational theory through interdisciplinary studies could yield a more comprehensive understanding of sports' role in student development. Extending this line of inquiry to various cultural and geographic landscapes will contribute significantly to a global discourse on the impact of sports in higher education, informing educational strategies and policies aimed at fostering well-rounded and socially and academically successful students.

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