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Reflective Learning in Higher Education

Edited by

Jordi Colomer Feliu

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Special Issue Editor

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About the Special Issue Editor

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Preface to "Reflective Learning in Higher Education"

Reflective learning in higher education explores tertiary education and its practices. It examines in-house and external individuals, as well as collective initiatives and activities that centre on generating and reflecting on knowledge. It also explores the transformative output of learning communities, the communities themselves and their reflective practices, and discusses how reflective learning and developing one's professional identity through reflection are linked. The connections between the theoretical and applied research on reflective practices, knowledge generation in all areas, professional practice and identity, through theoretical definitions, situated and grounded practice and transformative knowledge are also considered. The nine manuscripts in this Special Issue manifest that reflective learning is likely to (i) help forge students' professional identity and ensure sustainable competences are effectively developed, (ii) transform students' preconceived perspectives and social preferences to foster new reasoned action plans for decision making, (iii) promote an understanding of one's personal and professional strengths and limitations and develop the ability to identify resources and ways to solve existing and/or future professional challenges, and (iv) modify students' beliefs, attitudes, and daily behaviour to develop competences that will ultimately result in promoting sustainability.

Jordi Colomer Feliu
Special Issue Editor



Editorial

Reflective Learning in Higher Education: Active Methodologies for Transformative Practices

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Abstract: In this Special Issue, Reflective Learning in Higher Education explores on tertiary education and its practices. It looks at in-house and external individuals, and collective initiatives and activities that centre on generating and reflecting on knowledge. It also explores the transformation output of learning communities, the communities themselves and their reflective practices, and discusses how reflective learning and developing one's professional identity through reflection are linked. The connections between the theoretical and applied research on reflective practices, knowledge generation in all areas, professional practice and identity through theoretical definition, situated and grounded practice and transformative knowledge are also considered. The nine manuscripts in this Special Issue manifest that reflective learning is likely to (i) help forge students' professional identity and ensure sustainable competences are effectively developed, (ii) transform students' preconceived perspectives and social preferences to foster new reasoned action plans for decision-making, (iii) promote understanding one's personal professional strengths and limitations and develop the ability to identify resources and ways to solve existing and/or future professional challenges and (iv) modify the students' beliefs, attitudes, and daily behaviour to develop competences that will ultimately result in promoting sustainability.

Keywords: reflective learning; pedagogical approach; transformative education; tertiary systems; sustainability

1. Introduction

Sustainable development is described by the United Nations Economic Commission for Europe (UNECE)'s Strategy for Education for Sustainable Development (ESD) as being underpinned by an ethic of solidarity, equality, and mutual respect among people, countries, cultures and generations. ESD is development in harmony with nature and meeting the needs of the present generation without compromising the ability of future generations to meet their own needs [1]. It empowers people to change their way of thinking and to work towards a sustainable future. Knowledge, skills, and attitudes to managing sustainable development are under the spotlight in all types of education because they are needed for future agents in the field of sustainable development [2,3]. ESD aims to develop competences that enable and empower individuals to reflect on their own actions by taking into account their current and future social, cultural, economic and environmental issues. ESD is designed for local and global perspectives, acts in complex situations in a sustainable manner—which may require the individual to strike out in new directions—and participates in socio-political processes moving societies towards sustainable development.

The global challenges facing contemporary society call for viable strategies and prompt action to address individual and collective issues and challenges, as well as their approaches to tackling them. To do so requires observing and understanding the viewpoint and complexity of the educational systems; as represented in the United Nations 2016 Sustainable Development Goals (SDGs) to be achieved in 2030. However, less than one decade remains in which to establish and facilitate education frameworks for citizenship awareness and participation, and develop new ways of knowledge production and decision-making with respect to sustainability. Efforts should be channelled towards (i) validating different didactic strategies and approaches to address sustainability from a constructivist and pedagogical community [4], (ii) diagnosing the status of sustainability training needs for formal and/or non-formal education, (iii) identifying the sustainability competence levels of children and young people currently in educational centres across the board and (iv) developing and testing appropriate and effective educational activities and practices [5]. While a few studies have investigated the pedagogical approaches and their effects on sustainable competences [6–8], the research, however, still remains limited.

The process of education is characterised by cognitive contemplation, learning to manage processes through skills and active experimenting [4,6]. It is an individual process where students expand their knowledge and understanding, their skills and experiences, values and attitudes and develop these into social values [9–12]. This is an interactive process in which the students, as learners, examine their experiences, reflect on them through spontaneous or routine activities, discover and subconsciously construe new meanings and insights, and foresee new perspectives [11]; it is the process of integrating the previously available knowledge with the new, by putting their theoretical knowledge into practice [9,12]. Independent of what formal knowledge is provided in the education process, each student will model original understanding of the phenomenon or activities and will create and build their own theories to final understanding. Reflective learning, then, allows for students' personal growth to be observed and helps to foresee ways of developing teaching processes to encourage learning in, for instance, higher education institutions, among others [13,14].

Professional development is a person's capacity to continuously learn through their ability to reflect, to analyse their experiences in depth, to develop and substantiate knowledge, and to refresh and reevaluate it. All this is in order to better know and manage themselves by diagnosing personal mistakes, and acquiring and developing efficient analytical skills for learning and about learning, through learning [13]. Reflection is directly linked with a practitioner's motivation for conscious activities, their modelling and adjustment; it indirectly determines the practitioner's empowerment for constant learning/development by assuming responsibility for their own actions and solutions [15–17]. The process of reflective learning is characterised by a transformative empowering of students for personal, unrestricted, independent activity by (i) analysing their own experiences and learning skills, (ii) relating theoretical knowledge to practical knowledge and developing skills to identify and solve problems and (iii) changing their attitudes and becoming more tolerant [18,19].

When reflection (as a component of reflective learning), deliberates on acquired experience, diagnosing one's own mistakes and learning from detailed analysis, only then does an open possibility for reform emerge from the professional experience which employs reflective thinking and refers to one's personal system of viewpoints, attitudes and values [20,21]. Reflection—as the premise of the educational transformation of experience for learning at primary, secondary and tertiary institutions—depends on the conditions provided for it. Conditions for reflective teaching and learning are created by developing the learner's competence to reflect, where individual experiences, thoughts, emotions and actions become the essential elements embedded in the ability to recognise the social and political contexts in which the individual lives and the values they want to keep to be inclusive, democratic, sustainable and social [22,23].

2. Conceptual Contributions

In this Special Issue, two papers focus on developing conceptual models. In Contribution 1, Calvo and colleagues present a theoretical framework developed by Wingate to evaluate a curriculum-integrated inclusive practice intervention in the United Kingdom with students from a first-year credit-bearing module at a tertiary institution. The study uses a mixed-methods approach that includes a literature review, secondary data, a feedback questionnaire and a focus group to evaluate a teaching method and reflect on the collaboration of the team members. The team teaching the module and the students taking it, considered the intervention as positive, welcoming and often crucial for supporting undergraduate students into the disciplinary discourse of their subject of study. Recommendations were made to develop better guidelines on how to deliver the integrated academic literacy as well as the importance of student participation, student learning assistants and graduate teaching assistants, in the design of the intervention. The study contributes to the literature on inclusive practice intervention and pedagogical approaches to integrating academic literacy into subject teaching for a diverse student population, thus contributing to the social sustainability of universities.

In Contribution 2, Gómez-Barreto, Merino-Tejedor and Sánchez-Santamaría prove that higher-order thinking skills are recognised as influential attributes to be considered for quality learning in pre-service teachers. Using an adapted tool based on Ritchhart's scale [24] with eight scales of cultural forces assessment, over 700 pre-service teachers identified pupils' prime-valued skills as being interactions, expectations, environment, language and time, as well as others like the development of thinking skills, modelling, opportunities to think and thinking routines. These dimensions are highly useful instruments for professors to obtain accurate feedback on how students perceive that learning-process mediation emphasizes the promotion of thought. The analysis of the dimensions may provide lecturers with information on how to facilitate reflection on teaching action(s) and (as teachers need evidence that makes them aware of the importance of promoting routines and situations linked to reflective thinking) how to optimise educational quality. In Contribution 8, Alsina and Mulà begin to characterise the elements of teacher educators' professional practice that promote the transformation of prior knowledge, experiences, and system beliefs into professional competences, based on reflective learning and education for sustainability. To obtain data, they analysed 30 class sessions given by a mathematics teacher. Five elements of the teacher's practice were identified: (1) presents real action, (2) uncovers students' values and preconceptions and takes them into consideration, (3) systematises these values and preconceptions and contrasts them with the 'ideal', (4) helps the learners to understand the perspective offered by mathematical and sustainability concepts and (5) helps the students develop a new perspective acquired through grounded and reasoned action plans. A key conclusion of the study is that it is prior knowledge, experiences, and beliefs which are transformed if the two agents involved in the learning process (pre-service teachers and university lecturers) are synchronised.

3. Transforming Learning through Active Methodologies

Contribution 3 by Cañabate, Serra, Bubnys and Colomer, focuses on how reflective learning, when operated together with cooperative learning, may foster and enhance the professional identity of tertiary students studying to be teachers. In this study, pre-service teachers were involved in reflection-in-action and reflection-on-action in order to contemplate their professional identity. The students' reflections were firstly analysed from the pre-service teachers' reflective narratives that included the focus of the reflection, awareness of previous beliefs, knowledge, and experiences, inquiring into and focusing on possible actions through questions and hypotheses, and arguing for concrete learning objectives. Then, they were analysed through the pre-service teachers' professional identity, including self-esteem, task perception, job motivation, and expectations about future jobs. The results from the instructional cooperative approaches based on the reflections on the in-practice activities carried out at a primary school, disclosed the differences between them, with non-structured approaches scoring higher than structured ones. The cooperative challenges, when embedded in the reflection process, profoundly

helped pre-service teachers to identify aspects of their professional identity that may ensure an effective intake of sustainable competences.

In Contribution 4, Beranič and Heričko postulate that in order to achieve the best possible learning outcomes, it is advisable to implement learning approaches that require students' active participation, for example, an experiential learning approach. In their pedagogical proposal, introducing enterprise resource planning (ERP) concepts to IT students entailed many challenges. Due to the system's complexity, newcomers need an extensive amount of time to be able to use it independently. The authors implemented a game in sequential rounds, whereby each round ended with a review of the collected experiences. The simulation game was used at the beginning of the course to assist with the introduction of ERP concepts. Perceived usability was measured using a System Usability Scale (SUS), while the students' experiences were gathered using a self-evaluation questionnaire. The study revealed the positive impact the experiential learning approach had. Students evaluated the usability of SAP ERP as OK, and empirical analysis confirmed that using the simulation game to introduce the ERP concepts resulted not only in anticipated knowledge and skills, but it also increased the students' intent for future engagement.

In Contribution 7, Rodrigo-González, Caballer-Tarazona, and García-Gallego propose a teaching activity aimed at promoting social values, such as trust and reciprocity, among undergraduate students in Economics and related degrees. They present the Reading-Experiment-Discussion experience, a three-step activity as part of a class of a specific module at a Spanish tertiary institution. During the Reading step, the authors encouraged the students to reflect, learn, and think critically about social values. In the second step, Experiment, students made decisions in a trust game experiment in which a game created to measure trust and reciprocity in economic environments was used. Students then gave opinions through a post-experiment questionnaire. They also investigated the association between students' decisions and their attitudinal and sociodemographic characteristics by linear regression analysis. Experimental data showed that decisions on trust and reciprocity are dependent on earnings information and that, on average, females trust more than males. Finally, in the Discussion step, the learning was reinforced by sharing the readings about morals and the experimental decisions. In short, the pedagogical approach might greatly help to transmit to students the role social preferences play in the individual decision-making process.

In Contribution 9, Bubnys deals with experiential reflections of university students studying in a Bachelor of Special Education degree study program in a Lithuanian tertiary institution. The special educator was a teacher of children with special educational needs, i.e., an educational assistance specialist who is able to recognize, assess, and meet children's special educational needs arising from disabilities, disorders or learning difficulties, and to professionally provide special pedagogical assistance for inclusive and special education. To analyse the experience of prospective special educators who study at the university for four years, first year students were chosen. In the first month of their studies at the university, the first-year students did their teaching practice in institutions within the education system: pre-school, general and/or special education institutions. The aim of the practice was to become familiar with the subtleties of their future professional activity. The initial experience students had at the start of their studies was found to be important and significant for further studies at the university. The manuscript deals with the results of the written reflections of students who had returned from the practice. The phenomenological hermeneutics method revealed the students' experiences in their practical activities during their observational practice provided the students with a deeper understanding of their area of study and, through the (self) education process, a precondition for reflective learning in further university studies. The manuscript presents future special educators with practical experiences and perceptions of their roles in the profession. The results reveal that self-reflection provides students with a deeper perception of themselves as people with special educators' needs and problems, personal strengths and competence limitations that then enabled them to identify sources and means for solving existing and future professional activity problems. It further reveals that cooperation with family members, university teachers, social

pedagogues, teachers, children with special educational needs, and sharing experiences with student colleagues can lead to greater self-confidence in oneself as a future specialist. Curiosity and personal initiative enabled students to identify the positive and difficult moments of their professional activity and future professional roles while learning from experience.

4. Applied Research on Reflective Practices

In Contribution 5, Grant, Gilgen, and Buchmann present the World Food System Summer School—an innovative two-week course seeking to develop the knowledge, skills and attitudes of the next generation of decision-makers to build sustainable food systems. Meaningful learning, where the participant was able to relate new information to existing knowledge, is a critical part of education about complex systems and requires the integration of reflective approaches to teaching and learning. Grant, Gilgen, and Buchmann adopted the rich picture method for three summer schools in Switzerland, South Africa and Côte d'Ivoire (74 participants with 29 nationalities) to support participant reflection on their knowledge acquired about complex food systems. Coding and comparing 51 pairs of pre- and post-course pictures of food systems clearly demonstrated newly gained knowledge as the number of sub-categories being significantly drawn increased from 11 to 19 in the post-course pictures. Interestingly, the largest increase occurred for environmental sustainability (57%). The rich picture method is a highly valuable, simple tool with which to gain insight into how participants' knowledge changes and identify where the gaps in meeting the learning objectives are. This was particularly useful within a highly diverse participant cohort, as it allowed participants to discuss and reflect on their own learning experience in a personalised way. Additionally, the rich picture method provided insights for faculty to improve their approaches to teaching on food systems.

In Contribution 6, Díaz-Iso, Eizaguirre, and García-Olalla describe the integration of reflective learning to contribute to developing a greater awareness among individuals of the importance of facing the 21st century's sustainability challenges. This paper analysed the impact an extracurricular volunteer activity in Tangier, Morocco had on the development of student reflection at a Spanish university. The objectives of this study were first to explore students' primary reflections on the experience and second to analyse students' perceptions concerning the importance of participating in the experience in order to develop reflective learning. In-depth interviews were conducted with 23 students who participated in the volunteer activity. Data analysis was carried out to conduct a descending hierarchical classification (DHC) and a constant comparison analysis. This research highlighted the value that voluntary extracurricular activities have in developing reflections which then guided changes in the beliefs, attitudes, and daily behaviour of students and ultimately resulted in sustainability. Thanks to this, not only was it considered essential that students participated in social projects, but also that they undertook these with peers and instructors who could create environments of support and trust.

5. Discussion and Conclusions

Reflection is recognised as one of the most important transferable competences in lifelong learning and affects continuous personal and professional development. Reflective learning is becoming increasingly relevant to meet the challenges of a technologically advanced world and to develop the ability to adjust to ever-changing environments. As reflection allows for contemplation about new experiences and their association with past experiences in different contexts and focuses on future transformations, it offers ways in which, through active methodologies, reflective learning can change a person's awareness and ability to act in different contexts. As pointed out by Greig and Priddle [25], the Sustainable Development Goals require that, in the coming years, all learners should acquire the appropriate knowledge and skills to promote sustainable development. This objective demands the applicability of transformative interdisciplinary approaches, oriented to promoting (in addition to subject knowledge) sustainability as an explicit outcome. According to these authors, the complex nature of sustainability challenges indicates the need for learning experiences that emphasise active,

reflective learning across and between discipline areas [25]. Reflective learning enables learners to improve their thinking, which leads to better actions towards well-being over time. Through reflection, learners gain a sense of power over their future actions—and a sense of direction—leading to the development of agency. Reflective learning results in a growing awareness of one’s self, others and society at large. Developing reflective and critical competences are key objectives for tertiary educators, who need to adapt to an ever-evolving curriculum and to changing techniques and social environments.

For educators: Educators’ tasks in the inclusive classroom include giving careful consideration to what is to be taught and how it is to be taught (rather than who is to learn), considering the learning needs of all children and young people (not just those with additional needs), questioning beliefs and rejecting deterministic and associated ideas, reflecting on daily life situations, constantly seeking out and trying new things to support all learners, discussing new initiatives with colleagues in order to receive feedback, examining, framing and attempting to solve dilemmas during activities, using journals to track individuals’ learning, and taking responsibility for their own professional growth and understanding [26]. Reflective practices focus on students who may have behavioural, emotional and/or social difficulties which hamper their engagement as a learner and create personalised learning pathways. It prompts individual-centred reflection on how to increase the learner’s engagement and thus leads to deep learning outcomes.

For students: The practice of reflective experiences acquired through active reflective methodologies can help to change formal learning habits and improve students’ learning outcomes, as metacognitive skills developed through reflection are identified as one of the most important factors influencing learning [9,27]. The process of reflective learning is directed towards analysing and thinking over one’s activity, inner self-feeling, attitudes, feelings, and empathies. This is not just knowledge and self-perception but also finding out how others see you. Inner reflection is directed to personal activity, ideas and feelings. Outer reflection is directed towards processes, and events related to the external world. Students, when placed in active reflective practices, develop higher cognitive processes and trigger individual activities with a focus on finding problems and solutions, comparison and contrapositions, statement and confirmations, aim, action and result [28].

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Article

A Journey of Self-Reflection in Students' Perception of Practice and Roles in the Profession

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Abstract: The basis of the study is the findings of scientific research dealing with experiential reflections of university students studying in the special education Bachelor degree study program in Lithuania. The special educator is a teacher of children with special educational needs, an educational assistance specialist who is able to recognize, assess, and meet children's special educational needs arising due to disabilities, disorders, or learning difficulties, and to professionally provide special pedagogical assistance in the conditions of inclusive and special education. In order to analyze the experience of prospective special educators who study at the university for four years, first year students were chosen. At the start of their studies at the university, in the first month of their studies, students do their practice in the institutions of the educational system: Pre-school, general, and/or special education institutions. The aim of the practice is to get familiar with the subtleties of the future professional activity. It is maintained that students' initial experience outlived at the start of studies is important and significant for further studies at the university. The article deals with the results of written reflections of students who have returned from practice. The phenomenological hermeneutics method enabled to disclose students' experiences in their practical activities during their observational practice, providing deeper understanding of the study area, as a precondition for reflective learning in further university studies, and by interacting with participants of the (self) education process, the article presents future special educators' practical experiences and perceptions of their roles in the profession. The results disclosed that self-reflection provides students with deeper perception of themselves as people with special educators' needs and problems, personal strengths and competence limitations that enable them to identify sources and means for solving existing and future professional activity problems. It further reveals that cooperation with family members, university teachers, social pedagogues, teachers, children with special educational needs, sharing experiences with student colleagues could lead to greater self-confidence in oneself as a future specialist. Curiosity and personal initiative enabled students to identify positive and difficult moments of the professional activity and future professional role while learning from experience.

Keywords: Experience; student; higher education; practice; self-reflection; (self-)educational process; roles in the profession

1. Introduction

The goal of education for sustainable development is to develop competencies relevant for professional and social activities and a person's self-expression in the rapidly changing world, distinguishing itself by manifold relationships [1,2]. Sustainable development in education is related to the development of transformational competencies [3,4]. In this respect, a special role falls on higher education institutions educating teachers. One of the essential goals is to ensure that educating teachers, the principles of education for sustainable development, are actually implemented and that future educators acquire such competence that would enable to implement education for

sustainable development in the teaching/learning process. Among other aims, higher education institutions seek to educate independent students and professionals in their study areas. Successful implementation of this aim requires acknowledgment of the fact that becoming independent primarily relates to development of self-assessment abilities in order to know and reflect on future professional activities [5–10]. The development of latter abilities is possible through continuous communication and cooperation with all participants of the (self)educational process, who take part directly and indirectly in the process of becoming professionals in their study area [11–13]. It is important to help students recognize what they have to know and why. The next step is for them to know how to apply their knowledge in various problem situations in order to broaden their understanding.

In order to ensure high quality (self)education for all members of the society, recognizing and respecting diversity, taking into account every person's individual abilities and their needs, it becomes important to ensure availability and assistance to the persons who are more vulnerable and discriminated due to their particularities and specific needs. In this case, much attention must be paid to persons with special educational needs. Big responsibility in this case falls on the educational assistance specialists—special educators and higher education institutions preparing them. The special educator is a provider of direct assistance to the child who has special educational needs in the general education school and/or specialized special education centres [14].

In Lithuania, special educators are educated at one of the 14 universities, in which the study was conducted, the results of which are presented here [15]. The latter university has implemented the study program Special Education (later, Special Education and Speech Therapy), attributed to education sciences) for more than fifty years. The content of the program is modelled so that it ensures the provision of qualified assistance to pupils of all age groups while solving emerging learning problems: Identifying the principles of curriculum individualization choosing, adapting and implementing appropriate learning strategies, teaching aids and compensatory equipment and providing other learning-related services. The special educator is a teacher of children with special educational needs and a teamwork representative, who is able to communicate and collaborate with teachers, children with special educational needs, their families, and professionals. During studies, implementing the special education and speech therapy study program, new knowledge, learning experiences, and each student's unique path of learning are developed through teacher-student collaboration, involving social partners from educational institutions, and using international experience. Therefore, it is obvious that the efficacy of special pedagogical assistance is determined by the interaction between special educators and other teachers while performing the main function, i.e., implementing key ideas of inclusion and empowerment.

Reflection during studies is especially important in education of future special educators for their inclusive type of work [16–20], when the activities are based on relations between the educational process participants, encountering personal objections, contradictory feelings and emotions, and the like. Special educators who seek humane and stimulating inclusive education will be able to integrate their own experience and theoretical knowledge when they adequately reflect during their study, which is one of the aims required to foster students' ability to reflect on their own experiences [21–23].

Reflective analysis of one's actions with regard to interactions and cooperation between the participants of the education process, taking place at the higher education institution, is a complex teaching/learning process that can be developed both formally and non-formally. While the reflection competency can also be developed in an isolated environment in which students analyze their actions themselves, having dissociated from others, this does not enhance their learning abilities. Communication, cooperation, and feedback from teachers, practice supervisors (mentors), student colleagues, and other stakeholders are all relevant and significant in this process [24–27]. In the presence of cooperation environment, reflection enables the student's professional development at the higher education institution [28–30]. The reflection process is basically a "conversation with oneself": You give questions to yourself, consider solutions, evaluate results and make changes; but in most

cases, individual reflection begins as cooperation between family members, teachers and students, and practitioners, i.e., as a part of the group work process.

By interacting with others, students are able to understand themselves better as prospective special educators, their needs and problems, personal strengths and competence limitations, and they are also able to identify sources and means for addressing current and future problems of professional activities. This is also grounded by Hilden and Tikkamäki [31] (p. 83) who stated that “When promoting reflection through external dialogue, individuals together try to find something new and surprising—to be touched upon—in open interaction”.

Relating with other individuals during the period of reflection enables students to get used to coping with the complexities, challenges and uncertainties which are inherent in personal and professional development, by explicitly or implicitly intervening and using the students’ knowledge to facilitate reflection. In addition to relating with the teacher or professional, relating to other students and personal interests are also relevant as they promote reflection processes. Individual analysis of thoughts and feelings, sharing life experiences with other students, as pointed out by Peltier et al. [32], are considered to be the basis for reflection and change. Dialogue between students helps the learner to discover individual meaning of learning.

The objective of this research is a journey of self-reflection in students’ perception of practice and roles in the profession by interacting with participants of the (self)educational process.

The research aim is to disclose the experiences and effects of self-reflection on students of special education by interacting with participants of the educational process in order to establish their views and roles in the profession.

2. Materials and Methods

Research Methodology

Sample. The research sample consisted of 71 students, i.e., all first-year students who chose to study special education study program at the university in Lithuania. During studies, students get prepared to educate disabled children, children with special educational needs and other developmental disorders, to professionally provide special educational assistance in the conditions of inclusive and special education, adhere to the principles of tolerance and human values, working in different types of educational institutions, specialist teams, counselling teachers and pupils’ parents. After four years of studies, students who have chosen special education studies acquire the educator’s qualification.

Written reflections submitted by 65 students were analyzed. The number of reflections analyzed was determined by theoretical saturation [33,34], which came to prominence in the course of data analysis: The text or the content of another artefact used for the qualitative research; for example, a letter, diary, in this particular case, written reflection, in which all elements are repeated up to a specific unit of the analysis, allows further not to analyze the units of the analysis given by other respondents (in this case, written reflections).

On the second week of their studies, right after admission to the university, these students participated in the observational practice. The aim of this practice was to develop students’ self-reflection skills and students had to perceive themselves as prospective special educators. Upon completion of this practice, students started writing self-reflection reports. Students were exposed to all necessary conditions to be able to purposefully analyze the experiences gained during the practice and to be able to link them with the context of prospective professional area.

Research Methods. Data collection: Unstructured written reflection. Students had to write reflections in three months. In addition to that, they reflected on experiences gained during the meetings in which the researcher presented indirect type questions. This way, which is quite frequently used in qualitative research [35–37], the students analysed the experience they had outlived during their practical trainings. Students were given open-ended questions, encouraging them to remember

the experience outlined in practice and describe it in detail as much as possible, distinguishing specific events and describing their performed actions, looking back to their activities and reflecting themselves in various aspects. More detailed instructions were not given, leaving them to decide what was most important, relevant, and significant speaking about themselves and not about expectations of others. Writing of the reflections took them from one to one and a half hours.

In this particular case, reflective writing encompassed the analysis of a wider context of experience and action, meaning, and sense, and was also used as a research strategy for collecting data. According to Moon [38], reflective writing can be undertaken for a number of reasons, such as: the development of theory and adjustment in practical studies, preparation of an action plan, solution of obscurities and search for alternatives, evaluation of personal progress, etc. Written reflection created preconditions for students to analyze the experience outlined during practice, analyzing the experienced events. Based on the advantages and aims of reflective writing explained by scholars [39–42], in this case it was sought to generalize experiences and personal development related to practice performed at the institution. It is important to capture experience and think it over. Students had opportunities to reflect on the process of their learning, i.e., the meta-cognitive process, during acquisition of new experience.

To sum up, it should be stated that the choice of the method was based on the following essential approaches: Writing is inherently related to reflection, when questions and thoughts about the investigated phenomenon are written down creating the possibility to go back and reflect; the aim of writing is to empower us to see what we had not seen before so that the phenomenon is shown in a new way; writing can be compared with “falling forward—into the dark” with the aim of contacting what is not yet known, what was experienced as a whole; writing reveals richness of the phenomena in the outlined experience; writing is both a research process and product; writing is for investigating phenomena in the experienced world and for passing on the results of our investigation to others.

Data analysis: the phenomenological hermeneutics method. The method of phenomenological hermeneutics was employed, analyzing the text by phases, moving from the whole to the parts and back, and from understanding to explanation and back [43]: (1) Naive reading; (2) structural analyses, formulating themes; (3) full understanding, which contains generalization and reflection on the themes with regard to the research matter and research context; and (4) formulation of the results, presenting them in simple language and keeping it close to what was experienced.

3. Results

Having analyzed the written reflections on the question, “What people helped to understand subtleties of practice and what are one’s specialist’s role?” The phenomenological hermeneutics method comprising of seven dimensions and 24 themes was used to diagnose the answer.

3.1. The First Dimension

Understanding of practice subtleties in relating with family members reveals family members’ support for future special educators, who are getting familiar with peculiarities of the chosen specialty during their observational practice (see Table 1).

While solving problems, which they encountered in practice, students received information, support and assistance from their family members. Students mostly lacked information and skills of communication with children and possibilities of providing assistance for them. Reflections revealed that mothers helped students most in comparison with other family members. Based on her teaching experience, the mother “...much helped to understand how to communicate with children [...] encouraged, morally supported...” Mother’s psychological support, consolation, and encouragement motivated students to go deep into the study area, increased their self-confidence, foreseeing their possible actions with children in the future: “... because I was very afraid to do practice [...] my mother calmed me down [...] said what I can expect, what awaits me [...]”. Different special educators’ activity aspects were analyzed; ways of behavior and assistance were studied and children’s disabilities were discussed, considering the type of the disability.

Table 1. Understanding of Practice Subtleties in Relating with Family Members.

Theme	Subtheme 2	Subtheme 1
Explanation of behavior and ways of assistance for children	Explanation of children's behavior and ways of communicating with them.	Explanation of children's behavior emphasizing the importance of work
		Explanation of communication with children by encouragement and moral support
	Discussion of tactics of behavior with children	Explanation of main subtleties of practice and ways of behaving with children
		Assistance, foreseeing ways of behavior with children in various situations
		Emphasis on ways of necessary assistance for children by encouragement
Promotion of professional resolve	Promotion of conviction to work in one's profession	Foreseeing of ways of assistance for children by discussing
		Promotion seeking to make sure that the choice of the profession is right by observation
Emphasis on professional traits	Emphasis on responsibility and dutifulness	Emphasis on the purpose of practice, encouraging to assess one's choice to study
		Importance of responsibility and dutifulness, implementing professional roles
Promotion of investigative activities	Encouragement to investigate activities	Encouragement to investigate in order to understand
Foreseeing difficulties in professional activities	Perception of difficulties in professional activities	Discussion of future professional activities, foreseeing possible difficulties
	Provision of information about complicated situations in practice	Informing about troubles working with the disabled

Mothers were also the ones who mostly encouraged students to evaluate their choice of studies by making sure that students were suited for the chosen profession: "...helped to understand the importance of practice, so that I could find out if I can work, if I am not afraid of such work and whether I entered where I wanted ... " They discussed personality traits required for the special educator, the most important being responsibility and dutifulness. Family members deliberately hoped that discussions about future professional activities would affect students' actions and attitude towards science, motivate them for responsible and purposeful future activities, and encourage them to embrace (self)development of the personality traits needed for this work.

A mother encouraged her ward to perceive professional role through investigation of activities: "... she would always say that it was necessary to investigate everything, so that you could understand whether you like it..." Investigation of performed activities helped to better understand their professional roles: "... helped me to imagine myself as a special educator..."; abilities of investigative activities and learning to learn were also developed. Based on personal experience, students' parents would consider future complex professional activity areas while working with disabled people.

3.2. The Second Dimension

Cognition of practice subtleties in relating with special educators and teachers reveals special educators' and subject teachers' /form tutors' assistance for trainees (see Table 2).

Table 2. Cognition of Practice Subtleties through Relating with Special Educators and Teachers.

Theme	Subtheme 2	Subtheme 1
Disclosure of children's personal characteristic	Informing about children's personal traits	Assistance with recognizing children's needs
		Identification of children's needs
		Familiarization with children's personal and family peculiarities
Provision of knowledge about communication with children	Assistance in communication with children	Informing about individual communication with children
	Explanation of individual communication with children	Explanation of peculiarities of individual approach to each child
Explanation of organization of activities with children	Presentation of specificity of the activity according to children's needs	Explanation of peculiarities of special needs of children and specificity of work with them
	Foreseeing behavior strategies in teaching	Explanation of behavior with disabled children in the teaching process
	Explanation of requirements for children according to their needs	Explanation of peculiarities of communication with children: their needs and requirements for them
	Transfer of experience, managing situations in communication with children	Transfer of experience of "taming" difficult-to-communicate children through observation
	Sharing experiences about children's involvement in learning	Advice on how to arouse children's interest in the subject, allowing to give lessons
Familiarization with children's educational process	Informing about the parameters of the educational process	Familiarization with curricula, children and school specificity
	Acquisition of knowledge about differentiation of individual tasks	Finding out about peculiarities of tasking for children and communication with children through observed activities
Provision of information about specificity of disability	Provision of knowledge about children's diseases	Provision of information about diseases inherent in children
	Provision of knowledge about children's faculties depending on the disability	Provision of information about children's faculties, disabilities
Disclosure specificity of the chosen specialty	Presentation of the actual practice situation	Distinguishing of advantages and disadvantages of the chosen specialty
	Deepening of understanding about the type of work	Development of understanding about difficulty and responsibility of work
	Emphasis on moments of the activity	Familiarization with the specificity of work, advising on the future activity

Table 2. Cont.

Theme	Subtheme 2	Subtheme 1
Information about children's self-feeling and problems	Deepening of understanding of children's feelings	Explanation of children's feelings and self-feeling
	Discussion of children's problems	Familiarization with children's learning difficulties
Complexity of performance of the teacher's professional role	Foreseeing of possible mistakes in practice	Explanation of possible mistakes in the trainee's activity
	Performance of the teacher's role in the actual educational environment	The benefit of practice tasks, perceiving one's professional role
	Plugging in the performance of the teacher's role in practice	Teacher practitioners' assistance perceiving positive and difficult moments of the teacher's role
Promotion of personal motivation for activities	Promotion of plugging in the practical activity context	Encouragement to communicate in order to get to know the complexity of work
	Promotion of involvement in the activity with children	Encouragement to observe and participate in children's activities

During practice, students were made to familiarize with their future profession by special educators and subject teachers, who discussed ways of dealing with or assisting children, provided concrete advice and enabled them to learn from their mistakes. Information provided by special educators and teachers about communication with children helped students to understand the importance of individual communication with each child: "... explained how to approach each child, what were the child's usual moods. I understood that each child was different, communication with every child was individual..." Teachers helped students to understand that the peculiarity of communicating with children depends on the type of the child's disability.

Special educators provided information on different type of disabilities in order to help students understand what methods to use to arouse each child's interest, stating that the proper way of correcting behaviors should be applied to achieve adequate results and behavioral changes: "... explained how a healthy person should behave with the disabled. Not only with children but in general with all people. How they should be taught, interested, disciplined..." By so doing, teachers created avenues for students to involve themselves in activities and try out the advice in practice. Teachers also provided information for students about different educational process parameters: specificity of the school, curricula, children's disabilities, fatigue manifestations, etc.

Students reflect that teachers' explanations about diseases were the most useful: "... allowed to approach children, play with them, help to draw, mould and dress. Told about children's diseases: disorders, what was characteristic for them..." Personal involvement in activities enabled students to analyze their actions in action and learn from their experiences.

Consistency and coherence of personal-internal factors (expectations, needs, feelings, personality traits, interests, etc.) and environmental-external factors (organizational culture and microclimate, customers (children), etc.) create a sense of comfort and help students to grow as personalities and professionals during their practical activities. Mutual support and open relations between the student and practice supervisor are the main prerequisite for constructive reflection and self-reflection [44]. Teachers' personal approach and assessment helped students to better understand children's learning difficulties and experience feelings in various educational process situations. Seeking to avoid mistakes during practice, teachers familiarized students with trainees' most common mistakes.

3.3. The Third Dimension

Understanding how to practice subtleties through Relating with children reflects the peculiarities of perceiving one's role as a specialist's role and in understanding practice subtleties in relations with handling of children (see Table 3).

Table 3. Understanding How to Practice Subtleties through Relating with Children.

Theme	Subtheme 2	Subtheme 1
Children's indirect "assistance"	Knowledge of future work	Experiencing of failures through performed work
	Perception of preconditions for assistance for children	Perception of importance of children's cognition and provision of assistance for them
	Emotional—psychological entrenchment in the profession	Self-entrenchment in the profession due to children's attachment
	Learning to treat children	Understanding of the ways of acting with children in a particular situation The possibility of implementing practice roles Acquisition of skills of communication with children

Students understood the subtleties of practice and their roles as specialists' roles while directly communicating with children: "... communication [...] showed me subtleties of that work. Their presence nearby, talks with them were an interesting experience and made it possible to understand how to communicate with such people..." Experiencing failures and following the very children's advice extended trainees' knowledge of their future work. Successful child-student communication was the strongest argument that the student suitably chose as the high point of his/her profession.

3.4. The Fourth Dimension

Cognition of practice subtleties through relating with university teachers reveals teachers' impact on students' practical learning processes, which familiarizes the students with subtleties of their chosen specialties and with the peculiarities of their professional roles (see Table 4).

Table 4. Cognition of Practice Subtleties Knowledge of Their Future Work.

Theme	Subtheme 2	Subtheme 1
Evaluation of personal readiness	Promotion of evaluation of readiness to work in the chosen profession	Assistance evaluating one's readiness to become a special educator
Reflection on the practical activity by providing feedback	Focus on key moments of practice	Promotion to notice essential moments of activities in practice
	Reflection on practice	Sharing impressions after practice

University teachers were not active participants of students' observational practice. Consequently, reflections captured their poor contributions by helping students to perceive the study area: "... advised to look at everything more carefully, whether we really entered where we fitted, whether we would be able to do this work..." Teachers were more active when students returned from practice, sharing

impressions, reflecting on what was experienced and lived during practice, and how the attitude to the future profession was changing. Seibert and Daudelin [45], analyzing the importance of different environmental factors for assuring reflection and reflective teaching and learning at the higher education institution, agree that the university teacher's role in this process is one of the essential determinants. Research results demonstrate that reflection takes place more rapidly through individual and group activities if it is run by a skilled person.

3.5. The Content of the Fifth Dimension

Sharing experiences with friends/colleagues discloses a deeper understanding of the subtleties of practice and one's role as a specialist's role in relating with friends and colleagues (see Table 5).

Table 5. Cognition of Practice Subtleties through Relating with Friends/Colleagues.

Theme	Subtheme 2	Subtheme 1
Discussion on performance of the practical activity	Presentation of possibilities and limitations in practice	Explanation of peculiarities of approaching children and providing assistance for them
	Discussion on activity aims in practice	Finding out and sharing impressions, better understanding one's further activities
Provision of moral support	Moral support, remaining to study the profession	Encouragement not to quit studies
Cooperation through sharing personal experience	Going deep into practice while discussing	Recognition of details while discussing about practice
	Promotion of imagination, helping to go deep into the role of practice	Sharing previously gained experience during practice

Due to teachers' limitations not all students had the opportunity to directly interact with the children and to acquire knowledge in the behavior peculiarities of children with special needs. In such cases, students shared acquired experiences with other students "... we found out with group mates, shared impressions and then it was already much clearer what I had to do...", enabling them to plan their further activities with children and better understand aims of their activity.

Students' support was particularly important for those students who hesitated in making up their minds to be special educators. Friends "... encouraged, said, just don't even think about quitting these studies..." Friends' moral support and encouragement prevailed upon several colleagues preventing them from making spontaneous decisions to quit their studies. Senior students who had already completed this practice also helped students to solve practice related problems and to acquire more knowledge and experience.

3.6. The Sixth Dimension

Formation of the personal conception reflects the independent formation of students' personal conception about subtleties of practice and their professional roles during practice (see Table 6).

Table 6. Formation of the Personal Conception.

Theme	Subtheme 2	Subtheme 1
Assessment of the practical activity	Identification of difficulties in professional activities	Foreseeing the course of work and possible difficulties through the observed activity
	Cognition of practical reality through observation	Cognition of one's future work by observation
		Understanding of children's behaviour and communication with them in the educational process
		Understanding of tactics of work and behaviour with children
		Understanding of one's role observing special educators' activities
	Independent communication with children	Understanding of ways of communicating with children
	Systemization of information in practice	Observation of children and analysis by accumulating and recording information.
Cognition of practical reality implementing teaching	Perception of the teacher's role through activity performance	
Professional development	Curiosity for practice	Demonstration of pro activeness to get to know the specialty.
		Activeness and personal initiative as a possibility to learn
	Targeted simulation of experienced practitioners' activity	Understanding of work by observing the teacher's activities and behaviour
	Self-studying	Individual striving to understand
		Search for information about children with special needs
	Deepening the understanding of children's needs	Efforts to take interest in and understand children's needs
		Assistance for children, getting familiar with their diseases and needs
Solution of problems, implemented by practitioners	Observation of behaviour with children and solved problems	
Methodological educational experience	Preparation of educational material	
Professional socialization	Identification of oneself with the practical activity	Involvement in pupils' and teachers' work, perceiving the aims and tasks of practice

Cognition of specificities of the professional activity and professional role by observing special educators' activities was the main aim of students' practice. To achieve this, students had to be active participants in this process. Observation was one of the main sources for getting information. When students did not receive help from teachers and practitioners, they themselves had to actively participate in the observation process in order to better understand their study area: "... I had to find out how to communicate with children myself..." Students spent most of their practice time observing and analyzing children's behaviors: "...I was trying to accumulate as much information as possible.

Most of the time I was watching and recording useful information for myself..." Those students who had the possibility to get directly involved in the teaching process felt that they needed a lot of courage, specialty knowledge and skills for assisting children, and solving children's problems: "...giving the lesson, I felt that I lacked knowledge, courage to give a lesson in a good way..."

During practice, students realized that in order to make practice meaningful, they needed willingness to engage in activities and to be actively communicating with both children and teachers. Students were trying to understand and take over special educators' methodological experience individually: Mainly studying literature on children with special educational needs. Trainees realized that self-studying had changed their conception and knowledge about disabled children: "... when I now compare the knowledge I had before practice and now, it's just not comparable, I feel that I know a lot..." Personal interest extended knowledge about children's needs, diseases, and peculiarities of preparing methodical materials for work with children. Teachers' implemented solutions to problems helped students to understand how children's needs could be met.

3.7. The Seventh Dimension

The lack of assistance—"nobody helped"—reflects absence of assistance and the lack of personal motivation, thereby forming the conception of one lacking adequate support and having difficulties in pursuing a future professional role and acquiring new experience for future professional activities.

Some of the students failed to understand their professional roles and the possibilities, which are available to them in their professional activities due to the absence of teachers' social-pedagogical competencies: "... I almost did not see my specialty work ...", "... there were no direct explanations in schools. It seemed as if you were not there at all ...", "... it seems that I am not noticed ..." Students were left unnoticed in practice places or individual teachers' behavior towards them was hostile and ignoring. Individual teachers did not motivate students to take interest in their profession by encouraging them to change their choices and making inadequate assessments of their profession: "... their advice was as follows: hard work, you will not find a job upon graduation. During the lessons, I was not allowed to do anything ...". Often, students lacked educational-counselling assistance about peculiarities and behavior possibilities of children with various disabilities. Absence of such assistance resulted in some students' personal loss of interest to deepen their knowledge and named practice as having a good time: "... I treat these three weeks as vacation, because I did not receive help in understanding the subtleties of this practice ...". The lack of feedback after practice does not create possibilities for students to relate practical knowledge gained while working with children to theoretical knowledge, which they will acquire at the university. This is very important, seeking understanding of the effective and in-depth learning process.

4. Discussion

Analyzing the peculiarities of future teachers' education, scholars [46–48] often emphasize that cooperative environment and student support ensure a more successful adaptation to the profession and help to avoid problems encountering the reality in practice. The analysis of the data obtained during the research clearly highlighted not only the level of relationships between the participants of education processes, based on close relations, but also other areas of the professional activity and their content relevant to the student during his/her studies (see Figure 1).

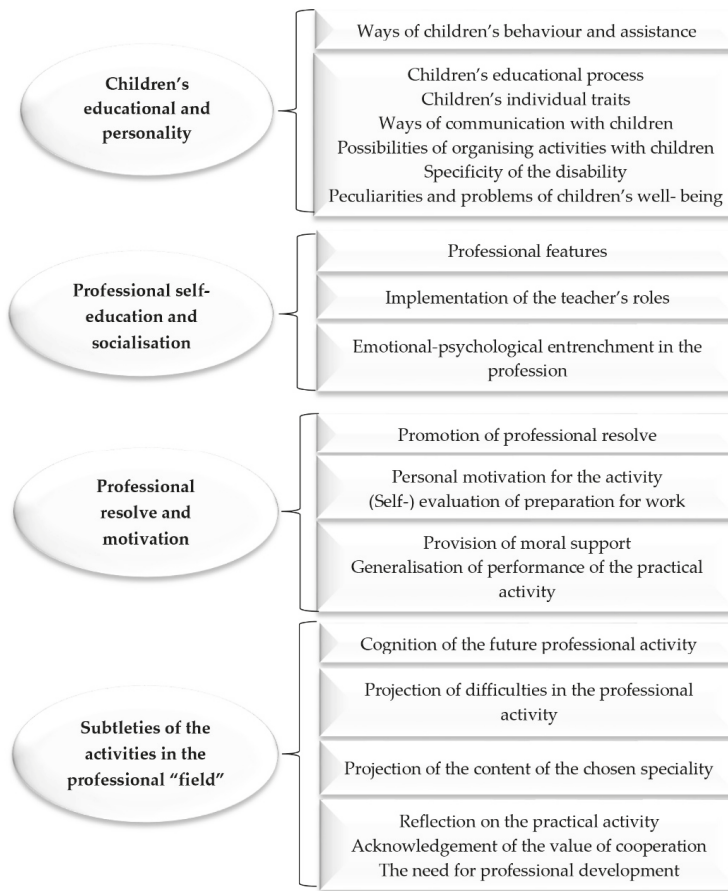


Figure 1. Areas and sources of cognition of professional activity subtleties.

During practice, four essential professional activity areas were relevant for students: Areas related to cognition of the child as a subject of the educational process, personal professional self-education and socialization possibilities, resolve and motivation to study, and professional "field" subtleties. Teachers who already had pedagogical experience in the places of practice were the most active participants and information providers in the process of children's education and personal characteristics. Family members and activities with children also helped to get a better understanding and knowledge of this area. The number of distinguished themes proves that this area was the most important and significant for students. It is evident and natural that the area of cognition of the professional "field" subtleties was not less important. Difficulties in promoting research activities were emphasized by family members and working teachers, while feedback in assisting to evaluate practical activities was accentuated by university teachers.

Entrenchment in the profession both emotionally and psychologically was determined by relationships with children and colleague students. Future special educators had possibilities to evaluate their professional choice and suitability for the profession in the relation with colleague students and on their personal initiative. Reflecting on the performed actions, university teachers and family members, as the main participants of this process, helped to evaluate personal preparation for further study activities. It is often emphasized that prospective specialists' practical training is

significantly influenced by cooperation between the university teacher (tutor), mentor in the place of practice and student [49–51], which helps to better understand and know the professional field. The data of the conducted research disclosed that, during their practice, students had received the best knowledge of the subtleties of practice and the perception of their role in the profession from family members. This enables to assume that the influence of the family in the process of education is often devalued, although this significantly contributes to the wider extension of knowledge in one's field and more successful formation of the professional identity. General discussion of practice problems with family members, psychological support, promotion of professional resolve, and investigative activities helped students to adapt more successfully to practice places, avoid unpleasant emotions, and negative experiences. Cooperation with family members through sharing experiences led to greater self-confidence of students as future specialists and enhanced motivation to go deep into their study area.

Information provided by special educators and teachers and meaningful cooperation at school created situations that warranted the students to go deep into the study area and enabled them to perceive strategies of communication with children, and to evaluate their roles as future specialists with personality traits that are needed to work with children. They also learnt to understand the specificity of organization of teaching and learning activities, and how to apply concrete working methods. Sharing of professional experience broadened the understanding of the ways of children's involvement in learning, situation management and task differentiation. Conditions created for students to personally involve themselves in concrete activities helped them to understand positive and difficult moments of implementing their future professional roles by learning from experience. Scholars notice that absence of external assistance during practice often causes many social, psychological and other problems [52–57]. Quite often these causes become the reason for termination of studies; therefore, practice mentors' and other teachers' assistance namely during observational practice was particularly important and necessary.

Subtleties of the future specialty unfolded through relations with children with special educational needs: Knowledge of children, understanding of ways of acting with children in a concrete situation, acquisition of communication skills in individual communication, children's attachment and provision of assistance for them were the main factors that determined better professional roles and emotional-psychological entrenchment in the profession of the students as prospective special educators.

Student colleagues' moral support was particularly needed for students who were still in doubt of their choice. Discussion of problems and personal experiences through students' cooperation helped to prevent distanced students from making spontaneous decision to quit their studies. Curiosity and personal initiative during practice enabled students to identify difficulties of their professional activities, also is the issue of independently communicating with children, and systematizing received information. The efficacy of reflective learning is determined not only by the relationship between the university teachers, teachers of the institution and students but also by the relationship between the very learners-practitioners. Cooperation between the latter in the reflective learning process is emphasized by Fisher and Somerton [21] and Dempsey et al. [58], who state that sharing ideas and attitudes with other people who outlived similar experiences is the basis of reflection. Student-student communication facilitates learning and application of existing knowledge. Students, purposefully simulating experienced teachers' activities, developed professionally, took over the methodological experience of education, deepened their understanding about children's special educational needs, and improved their skills of behavior with children and tactics of solving problems.

Analysing the features of manifestation of the teacher education process, it is emphasized that while learning there must be an environment ensuring the learner's autonomy and independence, clear system of incentives and activity priorities, effective feedback, and comprehensive communication and cooperation possibilities for the participants of the educational process [59–61]. One of the ways in which the administration of the higher education institution can facilitate effective relationships is

simulation of reflective practices [32]. Teachers of the higher education institution (tutors), practice supervisors in schools (mentors) should create conditions for students to see and hear them reflecting in the classroom, practice places and individual meetings. Since reflection is often a personal process, its simulation requires willingness and abilities of the teacher and practitioner who is already working at school to unfold.

Based on the obtained results, it should be recommended that, considering the aims of the first—observational—students' practice, the content of organization of studies should be adjusted: The first week before the observational practice should be dedicated not to studying separate subjects, but to cognitive-practical sessions, providing the basics of application of self-reflection in practice. It is recommended that the teachers who are responsible for practical studies should provide information to practitioners about the problems faced by students, necessary theoretical and methodological information about reflection as a reflective learning tool and its application possibilities during practice in the interaction with the trainee. This can be implemented by attending a concrete educational institution during the student's practice. It is recommended to develop didactic mentoring competencies of practitioners who supervise the student's practice, applying various possible teaching/learning forms. It is recommended to systematically plan and arrange meetings of working specialists and students at least once a month before the beginning of the study practice, through cooperation to find out and discover a general understanding of the aims and nature of the foreseen practice, combining students' and practitioners' expectations, needs and possibilities.

5. Conclusions

The interaction of the participants of the educational process and cooperation at the higher education institution help to ensure students' more successful adaptation in the teaching/learning process, perceiving their as future specialists' professional roles and subtleties of future activities. The mutual assistance process enables to create the environment empowering the improvement of reflection abilities that are needed when students become experienced professionals in their professional field. The research results highlighted the obvious need to link theoretical and practical knowledge during studies, where the learner's experience and its analysis become the main source of teaching/learning. The main goal the students and their supervisors at the university and in the place of practice should seek is the transfer of experience and assistance, familiarizing with the peculiarities of the future profession by helping to apply the acquired theoretical knowledge in practice. Every activity during practice should promote the student's further actions while learning, i.e., promote the search for answers to questions that the student failed to answer during the practice.

It is advisable to create support groups, using supervision elements, analyzing problems arising in the relationships with the trainee and projecting possible solutions of these problems. The same idea of support groups can be also transferred to the university environment by developing an optional module of the study subject, which could include the organization of student support groups before and after practice.

The limitation of the conducted research is that the results are presented analyzing students' experience after their first practice during studies. It would be relevant and significant to analyze and explore employing different research strategies, such as observation, action research, etc. in order to reveal the future special educator's professional growth and improvement during all studies, which would create conditions to improve the content of the study program at all stages of the teaching/learning process.

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Article

Advancing towards a Transformational Professional Competence Model through Reflective Learning and Sustainability: The Case of Mathematics Teacher Education

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Abstract: The aim of this study was to begin to characterize the elements of teacher educators' professional practice that promote the transformation of prior knowledge, experiences, and system beliefs into professional competence, based on reflective learning and education for sustainability. To obtain data, 30 class sessions of a mathematics education teacher were analyzed. Five elements of the lecturer's practice were identified: (1) presents real action; (2) uncovers students' values and preconceptions and considers them; (3) systematizes them and contrasts them with the 'ideal'; (4) helps to understand the perspective offered by mathematical and sustainability concepts; (5) helps students develop the new perspective acquired through grounded and reasoned action plans. A key conclusion of the study is that it is prior knowledge, experiences, and beliefs which are transformed if the two agents involved in the learning process (pre-service teachers and university lecturers) are synchronized.

Keywords: reflective learning; education for sustainability; teacher education; math teachers; knowledge transformation; professional competences

1. Introduction

The amount of scientific research related to teacher education is extraordinary and is focused on multiple unresolved aspects such as educational policies, quality education, or professional development, amongst others.

This article is centered on the professional development of pre-service teachers and, more specifically, on one of its main purposes: to transform prior knowledge, experiences, and belief systems into professional competence through progressive professional development, in order to effectively exercise the teaching profession [1], taking into account sustainability principles. In this paper, we follow Mayer and Lloyd [2] who state that while professional development can be described as the planned activities teachers engage in to improve their practice, professional learning implies how their practice changes. This change can be a result of their professional development, but also of the informal learning that takes place in their everyday classroom work. According to Webster-Wright [3], a prevailing view in this regulation is that there is a stage-based progression in competence from novice to expert. There is an assumption that, through continuing professional learning, professionals will maintain their competence and develop expertise. This assumption is also implicit in current moves seeking to make professional development mandatory for most professions. However, there is an increasing awareness that competence and expertise are context dependent. There is no question that competence development occurs; whether it is stage-based and linear has been challenged by those

who acknowledge its situated nature. Professionals develop their competences and skills in diverse manners depending on contextual issues influencing their practice, and how they understand practice.

The intention of this article is to offer various keys that empower the professional competence of pre-service teachers [4] in the area of mathematics education for sustainability. From this point of view, and as happens in other highly complex professional contexts, it is assumed that teacher education cannot be rethought based on mere intuition and experience. Progress will only occur if university lecturers, responsible for training pre-service teachers, explicitly incorporate key knowledge and lessons learned provided by research in various fields linked to teacher education. In this paper, we focus on two of these fields: education for sustainability and reflective learning. The first has been endorsed by the international community as a fundamental approach to address sustainable development—one of the most important challenges of our history [5–7]—as well as to move towards a 21st century pedagogy [8]. The second is an integral component of education for sustainability and has been shown to be effective for the development of teachers' professional competences [9].

This paper analyses and describes the teaching practice of a university lecturer who has embedded education for sustainability principles and reflective learning approaches in the course "Learning Mathematics" of the Degree in Early Childhood Education of the University of Girona. The purpose of the analysis is to identify and characterize key elements that contribute to challenge pre-service teachers' prior knowledge, experiences, and belief systems into professional competence in the area of mathematics education for sustainability.

1.1. Mathematics Education for Sustainability

For the past 30 years, education has been described as the great hope to create a more sustainable future. Underpinning education for sustainability is a commitment to engaging people and social groups in learning to live in sustainable ways. It encompasses a new vision of education that supports learners to reflect upon preferred futures and define their vision for sustainable development [10]. Education for sustainability is focused on pedagogy as it seeks to equip learners to respond to the complexities and uncertainties of the future, and uses well established and less well-known pedagogical approaches [11], such as futures thinking, learning to change, systems thinking, stakeholder engagement, reflective learning, and participatory learning [10,12,13].

Mainstreaming sustainability in teacher education has been identified as a key priority in authoritative international documentation [5–7]. The education of pre-service teachers plays a vital role in achieving changes in teaching and learning in schools [14], as well as shaping the knowledge and skills of future generations [15]. Bourn and Hunt [16] highlight that education for sustainability amplifies questions about the purpose of teachers in society. They do not only hold the key to promote sustainable development understanding and competences, but also support social justice, equity, and environmental responsibility in our communities.

Much has been written about re-orienting teacher education for sustainability [15–23], stressing the need to rethink content and competences, but also promoting the clarification of sustainability values and the development of reflective practices [6]. There are many experiences documented regarding the embedding of sustainability principles in specific pre-service teacher education subjects such as language or science education [24–26]. However, there is a lack of literature unpacking the connections between mathematics education and sustainability. Most of the documentation consists of reports and booklets describing inquiry-based school projects that have engaged students in using mathematics to explore specific sustainability challenges. There is little research that investigates the fundamental role of mathematics education in supporting learners to design creative ways to meet sustainable development needs in efficient ways, understanding the natural world and our relationship with it, acquiring a critical understanding of progress and technological advance, or solving complex problems using systems approaches, to mention some.

In Spain, competences form the scaffolding around which university education courses are constructed. These competences usually appear as generic, specific, and transferrable skills that

graduates must demonstrate over the course of their degree. The University of Girona has included sustainability as a transferrable competence, and all lecturers are expected to embed education for sustainability in their courses. The Department of Specifics Didactics of the Faculty of Education has worked in this direction for a long time, especially in the areas of science and mathematics education. Many subjects have been rethought in order to tackle the sustainability challenge and help pre-service teachers understand their personal and professional responsibilities regarding sustainable development. First, sustainability competences were embedded using the framework developed by ACES (Higher Education Environmental Curriculum Network) [27] and, later, the guidelines developed by the Conference of Rectors of Spanish Universities (CRUE) Sustainability Group [28] and the UNECE Education for Sustainable Development Competence Framework [29]. The design of the subject “Learning Mathematics” has been informed and shaped by the latter and has implied making an emphasis on holistic thinking, envisioning change, and transforming learning systems, as well as developing learning experiences focused on the pillars of learning to know, learning to do, learning to live together, and learning to be. The professional development experience of this course, therefore, is built on critical reflection and participatory and action learning pedagogical strategies, reflective learning being at the core of the learning experience and being used as a tool for values clarification and action empowerment. This article is interested in analyzing the transformative model of reflective learning in the context of mathematics education and sustainable development. We consider that critical reflective learning should be a key pillar to enhance the professional development of pre-service teachers in the area of mathematics education for sustainable development as it helps learners to clarify and challenge their prior knowledge, experiences, and systems beliefs and transform them to include sustainability criteria.

1.2. Reflective Learning as a Transformative Model of Knowledge, Experiences, and Belief Systems

Reflective learning promotes the integration of people with their experiences as students, with theoretical knowledge, and with their representations of what it is to teach and learn. This approach guides students towards inquiry-based practices within the professional context, in a way that creates new mental structures during the training process through self-regulated learning [30].

Black and Plowright [9] designed a multi-dimensional model of reflective learning for professional development that can be helpful to frame mathematics education for sustainability. In this model, they included the following dimensions: (a) the source of reflection, comprising learning experience and practice experience and known as the experiential process; (b) the target of reflection, namely reflection-on-learning and reflection-on-practice, and, also the levels of reflection in relation to the target; (c) the realization of reflection, through written and internal dialogue with oneself, which is known as the transformational process; and (d) the purpose of reflection, i.e., reflection for learning and reflection for practice, referred to as the developmental process. This model includes reflection on learning for further learning and self-development; reflection on learning for application to professional practice; reflection on professional practice for further learning and self-development; and reflection on professional practice for application to future professional practice [3] (p. 255).

In recent years, there has been an increasing number of studies focusing on analyzing the effects of reflective learning on teacher education and on designing tools aimed at transferring control and awareness of each activity to students, so that they can appropriate the meaning of the knowledge and use it independently through formative and authentic evaluation. A review of the literature has been carried out in relation to the main benefits and obstacles of reflexive learning [31]. The results of this body of research on reflection in teacher education indicate that the main benefits of its application are as follows: it promotes collaborative work among equals [30]; it constructively guides the process of reflection individually and in groups [32]; and it fosters self-regulation processes to promote autonomous learning [33]. Regarding sustainability, reflective learning allows us to understand our own values and abilities and provides strategies to transform our practice; also focusing attention on the process and not the results, thereby helping to better understand the complexity of future professional

practice [34] and sustainable development. Regarding the obstacles, previous studies indicate that reflective learning implies a change in the way teaching, learning, and evaluating are conducted at universities, a challenging task that not everyone is willing to adopt [35]; it requires practice as a starting point for reflection and also an awareness of knowledge, experiences, and beliefs [36]; it can provoke emotional conflicts when contrasting ideas with others and it requires the use of new tools (portfolios, narrative texts, questionnaires, etc.) that can be difficult to develop for students, and challenging for university lecturers to assess [37]. Alsina et al. [38] point out that the use of reflexive learning in the management of discourse and practice during teacher education, together with the use of specific tools, promotes processes of self-regulation and confrontation in pre-service teachers that lead to the deconstruction, co-construction, and reconstruction of knowledge (Figure 1). These processes are key for pre-service teachers to challenge current unsustainable values, practices, and experiences and develop alternative ways of teaching that promote sustainability principles.

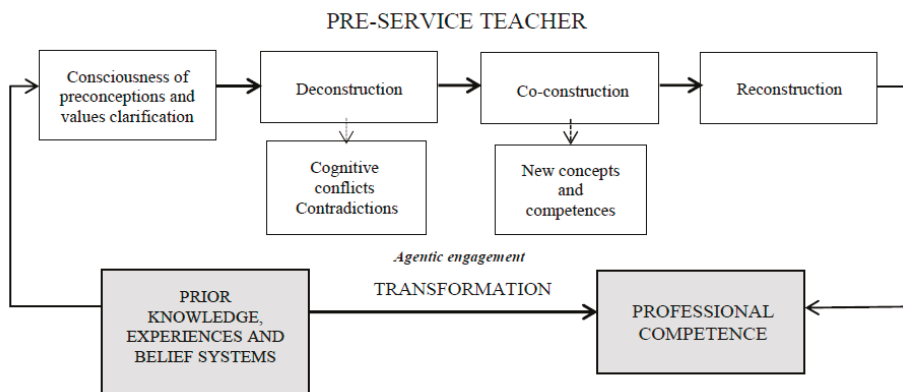


Figure 1. Pre-service teacher elements for the transformation of prior knowledge, experiences, and belief systems into professional competence.

“Deconstruction” is meant as a process from which students become aware of their implicit knowledge, values, and beliefs while seeking alternatives to transform them and improve their professional profile in teacher education and sustainability [39]; “co-construction” is conceived as a social and interactive process in which students share their prior knowledge, experiences, and beliefs with the mediation of an expert, to promote professional learning through collective scaffolding, that is, through collective reflection and construction [40]; and finally, “reconstruction” is a process that involves the transformation of prior knowledge, experiences, and belief systems into professional competence [41]. Loughran [42] indicates that all these processes promote socially acquired knowledge, personal opinions, and the reconstruction of social knowledge.

In particular, Alsina et al. [39] identified 12 elements, which have been called self-regulation traits [43], which facilitate the transformation of prior knowledge, experiences, and belief systems about the teaching profession into professional competence. The first five traits foster cognitive processes related to the deconstruction of: prior experiences; beliefs about oneself; beliefs about the way the class functions; implicit disciplinary knowledge; and implicit didactic knowledge. The remaining seven traits promote processes related to the co-construction and reconstruction of professional competence: interaction with context I (at the school); interaction with context II (the university); interaction with oneself; interaction with peers; interaction with experts; interaction with theory; and critical professional knowledge. According to Larrivee [44], these elements are fundamental for the training of reflective teachers who are critical and capable of learning throughout their lives. Thus, they are fundamental to promote sustainability across the schooling system.

In addition, other elements that have been defined from the results of educational research on teaching practices also intervene in this transformation process. Due to its important role, we want to highlight the element called “agentic engagement”, which Reeve and Tseng [45] (p. 258) define as follows:

“Agentic engagement is students’ constructive contribution into the flow of the instruction they receive. What this new concept captures is the process in which students intentionally and somewhat proactively try to personalize and otherwise enrich both what is to be learned and the conditions and circumstances under which it is to be learned.”

The above definition includes emotional and cognitive elements. Thus, we must consider that in addition to the conflicts and contradictions indicated in Figure 1, other elements also participate in the construction of new knowledge and experiences that take into account sustainability. These are elements of an emotional and cognitive nature, such as intentionality and proactivity or, more generically, attitudes towards learning and sustainable development.

2. Method

A case study of a descriptive type has been designed based on a qualitative approach [46]. Stake [47] described case studies as “the study of the particularity and complexity of a single case, coming to understand its activity within important circumstances” (p. xi). To obtain the data, the professional practice of a mathematics education university lecturer at the University of Girona (Spain) was observed. Specifically, the analysis was made in the subject “Learning Mathematics” of the Degree in Early Childhood Education, which includes 30 class sessions (10 theoretical and 20 practical). It is the first subject of mathematics education that students attend and it is located in the first semester of the 2nd year, after students have received basic training in psychopedagogical bases. In total, there are 48 students enrolled.

All class sessions were recorded on video, since this technique provides data from a more objective perspective; allows the analysis of a large quantity of data from a variety of perspectives and with different analytical frameworks; and also allows the integration of microanalysis and macroanalysis [48], among other advantages.

An audio recorder was attached to the teacher’s neck and a video camera was used to record the class sessions. The camera was located in a corner of the room so that the blackboard and as many students as possible could be included in the frame. During the recording, the person filming was attentive at all times to what was occurring, to be able to move the camera if necessary or zoom in to better record what was happening. The camera constantly followed the teacher (who is the focus of the study), covering as many students as possible and zooming in to record interactions related to the reflective dialogues, or to focus on the written productions resulting from the shared experience.

For the analysis, MediaNotes was used, which is a software-based video annotation system [49] that allows users to upload, tag, and annotate segments of the video. According to ref. [50], video annotation software systems provide users with the ability to synchronously or asynchronously watch and code (or tag) the video. In some of the video annotation software programs, the user can pre-define the criteria for tagging (analysis), whereas in other examples, the user is provided with pre-established tags. In most of the video annotation systems, the user can highlight certain parts of the video and add commentaries. MediaNotes was chosen over other video analysis tools because the coding and search options make it easier to data mine [51,52]. In addition, it has also been used as a video-based method of observation to promote teacher reflection [50,53].

To analyze the data, the authors used a deductive application of categories. Deductive category application works with prior formulated, theoretical derived aspects of analysis, bringing them in connection with the text. The qualitative step of analysis consists of a methodological controlled assignment of the category to a passage of text. Even if several procedures of text analysis are processing that step, it is still poorly described [54]. More specifically, the authors used the twelve self-regulation

traits described by Alsina et al. [38]. As indicated in the section above, these traits are the pre-service teacher elements that promote the transformation of prior knowledge, experiences, and belief systems about teaching into scientific and professional competence (see Figure 1). To conduct the analysis, MediaNotes' tagging features were used to mark specific segments according to our own framework and the commenting features used to provide detailed insight that provided evidence of the university lecturer's practice.

To complete the analysis and investigate the lecturer's practice and its effect on student performance in more detail, the authors also analyzed the lecturer's evaluation forms completed by students enrolled on the "Learning Mathematics" subject. In a recent study, Ayllon, Alsina, and Colomer [55] assessed the effect of these on the three dimensions of need-supportive teaching (NST): autonomy support, structure and involvement [56], and students' self-efficacy [57], in order to gain new knowledge about students' achievement in higher education. In this context, and within the Self-determination Theory (SDT) framework [56], NST is a powerful instrument to motivate students and help them achieve better results. From this point of view, these authors analyzed 86,038 complete evaluation forms (27,216 for 2014; 29,946 for 2015; and 28,876 for 2016) and confirmed their ability to inform higher education teaching and learning through the university lecturer's teaching practice. Thus, this paper considers that it is important to analyze these forms that can provide complementary data about how the lecturer's teaching practice can contribute to the professional development of pre-service teachers in the area of mathematics education for sustainable development, taking into account the vision that students have about their lecturer's teaching practice. The analysis of the forms also allowed the triangulation of results, thus enhancing the research validity.

The process for students to complete the evaluation forms is as follows: three weeks before the end of classes, students answer a brief online questionnaire via the Moodle platform: this means that students do not know their final mark when completing the questionnaire. The questionnaire is not compulsory, but students receive messages encouraging them to answer. They can do so at any time of day during the seven days that the questionnaire is online, and it is completely anonymous. In total, the lecturer obtained 12 complete evaluation forms, which represents 25% of the total number of students who attend class.

The evaluation form consists of two main parts. In Part A, students are asked the following six questions (in this order):

1. This lecturer has introduced the course syllabus and the evaluation criteria clearly.
2. With this lecturer I learn.
3. This lecturer motivates me to make an effort and to learn by myself.
4. The course support material that the lecturer provides me with, helps.
5. The evaluation procedure allows me to show my knowledge.
6. This lecturer helped me with my doubts when I consulted him/her. Questions 1 and 4 focus on structure, that is to say, they refer to the amount and clarity of the information that the lecturer has provided to students about what is expected and how they can fulfil these expectations (such as, for example, setting rules and providing feedback). Question 3 focuses on autonomy support, as students find themselves more engaged in the process of learning when the lecturer fosters relevance by identifying the value of tasks, lessons, materials, and activities. Question 6 focuses on lecturer involvement and to what extent the lecturer is available to all students and committed to their learning. Finally, Questions 2 and 5 refer to students' self-efficacy or feelings of competence in relation to their cognitive judgement of their personal capacity to learn. Finally, Part B simply asks,
7. I evaluate this lecturer's performance as positive. Answers to all questions are on a scale from 1 to 5, where 1 indicates "strong disagreement" and 5 "strong agreement."

The authors are aware that through their researcher positionality and as qualitative researchers, they can influence the research they do and shape the knowledge produced [58]. For this reason,

reflexivity has been an integral aspect of this study and has been put into practice through informal descriptions, memo-ing, and an iterative process of questioning the methods used and results emerged. Following Bourdieu [59], when conducting the research and analyzing the data, the authors took into account their social origins (class, gender, background, etc.), the position they occupy in their academic fields (maths education and sustainability), and their intellectual bias associated with how they see and interpret the world.

Regarding the ethical considerations, before initiating the study, the informed consent of the lecturer and the students was obtained. In addition, the lecturer agreed to provide the results of the evaluation forms, but all data that could identify the lecturer was intentionally deleted.

3. Results

This section is organized according to the self-regulation and confrontation processes described in Figure 1 (deconstruction, co-construction, and reconstruction), and considering the 12 self-regulation traits defined by ref. [38]. It is considered that pre-service teachers' comments and productions are the result of their way of acting, which is why such evidence is indispensable to identify teacher practice and extract the main elements that characterize it. Although all sessions were recorded, a teaching sequence of one of the parts of "Learning Mathematics" is presented and analyzed as an example: algebra and logical-mathematical reasoning in Early Childhood Education.

3.1. Phase 1. Deconstruction of Prior Knowledge, Experiences, and Belief Systems

In this initial phase, the university lecturer puts into practice some procedures and skills to establish a relational climate that encourages the active participation of students. In our case, the lecturer uses previously thought-out questions and formulates challenges to the students. On the one hand, the questions that are posed to pre-service teachers when starting the topic of logical-mathematical reasoning are: "What do you think is logical-mathematical reasoning?"; "what is it for?"; and "what benefits do you think it contributes to effective performance in today's unsustainable context?" On the other hand, a structured logical material (Dienes' Logical Blocks) is presented to the students and they are asked to find out what knowledge related to algebra, children from 3–6 years old could learn with this material. These questions and challenges are formulated to reveal pre-service teachers' prior knowledge, experiences, and beliefs. The questions are linked to the socio-cultural context so that students can begin to understand the role that mathematics education can play as an agent of change in accordance with sustainable development.

The procedure for discussing student responses takes into account the guidelines of ref. [60] to promote reflective dialogue: students are grouped into small groups (3–4 students) and debate the answers for a limited time, not exceeding 15 min. Afterwards, each group writes the agreements and a spokesperson communicates the answers to the others. While the lecturer writes and organizes the answers on the board, he does not make evaluative comments, makes sure that what is written matches what the students say, accepts all interventions, and maintains close contact with the participants through non-verbal language (gestures, looks, movement in the room, etc.). Table 1 presents some evidence about the prior knowledge, experiences, and beliefs revealed by students.

In the evidence provided in Table 1, it is observed that, through the questions formulated, the university lecturer has helped to uncover some pre-service teachers' intuitive knowledge of logical-mathematical reasoning. In summary, this knowledge shows that students know some of the general functions of logical-mathematical reasoning (organize and structure thought, enable thinking, internalize strategies, etc.), but do not specify the main content associated with logical-mathematical reasoning or algebra in the early ages, such as sorting, classifying, and ordering objects by size, number, and other properties; recognizing, describing, and extending patterns, such as sequences of sounds and shapes or simple numerical patterns, and translating from one representation to another; or analyzing how both repeating and growing patterns are generated [61]. The data also shows that pre-service teachers realize that math can be used to understand better the socio-cultural context and environment

where they live, but do not generally explicitly see its connections with sustainability, such as predicting possible effects or searching alternative ways of thinking and acting.

Table 1. Prior knowledge, experiences, and beliefs systems on logical-mathematical reasoning.

Prior Experiences	<p>“I was not aware of the possibilities offered by the socio-cultural context and environment to work on mathematics. Therefore, I have realized that my previous learning experiences have not been relevant to me.”</p> <p>“First I thought that doing a worksheet or two a day was little because I had learned math in schools where they did more.”</p> <p>“When I reflected more as when we remember the games of our childhood, the impressions we had. I realized that by enjoying the game, we used mathematical reasoning.”</p>
Beliefs about Oneself	<p>“I haven’t liked mathematics since ESO (compulsory secondary education). I now like it thanks to engaging with other methodologies. Before I only saw numbers and math operations, now I see many other themes, such as sustainability, that I have never dealt with before.”</p> <p>“I noticed that I had never thought if students were capable of keeping up with the pace I asked for in the activities. And that I acted according to my preconceptions.”</p> <p>“Will I be able to change traditional educational practices and carry out innovative actions and dynamics that favor logical-mathematical reasoning and sustainable development in an experiential learning way?”</p>
Beliefs about How the Class Functions	<p>“Before I used to think that it was more difficult to work mathematical concepts with little children, but I have learned that there are many resources to do this and that it is important to work on it because mathematics is everywhere.”</p> <p>“Having noticed how difficult communication between the two tutors of the same course can be, I considered that managing the same class group between two tutors would be equally or more complicated to manage.”</p>
Implicit Disciplinary Knowledge	<p>“Logical-mathematical reasoning is a type of mathematical knowledge that allows us to use different strategies to solve problems.”</p> <p>“This is a series of strategies to develop thinking in general and mathematical thinking in particular.”</p> <p>“Logic serves to learn to reason and structure the mind.”</p> <p>“Logical-mathematical reasoning is a part of mathematics that is not contemplated in the Curriculum as a block of content, but that is given an instrumental role.”</p>
Implicit Didactical Knowledge	<p>“Before I saw maths as something that we had to learn through books, and that it served little in everyday life. I had a wrong idea about maths since I thought it was not in our daily lives.”</p> <p>“Previously it did not relate with a capacity to experiment and manipulate with logical-mathematical reasoning.”</p> <p>“I considered that algebraic reasoning was not necessary until high school.”</p>

3.2. Phases 2 and 3. Co-Construction and Reconstruction of Knowledge

After deconstructing pre-service teachers’ knowledge, experiences, and system beliefs, the lecturer takes the pre-service teachers to the co-construction phase. First, he makes an anchor between prior knowledge and sustainability science knowledge, providing students with theoretical documentation in the form of the specific documents provided, and supported by their own bibliographical searches. In this context, he uses a type of neo-Vygotskian instruction called “Concept-based instruction” (C-BI), which is carried out through a series of stages that can be organized and implemented for a specific educational context, as determined by the educator in accordance with the specific context [62–65]. Generally, however, the initial stage from which all others emerge is the orientation stage, which determines the overall quality of a particular approach to a given situation. This stage begins with the students’ pre-understanding of a certain topic. Hershkowitz and Schwarz [60] referred to pre-understanding as the Orienting Basis of Action, or OBA, because it is assumed that students base their actions, including language action, on their OBA. This knowledge can come from everyday experiences or from previous instruction, especially of the traditional type. The new conceptual knowledge is first explained and then represented imaginatively to learners as a Schema for the

Orienting Basis of Action, or SCOBA. According to ref. [65], the remaining stages of the Gal'perin [64] educational model are designed to promote student internalization of the knowledge represented in a SCOBA, and to use that knowledge in practical activities, including spoken and written communication.

Based on the lecturer's guidelines, the pre-service teachers share their conceptual expansion or SCOBA, following the same procedure as in the first phase of the teaching sequence. Table 2 presents some evidence of the co-construction phase in relation to algebra, logical-mathematical reasoning, and sustainability, obtained from their pre-service teachers' portfolios.

Table 2. Co-construction of knowledge, experiences and belief systems.

Interaction with Context II (the University)	<p>"The methodology has been very different from the one we are used to... contrasting opinions with colleagues, building our own knowledge has a very important added value."</p> <p>"The methodology used is more interesting and enriching than if the teacher explains a lesson and students take notes without understanding what we are doing, because we try to write everything down and there is no time to think about what is being explained. Therefore, I find it a good way, we all learn from everyone and at any time you can present your doubts, since you understand well what others are saying."</p>
Interaction with Peers	<p>"Discussing and sharing experiences is always better than sitting on a chair and the teacher dictating something you often do not even listen to".</p> <p>"I realized that between all the students we were able to define a concept that we did not think we knew."</p> <p>"We have managed to achieve significant learning since we have been the protagonists at all times and we have actively participated, understood and found meaning in everything we have learned."</p>
Interaction with the Expert	<p>"The reflective dialogues with the lecturer have made me see that mathematical logic reasoning offers some basis to think critically, to understand the world, and analyze things in a different way."</p> <p>"The university lecturer has helped me to see that all children can learn maths. This is very important to me since it has allowed me to understand what issues like equity or inclusive mathematical education mean."</p> <p>"Before I had other values and thought that mathematics was accessible only to the smartest ones."</p>
Interaction with Theory	<p>"Reasoning in general, and logical-mathematical reasoning in particular, helps to structure the mind; to develop children's ability to reason; and, above all, it helps to progressively internalize various elementary capacities to build other mathematical knowledge (quantities, geometry, measurement, etc.), as well as non-mathematical knowledge".</p> <p>"Mathematical logic is responsible for studying valid statements, the relationships between statements, the laws of deduction, etc."</p> <p>"Logical-mathematical reasoning is basic to understanding algebra".</p> <p>"At early ages, logical-mathematical reasoning is based on the work of algebraic content, such as different types of relationships (classifications, orders, patterns, etc.) and changes".</p>

As it can be observed in Table 2, using CB-Instruction, the lecturer not only encourages pre-service teachers to acquire disciplinary knowledge, but also to learn strategies and resources to carry out effective teaching in considering sustainable development. According to ref. [61], effective teaching means identifying what students already know and what they need to learn, and then stimulating and helping them to learn it well. The association of American mathematics teachers develops this idea with the following three requirements: (1) teacher effectiveness requires mathematical knowledge and awareness that students are learning and must have adequate access to pedagogical strategies; (2) effective teaching requires a supportive and stimulating learning environment; and (3) effective teaching requires constantly striving to improve.

From this perspective, the SCOBA designed by the lecturer in the co-construction phase of the teaching sequence has allowed students to learn methodological resources and appropriate ways of acting according to education for sustainability principles in order to promote the learning of algebra and logical-mathematical reasoning at early ages.

In the next stage, the reconstruction phase, the lecturer encourages students to contrast their previous knowledge with new perspectives, understanding contrast to be a process that starts from the experience of each member of the group [60]. The lecturer shows different structured logical materials and asks students to work in groups (3–4 students) to analyze them and design some activities based on a learning guide. In each activity, students have to describe: (1) the level and contents; (2) the management of the activity; (3) the solution of the activity; and (4) the mathematical language and other aspects associated with communication, such as the questions that children are asked to promote understanding, etc.

The activities designed are presented to the other students and, after the lecturer has mediated and consensus has been reached by everyone through a process of interaction, negotiation, and reflective dialogue, activities are then implemented in a school. Specifically, each group of students applies the activities to a group of about 10–15 students from 3 to 6 years old. With this task, the teacher enables pre-service teachers to apply the theoretical knowledge acquired and to obtain conclusions regarding their own practice in a real situation. Considering education for sustainability criteria, the lecturer establishes links between the university and the community while creating a context that encourages the development of professional competences in this area. Table 3 shows the evidence collected from this phase.

Table 3. Reconstruction of knowledge, experiences and belief systems.

<p>Interaction with Context I (at the School);</p>	<p>“At the school we were able to practice and then we reflected on what had gone well and what had gone wrong. In short, we did a self-assessment of our own practice. With this reflective practice, we observed that theory was fundamental to our design and implementation of the activities”.</p> <p>“Knowing examples about mathematics and sustainable development and seeing real situations that occur in schools has made me realize the important role of the educator, his methodology and the great amount of work he has previously done to reach these results.”</p> <p>“The fact of creating ourselves a teaching material for children to learn mathematics (and then put it into practice in a school) has allowed me to learn to ask questions, as well as to see that the use of materials is a suitable methodology for children to learn.”</p> <p>“By observing real practices on mathematics and sustainability, I have realized that, by allowing children to act freely, a more relaxed and more adequate environment for their global development is created. I have also understood that it is a methodology that offers the results that every teacher wishes, that students acquire good learning.”</p>
<p>Interaction with Oneself</p>	<p>“I have observed that you learn much more from experience and autonomous learning than through the introduction of theoretical content.”</p> <p>“My attitude towards mathematics in general has changed: I have adopted a more reflective attitude of analysis and, above all, of counteracting my own opinion with that of others.”</p> <p>“Throughout the course I have learned several things and have applied some that have been useful to interact with students, and I think that I will continue to use them in my day to day as a future teacher.”</p>
<p>Critical Professional Knowledge</p>	<p>“Manipulating, experimenting since children create mental patterns of knowledge from direct action with objects. This aspect is fundamental, so it is important to have many different materials, both commercialized and self-built.”</p> <p>“Presenting activities in reverse order, according to age”.</p> <p>“Performing activities from simulated environments (computers, etc.), after having sufficiently guaranteed direct action with manipulatives”.</p> <p>“Progressively introducing symbolism in logic games”.</p>

The evidence presented in Table 3 reveals the starting point from which students began, the process they followed, and the transformation experienced throughout the process. This contrast has caused some cognitive conflicts, according to ref. [32] (p.108) who state that “critically reflective learning is, in itself, disturbing, but also stimulating and demanding, potentially”. In addition, students identify what they need to rethink about how to teach and learn in the area of mathematics education for sustainable development. This idea links with Esteve and Alsina [30], who point out that these

cognitive conflicts are necessary to begin to self-regulate one's knowledge, and also to seek answers individually and collectively in order to advance, improve, and learn.

From this perspective, these cognitive conflicts, managed successfully by the lecturer and the students themselves, help to reconstruct prior knowledge, experiences, and belief systems and to build new professional knowledge in a collective and consensual way. This is when it becomes clear that the pre-service teachers in our study have understood that knowledge and skills in mathematics and sustainable development cannot be acquired only through the simple transmission of information by the lecturer, and that they must assimilate it from their own practice.

If the evidence of Table 3 is analyzed in more detail, we can also observe that the experience has enabled endogenous, collective, and cooperative work, key to education for sustainability. Students come to the conclusion that everyone can learn from everyone: the students from the lecturer, the lecturer from the students and, above all, the students from themselves.

Finally, and in order to complement the data presented, we considered the results of the lecturer's evaluation forms and compared the results with the means of the department and of the degree in Early Childhood Education. For the seven questions posed, the lecturer received a better mark than the means of the department and the degree. He was marked with the highest rate in five of the questions (5 out of 5), including the final one that asks the students to evaluate the overall lecturer's performance. The analysis of students' qualitative comments shows that what they valued the most is the practical nature of the subject and the lecturer's teaching performance.

4. Discussion and Conclusions

In this article, a link was established between reflexive learning and education for sustainability, and this was integrated within a teaching-learning process of the professional didactic and disciplinary knowledge needed to teach mathematics.

In accordance with Sanmartí, Jorba, and Ibáñez [66], when training teachers, we think it is necessary to teach them how to learn from within the discipline itself, if we want the teaching process to be successful. This is not so much because it is difficult for pre-service teachers to apply general learning strategies to the learning of specific didactic knowledge—in our case referring to mathematics education—but also because teachers must design their didactic practice so that students can implement these strategies to learn.

More specifically, the initial data obtained tends to show that the teaching practice described proved to be an effective tool to promote the professional development of future mathematics teachers. In particular, we were able to extract various elements of the teacher's practice, typical of reflective learning and education for sustainability. For example, the formulation of questions and challenges when starting a teaching practice, which are established as a fundamental tool to encourage reflective dialogue and activate students' prior knowledge in maths and sustainable development; or the fact that encouraging interaction with others, with oneself, and with theory promotes the construction of meanings and the learning of knowledge, in addition to the contrast between the new perspective and the starting point, according to Hershkowitz and Schwarz [65]. The lecturer uses education for sustainability pedagogical approaches such as participatory and action learning, as well as promotes closer links with schools in the community to work on mathematical and sustainability matters. Strategies are used to help train critical professionals who are willing to act and are prepared to adapt to different situations, based on the pillars of learning to know, learning to do, learning to live together, and learning to be.

In addition, the data from the evaluation forms confirmed that the lecturer's practice has had positive effects on various aspects of the students. In particular, the elements of reflective learning and sustainability seem to have influenced the three dimensions of need-supportive teaching (NST): structure, autonomy, support, and involvement [67,68], and also student self-efficacy [69,70].

From this perspective, Figure 2 shows the elements of the teacher’s professional practice that have contributed to the transformation of prior knowledge, experiences and belief systems into professional competence, using reflexive learning in the framework of sustainability.

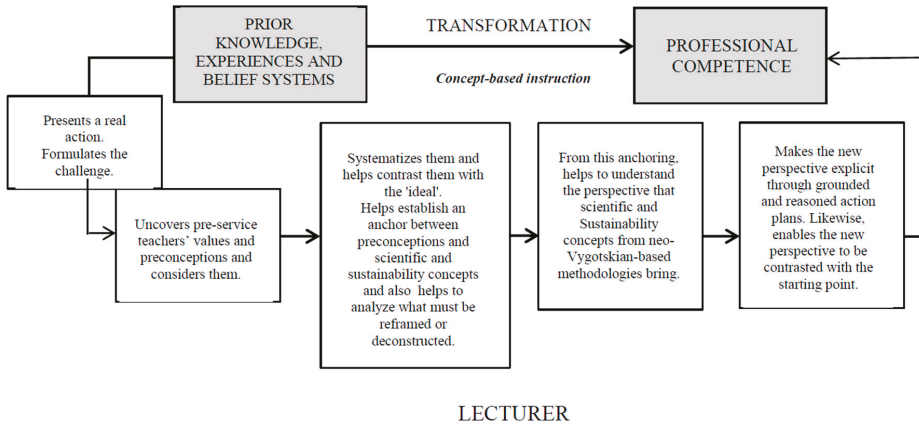


Figure 2. Lecturer elements for the transformation of prior knowledge, experiences, and beliefs into professional competence in teacher education.

Figure 2 shows that a vital previous element in mathematics education for sustainability is the teaching practice presentation through the formulation of challenges, problem solving, etc. In this formative setting, the first element is “uncovering students’ preconceptions”, that is, bringing to the surface students’ prior knowledge about mathematics education and sustainability, and keeping this in mind since it can sometimes be a real obstacle preventing the construction of the individual’s professional profile, as already indicated [39].

In order for the university lecturer management to be effective, the next element is to systematize this prior knowledge, experiences, and belief systems, contrasting it with pre-service teachers’ sustainability ideals, which can result in the emergence of some conflicts and contradictions. In order to manage emotions, it is important to build an anchor between prior knowledge and the students’ ideals, which is to say that the value that intuitive knowledge has in the construction of one’s own teacher profile must be acknowledged. As indicated, it is through this anchoring that pre-service teachers progressively incorporate and understand new concepts through Concept-Based Instruction [62–65]. Finally, in the last phase of the training, the lecturer incorporates new action plans, in the form of new methods of action that allow the co-construction and reconstruction of prior knowledge, experiences, and beliefs into professional competence. This allows the students to put into practice mathematics education for sustainable development in schools and reflect on their performance.

An important consideration to note is that, in this final phase, many students started to speak as a collective. This may mean that, through education for sustainability approaches and reflective learning, some of the students were able to leave behind a unidirectional vision of the teaching–learning process, in which the teacher transmits knowledge and the student receives it passively [31,69,70]. This statement is, however, a risky interpretation, since it is difficult to determine with exactitude if there has been a change in ways of teaching mathematical knowledge with the analysis of a single teaching sequence. However, some transcripts suggest that the inquiry-based and collective scaffolding that the lecturer promoted may have generated this transformation in some students, in line with ref. [67].

From the data obtained in this study on teacher elements that promote the transformation of prior knowledge, experiences, and belief systems into professional competence, together with the student elements indicated in Figure 1 [34], a first definition is proposed to advance towards a transformational

knowledge model in teacher education based on education for sustainability principles and reflective learning approaches (Figure 3).

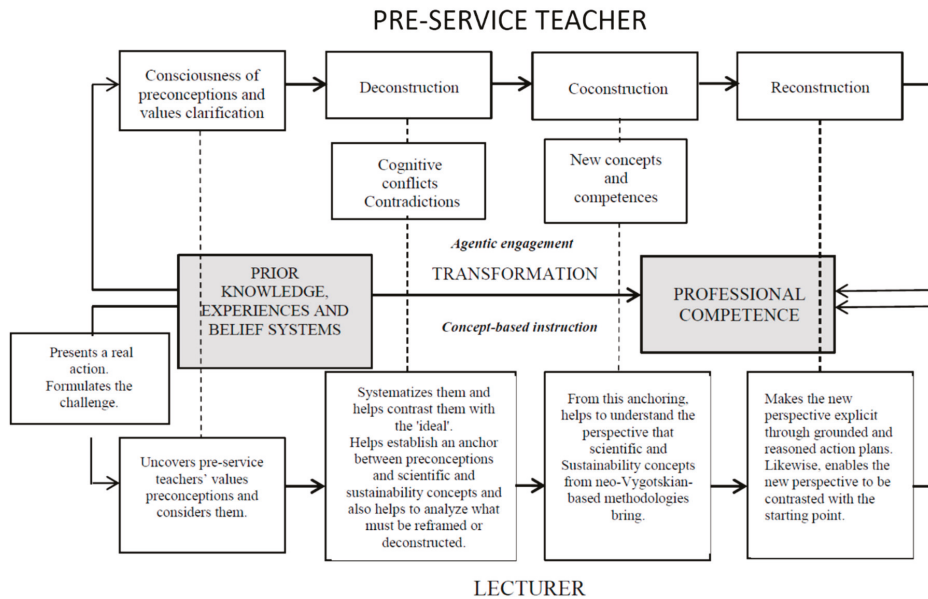


Figure 3. Elements for the transformation of prior knowledge, experiences, and belief systems into professional competence in teacher education.

Figure 3 shows, first of all, that one of the main purposes of teacher education and sustainability is to progressively transform students' prior knowledge, experiences, and beliefs into competences that contribute to their professional development. A second issue that is essential to consider is that knowledge is transformed into various phases that must necessarily be developed symmetrically in the two agents involved: pre-service teachers and lecturers. This is a matter of great importance, because if pre-service teachers and lecturers are not synchronized during a teaching sequence, it is very difficult for teacher education to contribute to the transformation of students' knowledge and values.

Some of the main limitations of the study have been the following: first, the data was obtained from the analysis of a single didactic sequence, which is why it is difficult to determine with exactitude if future teachers transform their knowledge about ways of teaching mathematics with sustainability criteria in mind. In addition, the teaching practice of a single teacher was analyzed, so the results cannot be generalized; second, we consider that it is not possible to achieve the effective transformation of university teaching and learning practice from a single subject. Therefore, it seems necessary that the university should adopt a whole-institutional approach to sustainability; third, some students indicated that the continued use of the techniques mentioned in our study, for example those aimed at promoting reflective dialogues, may cause monotony; and, finally, the data of the teaching evaluation is limited, since only 25% of the students answered, so it is not possible to obtain firm conclusions about the effect of the lecturer's practice on the three dimensions of need-supportive teaching (NST) and student self-efficacy. Therefore, in the future it would be useful to design new studies with larger samples to refine the transformational knowledge model described, and to incorporate other instruments and techniques to continue advancing towards teacher education based on education for sustainability principles and reflective learning approaches, with the purpose of improving the professional development of pre-service teachers.

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Article

Active Learning on Trust and Reciprocity for Undergraduates

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Abstract: We propose a teaching activity aimed at promoting social values, such as trust and reciprocity, among undergraduate students in economics and related degrees. We present our pilot experience of what we call RED–‘Reading–Experiment–Discussion’, a three-step activity as part of a class of a specific module at the University of Valencia. During the Reading step, we encourage students to reflect, learn, and critically think about social values. In the second step, Experiment, students make decisions in a trust game experiment, a game created to measure trust and reciprocity in economic environments. Students then give opinions through a post-experiment questionnaire. Our research hypotheses are tested by using non-parametric methods. We also investigate the association between students’ decisions and their attitudinal and sociodemographic characteristics by linear regression analysis. Experimental data show that decisions on trust and reciprocity are dependent on earnings information and that, on average, females trust more than males. Finally, in the Discussion step, the learning is reinforced by sharing the readings about morals and the experimental decisions. In short, RED may be of great help in transmitting to students the role of social preferences in individual decision making.

Keywords: sustainable education; trust; reciprocity; experiment; game theory

1. Introduction

Sustainable education involves an active academic engagement intended to create economic, social, and environmental programs able to improve living standards, generate empowerment, and respect interdependence [1]. To achieve this, a teaching approach rooted in ethics, values, social responsibility, and sustainability is required. In addition, it is necessary to revise the learning process of students. Deep learning techniques are aimed at helping students to develop a critical spirit and to reflect on concepts and paradigms in such a way that they are able to understand drawbacks, similarities, and complementarities among paradigms from different fields [2]. Consequently, activities promoting the deep learning of students aim to illustrate interconnections and interdependences, highlight dynamics rather than fix structures, and develop skills for critically assessing concepts such as Equity [2].

Following this approach, we present an educational activity that links economics with social values. Furthermore, this is a pioneering initiative to teach social values to first-year Business Administration (BA) and Tourism students at the University of Valencia (Spain). It was implemented through a transversal-skills module, just after the introduction of the “Ethical project: training ethical professionals”, designed as a progressive teaching process throughout a degree. In this way, ethics is taken into consideration as a transversal competency in the student’s curriculum. Specifically, our proposal revolves around the values of trust and reciprocity. In a nutshell, trust and reciprocity are two sides of the same coin: trust grows (declines) over time as a result of the other’s choice (not) to reciprocate cooperation [3]. They form the core of human relationships, essential for improving living

standards and may also act as seeds of sustainability for the socio-economic system [4]. For this reason, the concepts of trust and reciprocity require special attention from social science scholars as key values for a sustainable economic model.

Trust may be understood as one's expectations about the goodwill of others to meet their commitments and to not cause harm to others [5]. As a mental process, trust is based on the other's reputation, honesty, morality, and current and future circumstances to anticipate their actions [6]. Thus, this type of cognitive trust is configured with information, repeated interactions, past experiences, and history of cooperation with others [7]. As a voluntary decision, one may learn to trust others, unlike irrational trust that determines involuntary decisions [8]. Particularly in economics, research on social behavior focuses on the cognitive component of trust [9].

Reciprocity may be loosely defined as an obligation to respond in kind to what has been received, including gift exchanges within marriage or kinship relations. It is a broad concept that involves the exchange of goods or services, whether immediate or deferred, for psychological (social relations) or economic reasons (availability of resources) [10]. Thus, reciprocity governs the relations between different generations and statuses [11] and is regulated by the recognition of others and the concern for satisfying their needs for existence [12]. It is also understood as an intrinsic human behavior [13,14] as an instrument for maximizing economic and social advantage.

Experimental economics provides a large body of research on *social preferences*, such as fairness, trust, reciprocity [15] and other concepts, related to people's concerns about the well-being of others. Following a methodology based on laboratory experiments makes it a versatile tool to be used when implementing active learning strategies in social sciences. Compared to the traditional lecture method, the effectiveness of classroom experiments on student learning is widely studied with mixed findings. Some works do not find significant differences between experiment-based teaching and lecture-only teaching on student performance [16]. In contrast, other papers show such positive effects on student learning, performance, and attitude [17–20], that they encourage teachers to incorporate experiments into their teaching even if some extra work is necessary [17].

In this paper, we describe an educational activity that is an attempt to help introduce the teaching of social values as a transversal issue in social science faculties from the very beginning of a degree. From this starting point, a multi-task activity is integrated into the transversal-skill module of the first academic year, which is named *Incorporation to University Study*. It is designed with the goal of motivating students to reflect on social values, specifically trust and reciprocity, as necessary pillars for developing sustainable social and economic systems. To this end, students are encouraged to read and write on humanistic economics [21] to train autonomous and critical thinking and formal writing. Trust and reciprocity values are worked by using experimental games: students are involved in a trust game where they make decisions affecting their own and others' results. Reflection and discussion have a different tempo. Students spend a long time producing a progressive work of reflection. However, the discussion part, where they share and debate their opinions with others, takes place during one classroom session.

Game Theory offers the possibility to analyze a decision making context under the hypothesis of the rationality of players. The research question is focused on students' decisions in the trust game, a game created to measure trust in economic decisions. Rational players in this game should not trust nor reciprocate the partner. Taking this theoretical equilibrium as a reference point, we propose a finitely repeated trust game to study the educational learning of students in this context. Specifically, we designed an experiment that includes two treatments. The first is a control treatment: Students are paired to make individual sharing decisions in a trust game played several times with a different partner each time, and they are only informed of their own earnings, which depend on both players' decisions. In this way, their current partner's previous decisions should not affect the player's current decision. In the second treatment, however, players are informed of their partner's accumulated earnings before making a new decision. Allowing them to know their own and their partner's accumulated earnings may have an effect on their future sharing decisions. This gap may be interpreted as "endogenous income inequality", such that the following research question makes

sense: Does the information about the inequality in accumulated earnings have an effect on students' observed trust and reciprocity?

2. Materials and Methods

2.1. A Modified Trust Game

To create trust and reciprocity dynamics in the classroom, we ran a trust game experiment. Our experiment closely replicated one of the treatments in Berg, Dickhaut, and McCabe [22]. Specifically, both a sender and a receiver are endowed with the same amount of money E . The sender (trustor) decides which part $x \in (0, E)$ of the endowment to send to an anonymous receiver (trustee). The amount x is then multiplied by $n = 3$ in the receiver's hands. In our MTG, the receiver then decides which amount $y \in (0, E + 3x)$ to return to the sender. Consequently, the final pay-off for the sender is $\pi_s = E - x + y$, and that of the receiver equals $\pi_r = E + 3x - y$. Figure 1 shows the extensive form of our modified trust game (MTG).

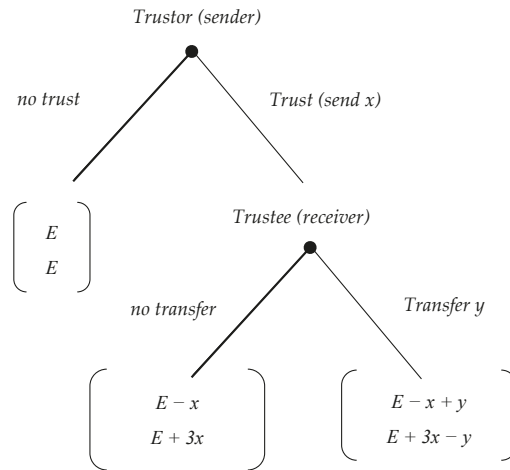


Figure 1. Extensive form of the one-shot modified trust game (MTG).

The MTG has a unique subgame perfect Nash equilibrium in ('no trust', 'no transfer') and therefore, neither trust nor reciprocity is a possible result under the assumption of rational *homo economicus*. However, in lab experiments, results that are not rational emerge involving the exchange of money between parties. It is observed that individuals were willing to share their money to improve their partner's outcome. For instance, in Berg, Dickhaut, and McCabe [22], the average amount sent by the sender was 51.6% of the maximum amount, and the average payback from the receiver was 15.53% of the maximum amount. Definitively, the role played by the sender is crucial, since the value creation (VC) eventually depends on his decision: $VC = (n - 1)x$ and therefore, on his belief about the receiver's reciprocal behavior. There is also an opportunity for both parties to enhance existing wealth whenever the receiver transfers back the amount received plus an extra (even) small amount ϵ : $y = x + \epsilon$. In such a case, the sender holds or increases his own wealth (since $\pi_s = E + \epsilon$) and, in turn, also the receiver's ($\pi_r = E + 2x - \epsilon$). The maximal value creation is reached when the sender sends all his endowment to the receiver: $VC_{max} = (n - 1)E$. In such a case, from a social viewpoint, the sender trusts the receiver the most when sharing all his endowment with the receiver. The receiver reciprocates to the sender when transferring back all the amount received from the sender plus an extra reward sufficient to maintain the egalitarian condition.

2.2. Participants

The activity was designed as optional within the transversal-skills module named *Incorporation to University Study*. By participating in the activity, students may obtain an extra point in that module. The participants were recruited via email sent to first-year BA or Tourism degree students at the University of Valencia in Spain. A total of 50 students (20 males and 30 females) aged 18 to 23 years old participated as experimental subjects. Through the online platform *Aula virtual*, they were asked to choose between two available dates to carry out the Experiment. Two groups were created: The first group was formed by 18 students who played a baseline treatment (T0), and the second group was formed by 32 students who played an information treatment (T1).

2.3. Hypotheses

Although many papers deal with trust and reciprocity [23], only a few analyze trust and reciprocity in a laboratory setting examining income inequality [24–27]. In our experimental finitely-repeated MTG, endogenous income inequality may emerge and may affect trust and reciprocity levels when players are informed of their partner's accumulated earnings. Specifically, we expect that trustors trust less and trustees reciprocate less when they are aware that their partner is thus far earning more. We formulate our two first hypotheses aimed to test for the effect that having information about the earnings of one's partner has on actual trust and reciprocity.

Hypothesis 1 (H1). *On average, the trustor sends lower amounts to the trustee when knowing that the trustee's accumulated earnings in the previous period were higher than their own.*

Hypothesis 2 (H2). *On average, the trustee returns higher amounts to the trustor when knowing that the trustor's accumulated earnings in the previous period were lower than their own.*

Even if a greater number of experimental studies find gender differences on trust in favor of males [28], some contradictory findings remain. For example, males send a higher portion of their endowment in experiments where the sample is heterogeneous in age. In addition, some authors attribute lower levels of female trust to their higher risk aversion [29]. However, when the characteristics of the participants are more homogenous, as in our case, the results tend to show higher levels of trust in females. This inspires our third and fourth hypotheses:

Hypothesis 3 (H3). *Compared to male trustors, female trustors send, on average, lower amounts.*

Hypothesis 4 (H4). *Compared to male trustees, female trustees return, on average, higher amounts.*

2.4. Learning Materials

The activity was designed to be multi-task to encourage students to reflect, experience, and debate social values in and out of the classroom. Students carried out different tasks: (R) reading and writing (out-of-class), (E) experiment (in-lab), and (D) discussion (in-class). Figure 2 shows the chronology of the whole activity we hereafter call RED–'Reading–Experiment–Discussion'.

At the beginning of the term, students were provided with a list of books on humanistic economics (see Appendix A). Each student chose one book and wrote an essay on it. This task involved reading, analysis, reflection, and writing, and was quite time-intensive, around 10 weeks, starting by mid-September. The essay was required to be submitted online by the end of November. Three weeks before the end, students were informed that they had to participate in an economics lab experiment. No information regarding the experiment was revealed to students. The last week of November, students participated in the MTG experiment (see instructions in Appendix B) and then answered a questionnaire (see Appendix C for details about the questions) about their initial opinions and analysis.

A discussion session was organized for students to relate the readings to the experiment in the first week of December.

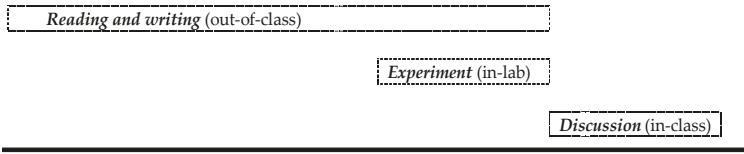


Figure 2. Chronology of the RED–‘Reading–Experiment–Discussion’—activity.

2.4.1. Reading and Writing

The Reading step had the purpose of introducing humanistic economics to students and encouraging them to reflect on values, such as trust and reciprocity, as essential features of sustainable cooperation. Students were provided with a broad list of books related to the Sustainable Development Goals (SDG) set up by the United Nations in its Conference on Sustainable Development in 2012. From that list, the student chose at least one and, close to the end of the term, submitted online a comprehensive summary of his readings. Such summaries were eventually shared and discussed within the group of students in the Discussion step.

Regarding trust and reciprocity as social values necessary to preserve societies, the second part allowed students to experience the application of these values by making decisions. Next, we describe in detail the Experimental part of the activity.

2.4.2. Experiment

The experiment was run at LINEEX, the experimental economics lab of the University of Valencia, during the academic year 2015–2016. The programming was made using the software z-Tree [30]. During the MTG experiment, students took resource allocation decisions in a modified version of the original TG by Berg, Dickhaut, and McCabe [22]. In Table 1, we make a list of the main features that characterize the original TG and our MTG.

Table 1. Main characteristics of the Berg et al.’s trust game (TG) and our modified trust game (MTG).

Original TG	MTG
Economic experiment	Classroom experiment
Hand and pencil experiment	Computerized experiment
From 60 to 90 min	90 min
2 experimenters, 2 monitors, and 1 recorder	2 instructors, 1 assistant
Undergraduate students	Undergraduate students
Any degree	BA and Tourism degrees
Monetary incentives	Class credit incentives
One-shot game	Repeated game for 10 rounds
Two treatments	Two treatments
No history/Social history	No information/Other’s earnings information
Two type players: A and B	Two type players: A and B
Random matching	Random re-matching
Each player type was located in a different room	Each player sat at individual PC’s in the lab
Initial endowment = \$10	Initial endowment = ExCU 50
The amount x sent by player A is multiplied by 3. With $x \in \{0, 1, 2, \dots, 10\}$.	The amount x sent by player type A is multiplied by 3. With $x \in \{0, 10, 20, \dots, 50\}$.
The amount y returned by player B is within the set $\{0, 1, 2, \dots, 30\}$.	The amount y returned by player B is within the set $\{0, 10, 20, \dots, 200\}$

ExCU: Experimental Currency Unit.

In the MTG experiment, subjects were first separated into two groups and randomly assigned a permanent role: type A or sender, type B or receiver. The game was repeated in 10 rounds. In each round, subjects were re-matched randomly, preserving anonymity to prevent any trust-unrelated effect, such as reputation, pre-arrangement, or punishment.

At the beginning of each round, subjects were given an ExCU 50 endowment. In each round, the sender decided first how much of that amount to send to an anonymous receiver. In particular, each sender chose the amount $x \in \{0, 10, 20, 30, 40, 50\}$. The amount sent was then tripled in the receiver's hands, who then decided how much to return to the sender, by choosing the amount $y \in \{0, 10, 20, 30, 40, \dots, 200\}$ such that $0 \leq y \leq 3x + 50$.

Two treatments were performed: a baseline treatment (T0) in which, at the end of each period, the subject received information just about own earnings. Any other information related to gender, education level, religion, wealth, etc., remained hidden. The amount of money the sender decided to send was treated as a measure of how much he trusted the receiver. Moreover, the amount returned by the receiver was interpreted as reciprocity. In this treatment, there were 9 males and 9 females participating.

In the information treatment (T1), we tested whether wealth inequality had an effect on trust and reciprocity. In this treatment, at the beginning of each round, the subject was informed about the other's cumulative earnings. Therefore, it may be the case that the subject chose considering the distance in earnings from their partner. In this treatment, the participants were 11 males and 21 females.

After the MTG experiment, students were asked to answer a questionnaire consisting of two blocks of questions. The first block related to sociodemographic characteristics (studies, gender, economic autonomy, and housing). The second one included a questionnaire based on the theory of multiple intelligences [31] concerning interactive, analytic, and introspective dimensions (see Figure 3).

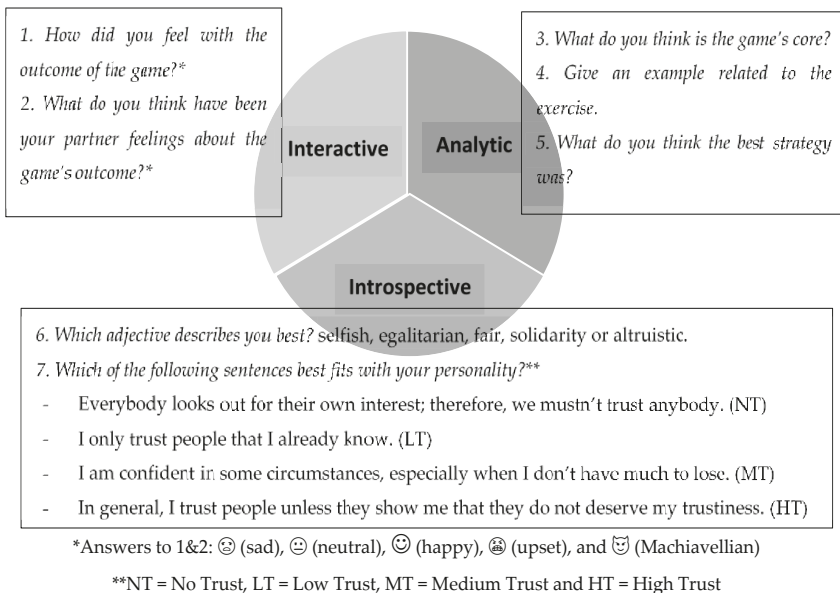


Figure 3. Questionnaire based on multiple intelligences.

Students were incentivized with one extra-credit point added to the student module's overall grade. Specifically, the MTG mark was weighted at 15% of the total mark in the RED activity. Since we wanted to observe students' natural willingness to share [32], the reward depended on share decisions contributing to the common good. Camerer and Hogarth [33] were first in suggesting that the TG is not

significantly affected by changes in the incentive mechanism. Luccasen and Thomas [34] confirmed this fact since they do not find significant differences between the rates of trust and reciprocity in TG experiments incentivized with cash or class credit.

2.4.3. Discussion

The Discussion part is the final step. At this stage of the activity, students shared their own reflections from the readings and tried to connect them to the MTG experiment they had participated in. This part was structured as follows: discussion group, oral presentation, individual reflection exercise, the teacher's intervention, and review of individual reflection exercises.

Students who chose the same book formed a discussion group for 30 min to comment on and make a synthesis of the book. In each discussion group, a spokesperson was named, who presented the main content of the book to classmates. Oral presentations and question rounds took 30 min. Next, students were asked to answer two questions to connect the readings and the experiment: "What is the topic that the readings you chose have in common?", "What is the link between your readings and the experiment?" Then, the teacher explained the purpose of the experiment and provided an example of collaborative decision-making. To finish, students were given time to rethink the above two questions and hand-in their written answers.

3. Results

3.1. Experimental Results

Our experimental data from students' decisions in the MTG experiment were classified by roles: trustor and trustee. Trustors' decisions were classified in three levels: Low, Moderate, and High, corresponding to transfers of up to 1/3, up to 2/3, and more than 2/3 of the ExCU 50 initial endowment. Table 2 reports the percentages of these decisions in treatments T0 and T1. Interestingly, at the High level, a difference of more than 17 percentage points between the treatments was found. This means that students with information about the other's "wealth" were less likely to transfer high amounts compared to students without such information.

Table 2. Classification of Trustors' decisions.

Decision/Level Treatment	Trust			No Trust	
	Low	Moderate	High	All	All
Baseline (T0)	16	27	31	74	16
%	21.62	36.49	41.89	82	18
Information (T1)	45	60	34	139	21
%	32.37	43.17	24.46	87	13
Information Effect	10.75%	6.68%	-17.43%	5%	-5%

Similarly, trustees' decisions were classified into three categories: Selfish, Egalitarian, and Altruistic. A decision was considered Egalitarian when the returned amount is $y^* = 2x$, so higher (lower) amounts were classified as Altruistic (Selfish) decisions. The minimum selfish amount is 0, and the maximum altruistic amount is $3x + 50$. In turn, selfish and altruistic intervals were divided into three equal-length subintervals: low, medium, and high.

According to this classification, a first view of the decisions of trustees is reported in Table 3. An overall information effect was found in all categories. When information about the "wealth" gap was available, selfish and altruistic decisions increased by 7 and 2 percent, respectively, whereas egalitarian ones reduced by 8 percent. More specifically, high selfish decisions increased by 9 percent when students had information about their partner's accumulated earnings. Likewise, high altruistic decisions decreased by 1 percent, which was overcome by the increase in medium altruistic ones.

Table 3. Classification of Trustees' decisions.

Decision/Level Treatment	Selfish			Egalitarian			Altruistic		
	Low	Medium	High	Total	Unique	Low	Medium	High	Total
Baseline (T0)	8	18	24	50	14	0	5	5	10
%	10.81	24.32	32.43	67.57	18.92	0	6.76	6.76	13.51
Information (T1)	9	37	57	103	15	0	13	8	21
%	6.47	26.62	41.01	74.10	10.79	0	9.35	5.76	15.11
Information Effect	-4.34%	2.29%	8.57%	6.53%	-8.13%	0%	2.60%	-1%	1.59%

Table 4 reports the descriptive statistics of the trustor's sharing decision and the trustee's transferring decision. Parameter λ represents the percentage of the endowment ExCU 50 sent by the trustor ($\lambda = x/50$). Similarly, we denote by r the rate of return paid back by the trustee ($r = (y - x)/x$). As already mentioned, in treatment T0 subjects had the same initial endowment and did not have information about the other's accumulated earnings at all. This situation was labeled as "Equality". In treatment T1, subjects were additionally given information about the other's accumulated earnings. Thus, subjects know *the gap in the accumulated earnings* before deciding. We defined that *gap* as the trustor's accumulated earnings minus the trustee's. Therefore, we differentiated among positive inequality ($gap > 0$), negative inequality ($gap < 0$), and equality ($gap = 0$).

Table 4. Sharing and Transferring decisions.

Treatment	Baseline (T0)				Information (T1)					
	Equality		Equality		Positive Inequality		Negative Inequality		Total	
Statistics	λ	r	λ	r	λ	r	λ	r	λ	r
Average	0.49	0.45	0.46	0.41	0.35	0.50	0.43	0.31	0.43	0.32
Median	0.40	0.13	0.40	0.00	0.40	0.25	0.40	0.00	0.40	0.00
St.D.	0.35	1.12	0.25	1.12	0.10	1.22	0.32	1.46	0.31	1.40
Min.	0.00	-1.00	0.20	-0.67	0.20	-0.50	0.00	-1.00	0.00	-1.00
Max.	1.00	4.00	1.00	3.00	0.40	2.00	1.00	6.00	1.00	6.00
Quartile 1	0.20	-0.40	0.20	-0.33	0.30	-0.50	0.20	-0.67	0.20	-0.67
Quartile 3	0.80	1.00	0.60	1.00	0.40	1.50	0.60	0.75	0.60	1.00
Obs.	90	74	18	18	4	4	138	117	160	139

Comparing both treatments, the difference between the median λ in T0 and T1 was not statistically significant (Mann-Whitney or MW test, $p: 0.2529$). Therefore, in general, the trustor was not observed to modify his sharing decision when knowing the trustee's accumulated earnings in the game. Even when the trustor knew that the trustee had a higher accumulated gain, he kept the median sharing amount (MW test, $p: 0.2571$). Specifically, the probability of sharing a lower λ was 0.544. Therefore, at first glance, our data do not allow us to confirm H1.

We also investigated any gender effects through H3 and H4. Figure 4 presents the box and whiskers plots of students' decisions grouped by gender and treatment. In line with H3, we first observe that female trustors' decisions were significantly different from those of male trustors in both treatments. Compared to T1, in T0 females transferred a higher median amount than males. One interpretation of this result is that males and females react in a different way when they are provided with information on their partner's earnings.

In the trustee role, females' decisions were similar to those of males in T0 (p -value > 0.05 for the median test), but not in T1 (p -value < 0.01 for the median test) since females paid back a higher median amount than males. Therefore, at this stage of our analysis, the data do not support our H4 regarding a gender effect in trustees' decisions.

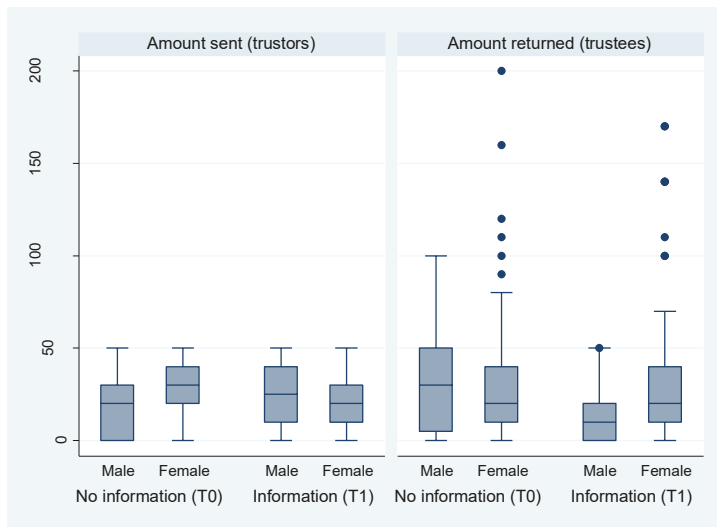


Figure 4. Distribution of the amounts sent/returned, by gender and treatment.

3.2. Econometric Analysis

Next, a linear regression model relating students' decisions in the MTG experiment to some attitudinal and sociodemographic characteristics was performed. A main reference is Glaeser et al. [35], together with other related works [36,37]. Our MTG differed from that of Glaeser et al. [35] in the endowment and the multiplier: Their game only endows the trustor, creating asymmetry in the endowment, which is a violation of our egalitarian condition and uses a multiplier of 2. Regarding the trust and fairness questions, these authors used the ones collected by the Global Social Survey. Many scholars have studied behavior or personality differences between business degree students and other degree students. Some studies argue that business degree students tend to show a more selfish behavior [38,39]. In particular, Sautter et al. [40] found a significant difference between finance students and other students and conclude that the former behave in a less ethical manner.

In our model specification, we included the following independent variables:

- Studies: It is a dummy variable taking value 0 for Tourism and value 1 for BA.
- Gender: It is a dummy variable taking value 0 for male and 1 for female.
- Employee: It is a dummy variable taking value 1 for students with a job.
- Home owner: It is a dummy variable taking value 1 for students living in their own home.
- Sharing a flat: It is a dummy variable taking value 1 for students living with flat-mates.
- Self-concept of trustiness: It is a general variable composed of four dummy variables: No Trust, Low Trust, Medium Trust, and High Trust.
- Self-concept about solidarity: It is a general variable composed of four dummy variables: selfish, fair, egalitarian, or altruistic.
- Empathy: It is a general variable composed of five dummy variables: 😞 (Sad), 😐 (Neutral), 😊 (Happy), 😡 (Upset), and 😏 (Machiavellian).
- Trust: It is defined as λ and measured as the percentage sent by the trustor ($\lambda = x/50$).
- Reciprocity: It is defined as r and measured as the return rate paid back by the trustee.
- Treatment: It is a dummy variable taking 0 for T0 (baseline) and 1 for T1 (treatment with information)

To select explanatory variables and models, we followed a stepwise method by applying Akaike's information criterion (AIC) and Bayesian information criterion (BIC) alongside the significance of variable coefficients. In a first step, we regressed a full model to identify those non-significant variables. In a second step, these were removed to regress a second model and compare the performance of both models according to AIC and BIC. This procedure was repeated to find the model that fits the data best.

Concerning trustor students, we estimated an OLS model, reported in Table 5. This model explained 36.32% of the variability of observed trust (λ = sent amount/initial endowment). Observe that some variables have a positive coefficient: studies, gender, and self-declared trust at the medium level have a positive effect on observed trust. Specifically, both BA students and female students showed more trust than Tourism students or male students. Therefore, there was a gender effect but in the opposite direction to H3. Moreover, the variable 'Employee' exhibited a significant and negative coefficient. This indicates that students that have a job show lower trust. Similarly, those trustors that in the questionnaire self-state a low trustiness in others behaved accordingly in the game, as indicated by a negative coefficient. Finally, the dummy 'Information treatment' had a negative and significant coefficient. In T1 trustors showed lower trust than in T0. This last result allows us to conclude that the fact of having information about the other's accumulated earnings during the game does have an effect on the trustor's decision, but we cannot prove its direction.

Table 5. Percentage λ sent to the trustees as a function of trustor's characteristics.

Independent Variables	Model 1
Studies	0.22 * [0.0492, 0.3907]
Gender	0.44 *** [0.2707, 0.6092]
Employee	-0.7 *** [-0.8515, -0.5484]
Low trustiness	-0.28 * [-0.5186, -0.0414]
Medium trustiness	0.64 *** [0.3600, 0.9199]
High trustiness	0.16 [-0.1105, 0.4305]
Treatment	-0.38 *** [-0.5586, -0.2013]
Constant	0.5 *** [0.2751, 0.7248]
N	250
R ²	0.3632
F	17.88 ***
AIC (full model: 84.24679)	82.71658
BIC (full model: 173.0654)	168.1191

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Regarding trustee-students, we considered the return rate (r) as a proxy of observed reciprocity. The decision to return an amount may be affected by the trustee's empathy with others and the self-concept of solidarity, or by other personal characteristics, such as academic studies, housing, economic autonomy, and etcetera. We perform two OLS regression models to study the trustee's observed reciprocity, presented in Table 6. In model 1, we found that housing and treatment significantly affected the trustee's return decision. We also found a negative coefficient related to the level of studies, meaning that BA students, on average, returned lower amounts than students enrolled in Tourism. The variable 'housing' showed an overall positive effect on the trustee's return decision. In model 2, regarding question 2 on inter-personal intelligence (see Figure 3), the answers corresponding to the faces (Happy) 😊 and 😏 (Machiavellian) were statistically significant but with opposite effects.

Thinking that the trustor was happy had a positive effect on the trustee's decision, whereas thinking that the trustor was Machiavellian had a negative effect on the trustee's decision. Interestingly, all labels related to the trustee's self-concept about solidarity showed a positive and significant effect. Finally, the variable treatment exhibited a negative and significant coefficient in both models, showing that having information about the other's accumulated pay-off during the MTG had a negative effect on the trustee's return decision. We can prove that there is an effect, on average, such that having information about their partner's accumulated earnings each period affects the return decision of trustees. However, we cannot prove the direction of such effect. In both models, the variable gender was not statistically significant, and therefore, H4 cannot be confirmed.

Table 6. Return rate of trustees as a function of personal characteristics/information.

Independent Variables	Model 1	Model 2
Own pay-off	0.0006 [−0.0000, 0.0011]	0.0006 [−0.0000, 0.0011]
Studies	−2.6963 *** [−4.2586, −1.1339]	
Home owner	3.1409 *** [1.5467, 4.7350]	
Sharing a flat	0.6086 * [0.1086, 1.1086]	
Machiavellian		−0.8552 * [−1.5125, −0.1978]
Happy		1.1827 *** [.7578, 1.6076]
Egalitarian		3.1067 *** [2.4664, 3.7469]
Fair		2.8601 *** [1.9125, 3.8077]
Solidarity		3.5118 *** [2.6105, 4.4130]
Altruistic		1.5055 *** [0.7485, 2.2625]
Treatment	−3.4912 *** [−4.1007, −2.8816]	−2.63599 *** [0.7485, 2.2625]
Constant	2.4283 *** [1.9207, 2.9538]	−0.6784 ** [−3.4300, −1.8419]
R ²	0.4337	0.4337
F	29.87 ***	29.87 ***
N	188	188
AIC (full model: 589.8584)	589.8584	589.8584
BIC (full model: 674.0059)	674.0059	674.0059

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Whereas Glaeser et al. [35] did not find a significant relationship between the attitudinal questions and the behavior of subjects in the laboratory, the opposite was found by Capra and Lanier [36] and Aksoy et al. [37]. Altruism was introduced by Capra and Lanier [36] as a control variable able to explain the decision in the TG. Aksoy et al. [37] replicated Glaeser et al.'s [35] work by using the original version of Berg, Dickhaut, and McCabe [22], concluding that both the attitudinal questions and altruism are good predictors of the behavior of subjects. Our results are in line with these findings.

3.3. Students' Reflections

Students' reflections were collected just after running the experiment. They first answered a questionnaire, and then reflections were discussed in the classroom. The questionnaire contained questions related to the experiment: What was it about, incentives, similarities to ordinary life situations, and students' self-perception about social values, mainly trust and reciprocity. Table 7 reports the students' main answers.

Table 7. Students' answers to the MTG-related questionnaire.

What Do You Think Is the Game's Core?	Give an Example Related with the Exercise	What Do You Think Is the Best Strategy?
Maximising profits Making investment decisions Distributing resources equally Observing generous and selfish behaviour Taking decisions based on others' decisions	When one shares with others one can find both grateful and ungrateful people Workers take part in benefits The stock market Cooperative enterprises	30% "I don't know" 56% "Collaborative strategy" 14% "Competitive strategy"

Dividing up the students' answers by treatment, we found differences among the three main answers to the question about the best game strategy (Figure 5). In T0, 75 percent of the students thought that a collaborative strategy was the best one, falling to 50 percent in T1. In T1, more than one-third of the students identify no strategy. Thus, students are shown to be more prone to collaborate in T0 (with equal initial endowments) than in T1, when they were made aware of any differences in wealth emerging during the experiment. Thus far, the teacher/experimenter only acted as an activity organizer.

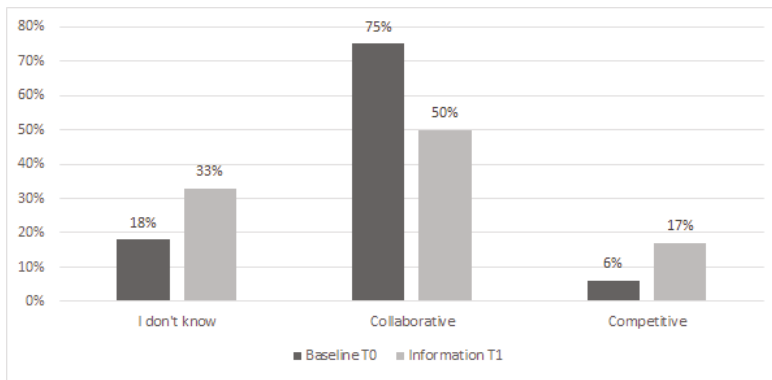


Figure 5. Identified strategies through the questionnaire concerning the MTG, per treatment.

A week after the experiment, the discussion stage took place. First, the students were grouped according to their chosen reading(s). They dynamically participated giving opinions/reflections about the content of the reading(s). Next, the teacher asked the students to answer two questions to relate the readings to the game: *What topic do the readings have in common? What is the link between the game and the reading?* To the first question, students provided answers that fit the topic. However, many of them found it difficult to answer the second question since they were unable to uncover the game's purpose. At this point, the teacher intervened and briefly explained the game's meaning and the collaborative strategy as one leading to the common good. Then students were asked to review, write, and hand-in their individual answers. Table 8 summarizes the students' answers that best fit the topic.

Table 8. Students' answers to readings-and-game-related questions.

What Topic Do the Readings Have in Common?	What Is the Link between the Game and the Readings?
Economics from a humanistic point of view A social and egalitarian economy A supportive model of economics based on cooperation and common development	"Everybody gets benefits when resources are shared" "Searching for the common interest" "Trust and reciprocity" "Cooperation and trust for achieving a proper wealth distribution"

4. Discussion and Further Extensions

In this paper, we designed an active learning activity for teaching social values under a sustainable education approach. Sustainable education posits that socio-economic systems should be understood as a dynamic organism and not as a fixed structure, where human relationships [41] and interdependences are crucial for improving living standards [4].

We took advantage of the versatility of the experimental methodology to allow students to engage in a multi-task activity. Students carried out three types of tasks, and their progressive active participation was required to foster a deep learning of abstract concepts. The activity required students to critically reflect on the interdependences and interconnections involved in the sustainability of systems. Likewise, it allowed them to experience how their decisions may affect the decisions of others and social welfare in general.

This paper addresses a research question on the sharing decisions of undergraduate students in an experimental setting, where they play a repeated trust game. The existence of effects on students' decisions related to 'wealth' inequality and gender was assumed. Additionally, degree studies [38–40] and attitudinal questions [36,37] were included as explanatory variables within a linear regression model.

To investigate the existence of a "wealth" inequality effect, students performed two experiments, with and without information about such gap. On average, having information about the other's accumulated earnings in the game does have an effect on students' sharing decisions, as claimed in Hypotheses 1 and 2. The fact that the effect is negative indicates that students decide to send and return smaller amounts in the experiment with the other's information and show a lower propensity to cooperate with each other. This result is in line with the literature related to public good games, which provides strong evidence from laboratory and field experiments that reveal that people's pro-social behavior is conditional on the social behavior of others, which is known as 'conditional cooperation'. Thus, one's decision to contribute to a common (good) fund may depend on the information available about the others' decisions, as well as on one's own type or on psychological traits [42–44].

In behavioral and experimental economics, the gender question is constantly investigated. There exists a general idea that women show more sensitivity to social issues and exhibit a greater willingness to help others than men. Specifically, in works on trust, reciprocity, and cooperation, the results on gender differences are ambiguous or contradictory [28,29,45–48] and context-dependent or design-dependent [49,50].

Experimental findings follow two main lines. On the one hand, most studies on trust games indicate that men that take on the role of trustor transfer a greater average amount than women in the same role [28,29,45]. Specifically, as a percentage of the amount sent by men, women send 14.52% less than men in Dittrich's [28], 9.48% less in Croson and Buchan's [29], and 14.62% less in Buchan, Croson and Solnick's work [45]. This gender difference is explained in terms of a different degree of risk-aversion between men and women, higher in the latter. In contrast, in the role of trustee, women return a greater average amount than men. Thus, women show higher levels of reciprocity than men [29,45,47,48]. More specifically, in terms of the return rate, women return more than men, on average: 12.22% *versus* –14.2% in Croson and Buchan's work [29] and –0.4% *versus* –13.6% in Buchan, Croson and Solnick's work [45]. In contrast, Dittrich's work [28] found that trustee women transfer a

lower amount than that of trustee men; -7.08% of the amount transferred by men. On the other hand, other studies applying public good games to evaluate behaviors and decisions that favor cooperation have not found a powerful gender effect on such behaviors and decisions [51].

The present paper contributes by providing new evidence on the gender effect in an information context. We hypothesized a potential difference between men's and women's sharing decisions in the roles of trustor (Hypothesis 3) and trustee (Hypothesis 4). Our results are in line with those above. In the experiment with information, female students transferred a lower (greater) median amount than male-students in the role of trustor (trustee). By using average values, we found similar results to those provided by the aforementioned authors [28,29,45]: trustors (trustees) women sent 19.32% (139.66%) less (more) than men. In addition, trustee women gave a return rate of 0.57, and men returned a negative rate of -0.20 . In the treatment without information, female students transferred a greater median amount than male students in the role of trustor, but no significant differences were found when they adopted the role of trustee, similar to those studies focused on cooperation [51,52]. By applying average values, trustors (trustees) women sent 58.51% (12.64%) more than men. Furthermore, trustee women (men) gave a return rate of 0.44 (0.41). In a nutshell, we found a gender effect depending on the experimental context [50].

To finish, this activity helped students to develop the ability to critically assess concepts and reflect on alternative economic paradigms. Introducing this kind of activity in class may stimulate students to enhance their awareness about their participation in society, as well as encourage them to think and reflect in broad contexts beyond theoretical teaching [53].

Further Extensions

Concerning the task of reading and writing, we propose to manage the reading task as a collaborative reading through virtual discussion forums in which both students and teachers are involved. The forums aim to promote continuous reflection and encourage students to share opinions and questions on a topic. The teacher could establish a timeline for the different chapters as a tool for managing the forum. This timing guide is useful to support the commitment and engagement of students with the discussion topics. Furthermore, opinions and information registered on the forum could be debated and analyzed by students later.

Regarding the MTG experiment, some variations may be implemented. First, it would be interesting for each student to have the opportunity to experience both roles (trustor and trustee), to be aware of the consequences of decision making from different positions. Second, the decision-making process within the experiment could be done in groups (3 or 5 students) instead of individually. That would allow us to observe the effect of the group on individual values. This group would only have validity during the experiment phase.

In respect of the discussion task, information collected in virtual forums may be introduced in the discussion. The spokesperson in each reading group should present a summary of the relevant ideas shared in the forum. In this way, students would start the discussion based on ideas that they had previously developed within the forums.

Finally, as a general suggestion, we propose to apply a multidisciplinary approach that involves several subjects, such as statistics, econometrics, experiment design, economics, psychology, sociology, anthropology, and so forth. This approach may help students internalize concepts, as well as develop the linking ability and global thinking.

An easy and direct application is to develop data analysis within a statistics class. Thus, students could work with data directly collected in the experiment and questionnaire, perform regression analysis, and interpret results, as a part of the activity itself. That would stimulate students' interest in learning more about statistics since by working with such data, they would be processing information on their own behavior. Therefore, they can see the applicability of statistics as a subject with a real, and at the same time motivating, example.

5. Conclusions

We have presented a multi-task activity, RED, aimed at spreading the social values of trust and reciprocity, which are, in turn, aligned with the United Nation's Sustainable Development Goals, among first year's students in the Business Administration and Tourism degrees at the University of Valencia in Spain.

RED integrates three parts: *Reading* essays on humanistic economics, participating in a trust game *Experiment*, and instigating a *Discussion* among students aimed at finding connections between the two previous stages.

Generally speaking, students have shown themselves able to critically analyze, reason, and write on specific social topics. They also made decisions in an experimental economic setting. Moreover, they were capable of arguing ideas, connecting concepts, and revising their own ways of thinking.

With respect to the MTG experiment, we found that being informed about their partner's accumulated earnings affected both decisions of both roles: trustor and trustee. Specifically, private information about their partner's earnings led to a reduction in trust and reciprocity. Regression analysis showed an information effect. The non-parametric analysis supported H2, but not H1.

On the other hand, on average, female students exhibited more trust than their male counterparts during the baseline. However, in the information treatment, the female participants trusted less than male students. Moreover, we found gender differences in trustor decisions, but in the opposite direction than that hypothesized by H3. In addition, the results did not show a significant gender effect on trustees' behavior. Therefore, H4 was not confirmed.

Concerning the classroom discussion, it has been shown to be an essential part of the activity, necessary to stimulate proactive and critical attitudes among students, engaging students with teachers.

To sum up, the RED activity accomplished a main pedagogical goal, which was principally to promote active learning in social values, nudging students towards greater reflection in decision making and, most of all, increasing their sensitivity to the well-being of others.

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

Appendix A

Table A1. List of readings available in the Reading part.

Author(s)	Title	Summary	Scope	Sustainability Goals Development
José Luis San Pedro (2009) [54]	Humanistic Economic	The book deals with ecology, development, economics and politics.	The need to humanize economics science.	G1. No Poverty G8. Decent work and economic growth G10. Reduce inequalities G13. Climate action
Gunter Pauli (2010) [55]	Blue Economy	A proposal for an economic system where the best for health and the environment is cheapest and the necessities for life are free.	Proposing a local and environmentally respectful system of production and consumption that basically works with what you have.	G7. Affordable and clean energy G11. Sustainable cities and communities G12. Responsible production and consumption G13. Climate action
James Robertson (1999) [56]	The new economics of sustainable development	The 'new economics' is based on the systematic development of individual responsibility, the preservation of resources and the environment, respect for qualitative values and respect for feminine values.	Reflection about the need to place ethics at the heart of economic life.	G5. Gender equality G8. Decent work and economic growth G13. Climate action G15. Life on land
Mohamed Yunus (2008) [57]	Banker to the poor	The author presents the history of micro-credits and the challenges he and his colleagues faced in founding Grameen Bank.	To rethink the economic relationship between rich and poor people, and among economics, public policy, philanthropy, and business.	G1. No poverty G8. Decent work and economic growth G10. Reduce inequalities G11. Sustainable cities and communities
Mohamed Yunus (2011) [58]	Building Social Business	The book introduces the concept of social business as an innovative business model which promotes the idea of doing business in order to address a social problem, and not to maximize profit.	Proposing a complement to traditional capitalism that may serve the most pressing needs of humanity especially poverty.	G1. No poverty G8. Decent work and economic growth G10. Reduce inequalities G11. Sustainable cities and communities

Table A1. Cont.

Author(s)	Title	Summary	Scope	Sustainability Goals Development
John E. Stiglitz, Amartya Sen and Jean-Paul Fitoussi (2010) [59]	Mismeasuring our Lives: Why GDP Doesn't add up	The limits of GDP as a measurement of the well-being of societies—considering, for example, how GDP overlooks economic inequality or the environmental impacts into economic decisions.	Assessing how our economy is serving the needs of the society. Proposing new sustainable measures of economic welfare, to measure things that matter.	G8. Decent work and economic growth G10. Reduce inequalities G11. Sustainable cities and communities G13. Climate action
Christian Felber (2015) [60]	Change Everything: Creating an Economy for the Common Good	A proposal for a new economic, social and political model for firms to be more solidary, egalitarian and ecological. The key to growth is that firms should work as a social tool rather than as money-making machines.	Proposing a different model based on sustainability, solidarity, cooperation and fair distribution of wealth in all sectors.	G8. Decent work and economic growth G11. Sustainable cities and communities G13. Climate action G16. Peace, justice and strong institutions

B.

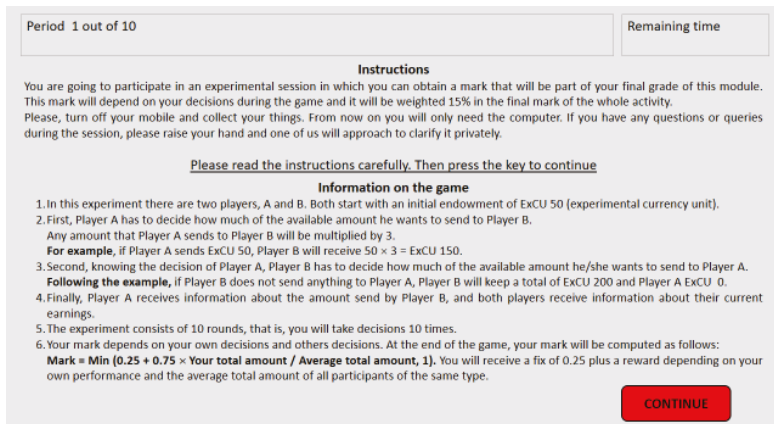


Figure 1. Baseline instructions to experimental subjects (translated from Spanish) Instruction screen.

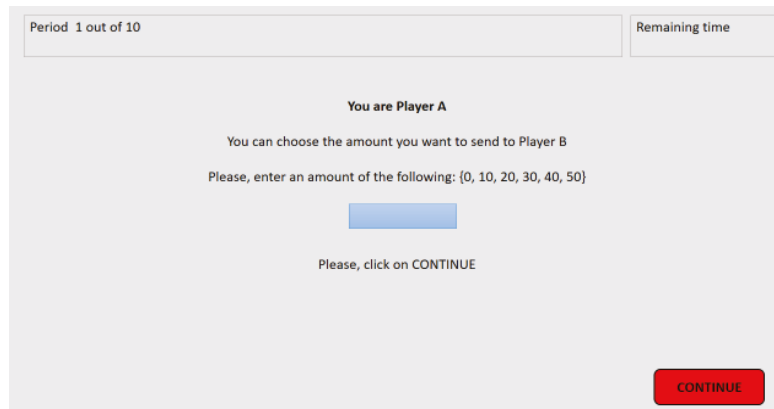


Figure 2. Player A's decision screen.

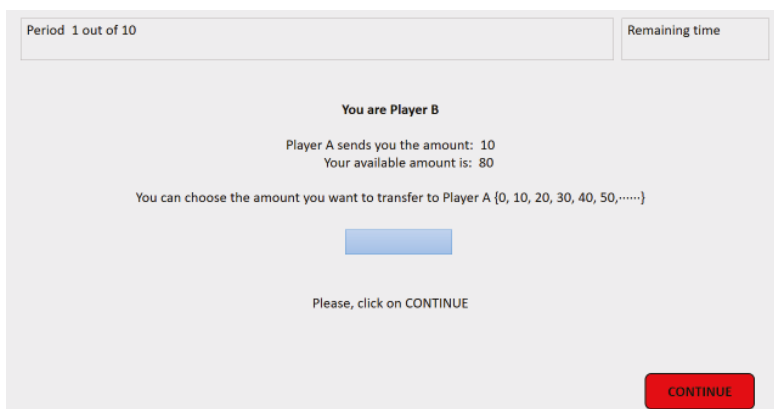
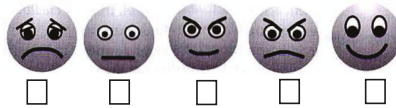


Figure 3. Player B's decision screen.

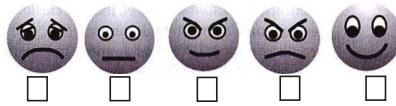
C. Questionnaire Post-Experiment

Name and surname:		
E-mail:		
Gender:	Age:	I live with my parents/flatmate(s):
Number of siblings:	I am sibling number:	I am a student/I have a job/Grant:
My hobbies:		

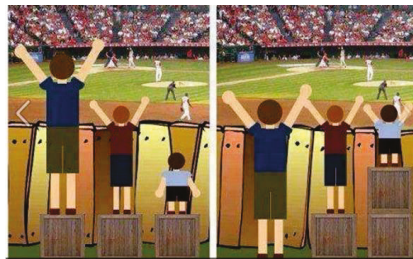
1. How have you felt with your final outcome of the game? Please tick a box from the alternatives below.



2. Could you please guess your partner feelings about the outcome of the game? Please tick a box from the alternatives below.



3. What do you think is the moral of the game?
4. Find an example from real life related with the game's core.
5. Which role did you play in the game? What was your outcome?
6. Would you have played the same way if your partner in the game were a friend? Can you explain why?
7. Would you have played the same way if the outcome was paid in cash at the end of the session? Can you explain why?
8. How would you have behaved if playing the opposite role?
9. What have you learned about yourself during the game?
10. What have you learned about your partners?
11. Do you think there was a 'best strategy' for each role in this game?
12. Have a look at the picture bellow. Tell us which adjective describes you better: selfish, egalitarian, fair, solidary or altruistic.



13. Which of the following sentences best fits with your personality?

Everybody seeks their own interest; therefore, we must trust nobody.

- I only trust people that I already know.
 - I trust everyone only in certain circumstances, namely when I do not have much to lose.
 - In general, I trust people unless they show me that they do not deserve my trust.
14. What do you think is the most effective strategy for achieving your personal, professional and social goals, an individualistic strategy or a cooperative one? Why? Point out pros and cons of each of the two alternatives.
 15. What values are important to you? Write them in order of priority.
 16. Was there something you especially disliked about the game?
 17. Was there something you especially liked about the game?

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Article

Extracurricular Activities in Higher Education and the Promotion of Reflective Learning for Sustainability

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Abstract: The objective of higher education institutions is to integrate reflective learning that contributes to the development of a greater awareness among individuals of the importance of facing the 21st century's sustainability challenges. This paper analyzes the impact of an extracurricular volunteer activity in Tangier, Morocco in the development of student reflection at a Spanish university. To this end, two objectives were proposed: (1) to explore the students' primary reflections of the experience, and (2) analyze the students' perceptions of the importance of participating in the experience in order to develop reflective learning. In the study, in-depth interviews were conducted with 23 students who participated in the volunteer activity. Data analysis was carried out using Iramuteq software to conduct a descending hierarchical classification (DHC), and MAXQDA software to conduct a constant comparison analysis. This research highlights the value of voluntary extracurricular activities in the development of reflections that guide change in the beliefs, attitudes, and daily behaviors of students that ultimately result in sustainability. Due to this, not only is it considered essential that students participate in social projects, but also that they undertake these projects with peers and instructors who can create environments of support and trust.

Keywords: extracurricular activities; volunteering; higher education; reflection; reflective learning; sustainability; sustainable development

1. Introduction

Public institutions, social organizations, schools, and families may all contribute to the development of citizens who are more aware of the importance of working toward sustainable development goals. Among these, higher education institutions play a fundamental role in educating competent professionals who can work to achieve sustainability [1,2]. Therefore, it is necessary to promote educational practices that help students become aware of the importance of exercising active and responsible citizenship that responds to the sustainability challenges of the 21st century [3]. It may be that generating a paradigm shift that addresses the students' sustainability needs, aspirations, and concerns becomes essential [4].

In this process, it is important to promote both active participation and autonomous and self-regulated learning in order for students to develop their reflective capacities. Reflection enables students to become aware of their strengths and weaknesses, provide solutions to complex situations while avoiding working by trial and error, face situations of uncertainty, to reformulate knowledge, practice and, most importantly, develop critical thinking skills and transform life experiences into learning [5–8].

In the field of curriculum development, researchers have shown an increased interest in analyzing the concept of reflection in higher education [9] and in demonstrating the importance of reflective practice within the curriculum in order to develop attitudes that contribute to sustainable development [10,11]. With regard to research into extracurricular activities, recent evidence suggests

the relevance of these activities in the improvement and development of reflective skills [12–14]. However, in-depth studies exploring students' experiences of self-reflection related to extracurricular activities (ECA onwards) are much needed [14].

In recent years, universities have aimed to integrate sustainability-related curricular and extracurricular reflective learning. Related to this, this research examines the emerging role of an extracurricular volunteer activity in Tangier, Morocco for the development of reflective skills. Specifically, the objectives of this study are:

1. To explore students' primary reflections from their voluntary extracurricular experience.
2. To analyze students' perception of the importance of participating in a voluntary extracurricular experience in order to develop reflective learning.

2. ECA (Extracurricular activities) to Promote Reflective Learning

Higher education is currently framed within a new conception of education geared toward sustainability. This requires the use of teaching and learning methods that motivate and make students aware of the importance of sustainable development. Such education needs to include key issues such as sustainable consumption, poverty reduction, and disaster risk [2]. It is essential to design courses that not only focus on student learning, but also contain reflective learning content that invites students to reflect on their daily learning and take action from a responsible, holistic, and forward-looking perspective [15,16].

In 1984, Kolb [8] conceptualized learning as a process of creating knowledge through the transformation of experience using the experiential learning model. Kolb proposed a cyclical learning model that consisted of four stages: concrete experience, reflective observation, abstract conceptualization, and active experimentation. According to the model, a cyclical process has to be completed, where experience constitutes the basis of learning and reflection. According to Kolb, learning occurs when reflection allows the individual to meaningfully learn from their own experience [17].

From this perspective, learning is less a process of knowledge acquisition, and more a process of knowledge construction in which reflective learning is paramount. This reflective practice is a dialog between thinking and doing [18–20]. Students who integrate theory and practice develop certain skills that enable better understanding of situations and the creation of independent meaning.

The term reflection has been defined in many ways. Moon [21] described it as a mental process applied in relatively complicated or unstructured situations where no obvious solution exists. Ryan and Ryan [22] argued that reflection allows students to examine what they believe and who they believe they are. Dewey [23] pointed out that reflection originates in a state of doubt or perplexity and, therefore, is an act of search and inquiry to find material to remove doubt and get rid of perplexity. For this reason, we defend that the reflective process usually begins in destabilizing and confusing situations. In these situations, instead of acting according to trial and error, a situation is interpreted and understood through questioning and research. In addition, reflection allows for the possibility of being aware of one's own actions, and learning from and improving those actions [24].

In relation to the moment of reflection, Schön [18] pointed out that there are two important temporal aspects: reflection-in-action (within experience) and reflection-on-action (after experience). The first refers to the reflection carried out as the action occurs. The second gives meaning to an experience after it has occurred. Such reflection can occur in two stages of the experiential learning model: in the reflective observation stage, when an experience is given meaning, and in abstract conceptualization, when concepts or hypotheses are generated [25].

Reflection, therefore, can be defined as engaging in a cognitive process in order to learn from experiences [6,16,23] and can be conducted through individual inquiry or in collaboration with others. Regarding individual reflective learning, instruments such as portfolios [20] or reflective journals [26] are used, where levels of reflection can be evaluated through forms of narrative. In these instruments, the quality of reflection varies according to the learner's ability to ask the relevant questions that will lead to learning [27].

Regarding reflective learning in collaboration with others, this can involve either interaction with peers or with a specialized instructor who guides the process. Socio-cultural theory conceives learning as a process of joint construction that occurs in the course of interaction [28]. In this regard, dialog is an essential moment of encounter, allowing for the construction of shared meanings from experience [29]. Among other methods, it can be carried out through seminars [30], online forums [31], or focus groups [32].

In this type of reflective learning, communication, cooperation, and feedback between instructors and peers play a fundamental role. Students, when interacting with others, promote reflective processes that help them to better understand themselves, their needs and problems as well as their personal strengths and limitations. In addition, these processes enable students to identify sources and means of coping with personal conflicts, challenges, and uncertainties [6]. For this process to succeed, the creation of a climate, based on mutual trust and positive bonds, is essential in order to provide security to the participating students [27].

Reflection is a process that requires stimulation, reinforcement, supervision, and training [23]. Therefore, the role of the educational instructor is fundamental when generating reflective learning [10,33]. The instructor, through dialog and the creation of a climate of mutual trust, should create a learning environment where students feel comfortable in expressing their thoughts [34] and reflecting on their actions [18]. The instructor is responsible for introducing, developing, and nurturing reflective learning [33]. Peer interactions also play an important role in the learning process. Sharing reflections, feelings, ideas, and experiences with others is a fundamental step in giving meaning to the learning process and student experience [17,35], and ultimately creating reflective processes where the points of view of others are assimilated, exchanged, and analyzed [36].

In the past two decades, a large body of scholarly literature has been published dealing with the importance of reflective learning in curricular disciplines related to education [24], health [26], social work [35], and business [34].

These studies have mostly been limited to the curricular field. However, there is increasing interest in the potential for ECA to promote reflection. ECA are defined as voluntary activities that take place outside the class schedule [37], which complement curricular training [38] and contribute to the students' personal [39], professional [40], and social [41] development. These activities are classified into sporting, cultural, solidarity, spiritual and artistic activities, and student clubs [41–43].

ECAs stand out for their ability to create spaces for the development of conflict resolution skills [44–46] and critical thinking and reflection on ethical values [12,14,47]. Indeed, Schripsema et al. [13] concluded that students who participated in ECA had better reflective skills than those who were not involved in such activities. In addition, [14] argued that participation in ECA facilitated reflection and allowed students to obtain the maximum out of that extracurricular experience.

3. Methodology

3.1. Context

This research explored a six-day extracurricular volunteer experience in Tangier, Morocco in January 2019 and June 2019 that involved 23 students from a Spanish university. The experience put these students in contact with people from a developing country. The gross domestic product (GDP) of the two countries should be highlighted as a gross indicator of their economic development level. In 2017, Spain's GDP was USD\$1311 billion and Morocco's GDP was USD\$109.1 billion.

During the six-day experience, students have the opportunity to become acquainted with the reality of immigration on the other side of the European border, participate in social projects, experience a culture and customs different to their own, and live as a group. The ultimate goal of this extracurricular experience is to promote student reflective learning regarding attitudes about sustainable development and explore the role that reflective learning plays in fostering sustainable development. In order to achieve this objective, the students are expected to engage in guided daily personal reflection.

Over the course of the experience, the students were introduced to three social projects in Tangier: (1) the Dar Al Baraka project of Casa Nazaret, a foster home that has arisen to respond to the needs of 10 people with special needs and without families and/or economic resources; (2) the Dar Tika project, a reception center that aims to provide care, training, and social insertion to underage girls at serious risk of social exclusion and/or lack of protection; and (3) the Padre Lerchundi project, a foster home for children that seeks to promote the integrated development of children aged 6 to 16 years old. In addition, as recommended by Elverson and Klawiter [48], at the end of each day, after participation in these projects, the students were encouraged to engage in guided reflection with their instructor.

3.2. Sample

In total, 23 university students (19 women and 4 men, aged between 16 and 24 years) took part in the experience. Students who participated in the experience in January 2019 ($n = 13$) are referred to as Group 1, and those who participated in June 2019 ($n = 10$) are referred to as Group 2 (see Figures 1 and 2). The percentage of participants who had previous experience in the extra-academic field was high. On the one hand, of the total number of participants in Group 1, 10 people had previously participated in ECA and three had not. On the other hand, when referring to Group 2, six people had previously participated and four had not.

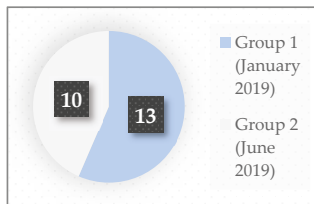


Figure 1. Characteristics of the sample. Distribution of the sample by group.

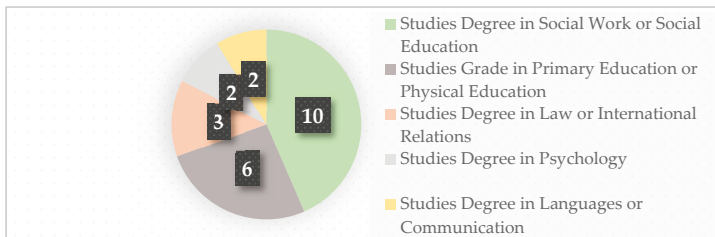


Figure 2. Characteristics of the sample. Distribution of the sample by degree studied.

3.3. Research Tool: In-Depth Open Interviews

The importance of the biographical-narrative approach in the social sciences is evident [49]. One of the options we considered for this study was to analyze the journals that the students were writing throughout their experience in Tangier. We believed that these journals were a valuable tool, as they reflected their day-to-day reflections. However, we were aware that many of the written reflections were personal and that the students may not want them to see the light. Given that the ultimate purpose of research into meaningful life experiences is not merely to understand the experiences people have had, but how their meaning is constructed [50], we decided to conduct in-depth open-ended interviews. As Chawla [51] defends, most recent studies of significant life experiences have been undertaken through structured or semi-structured interviews. When, thanks to our research, we encouraged participants to reflect on their own experience, we were at that moment contributing to a greater sense of authorship of the participants’ lives, and the development and transformation of the participants was reinforced.

Therefore, in order to collect the necessary information, in-depth open interviews were conducted after the students had returned from Morocco. Interviewing is a research technique where an individual (interviewer) requests information from another individual or group of individuals (interviewee/s) by using a script of questions to obtain data regarding a specific matter [52]. The interviewer also encourages participants to go further by re-wording, re-ordering, or clarifying the questions. This technique was chosen for the present study as it has been proven to be adequate to explore the experiences of participants and the meanings they attribute to them [53].

The question script developed for this study was composed of 10 questions, as seen in Table 1. Questions 1 to 7 were developed based on Moussa-Inaty's [24] reflection guiding questions method. Moussa-Inaty's research showed the positive effect that certain questions can have in guiding student reflection (see Table 1). Additionally, consolidated criteria for reporting qualitative research (COREQ) were also considered when designing the question script [53]. Through these questions, the primary student reflections from the voluntary extracurricular experience in Tangier were collected.

Table 1. Reflection guiding questions used in the in-depth interviews.

Reflection Guiding Questions	
1.	How has this experience changed your way of thinking?
2.	How could this experience change the way you act?
3.	What surprised you the most about your experience?
4.	What disappointed you the most about your experience?
5.	If you had a chance to make a change (related to the experience), what would that change be?
6.	What might some limitations be?
7.	What do you plan to do further (related to the experience)?
8.	How has participation in social projects promoted your reflection?
9.	How has reflection with your peers enriched your own reflection?
10.	How has having an instructor enriched your own reflection?

Questions 8 to 10 sought to assess the students' perceptions of the importance of participating in the extracurricular experience as a way to develop their reflective skills. These questions were designed based on the findings of the literature review, which highlighted elements that were key to the investigation [6,33]. In addition, in order to guarantee the validity of the interview schedule, it was subjected to an assessment by three experts. Finally, participants were asked questions about their age, course, and grade.

3.4. Data Collection Procedure

Group 1 data collection was carried out between January 2019 and February 2019 and the Group 2 data collection was conducted in June 2019. First of all, the researchers contacted students enrolled in the experience and informed them about the purpose of the study, both verbally and in writing. As they all agreed on participating in the study, students were asked to sign a written informed consent. Subsequently, interviews were conducted in a climate of confidence and trust, allowing more personal and detailed access to the students' experiences. Given the unique nature of each participant's experience, in-depth interviews allowed each case to be investigated and for additional relevant questions to be asked in each individual context [54].

3.5. Data Analysis

Once the information was obtained, analysis of the information and effective treatment of the data were carried out. In order to provide a more complete picture [55], a data-analysis triangulation, consisting of the combination of two or more data analysis methods, was carried out [56]. Specifically, for Questions 1 to 7, Iramuteq software was used to conduct a descending hierarchical classification

(DHC) [57]. For Questions 8 to 10, MAXQDA software was used to conduct a constant comparison analysis [58]. Results obtained by each type of analysis were then combined at the interpretive level.

3.5.1. Instrument Used to Analyze Students' Primary Reflections on Their Voluntary Extracurricular Experience in Tangier (Questions 1–7)

In order to carry out a lexical analysis of the reflections expressed in the interviews, Iramuteq software was used to conduct the Reinert method. This analysis proposes that every discourse expresses a system of lexical words (or a group of words) that gives coherence and rationality to what the speaker expresses. The objective of the Iramuteq software algorithm is to perform textual data analysis, through the repetition of lexical footprints (word succession), in order to identify the most frequent lexical words shared by interviewees [59].

The software divides complete words such as verbs, nouns, adjectives, and adverbs from tool words such as articles, prepositions, pronouns, and conjunctions and includes only the former in the analysis. In the same way, it decomposes the corpus into elementary contextual units (ECU), which are one or two sentences long (30–50 words). In this way, the software performs an analysis of the complete words in each ECU. These words are then used to create a contingency table showing how the vocabulary is distributed by the ECU. From that table, the software creates a square matrix of distances and groups the ECUs according to the complete words they share [60].

Using the Reinert method, a DHC was performed to classify and group the ECUs into classes and consequently reveal the most characteristic vocabulary in each class. In this classification, each class was made up of different groups of words that were included based on the frequency of words already lemmatized, and the association with the class was determined by a chi-square value equal to or greater than 3. This provided a margin of error of <0.05 (of a degree of freedom = 1) [59]. Using this classification method, several classes were obtained based on words and ECUs with statistically significant values.

Operations within this program are transparent and replicable until the moment of interpretation when researchers assign a tag to each class depending on the most significant complete words and the ECUs. Likewise, the Reinert method, which uses independence tests, calculates the relationship between each class and independent variable. If one class has a significantly higher proportion of ECUs belonging to a variable, that class is considered to be associated with that independent variable [61]. In this case, the group was used as a variable; assigning Group 1 to students who went to Tangier in January 2019 and Group 2 to students who went in June 2019.

3.5.2. Instrument Used to Carry Out an Analysis of Perceptions Expressed in Relation to Voluntary Extracurricular Experience in Tangier (Questions 8–10)

MAXQDA software was used to carry out a constant comparison analysis of the students' perceptions. This type of analysis is commonly used when analyzing qualitative data [62]. This software is used in qualitative research for its ability to synthesize, sort, and organize information collected with selected instruments and to present research results [63]. The program organizes and examines information by means of categories formed by a system of codes.

This software was chosen because of the possibility it offered of creating three separate categories for analysis. For the purposes of this research, it was important to separate the students' perceptions regarding the value of the experience in Tangier; their perceptions of the role of their peers; and their perceptions of the role of the instructor in their reflective development.

A code system was then utilized to examine the data. With regard to the second research objective, the code system emerged from the literature findings. However, as the data were being coded, new (sub)codes were incorporated into the system and existing ones modified. Table 2 shows the final code system used to carry out the analysis.

Table 2. Code system used for the analysis of Questions 8 to 10.

Categories	Codes
Importance of knowing the projects to develop reflection	To know; to think; to value; to be conscious; to compare; to change
Importance of living the experience with peers to develop reflection	To contribute; to enrich the reflection; to raise new situations
Importance of the instructor’s role in developing reflection	Guiding; motivating; resolving doubts; climate

4. Results

First, a DHC analysis of the reflections shown in the corpus (Questions 1 to 7) was performed using Iramuteq software (43,702 words; 24,031 words from the subcorpus of Group 1 and 19,671 words from the subcorpus of Group 2). Second, a mixed-method analysis of the perceptions expressed in Questions 8 to 10 was carried out using MAXQDA software. These questions formed a corpus of 11,822 words (5714 from Group 1 and 6108 from Group 2).

4.1. Descending Hierarchical Classification (DHC) Analysis of the Reflections Expressed in Questions 1 to 7

The first DHC divided the entire corpus into two different classes (or lexical worlds) (see Figure 3). Class 1 corresponded in a significant way ($X^2 = 34.81, p < 0.0001$) to the main reflections expressed by Group 1, and Class 2 to the reflections of Group 2 ($X^2 = 34.81, p < 0.0001$).

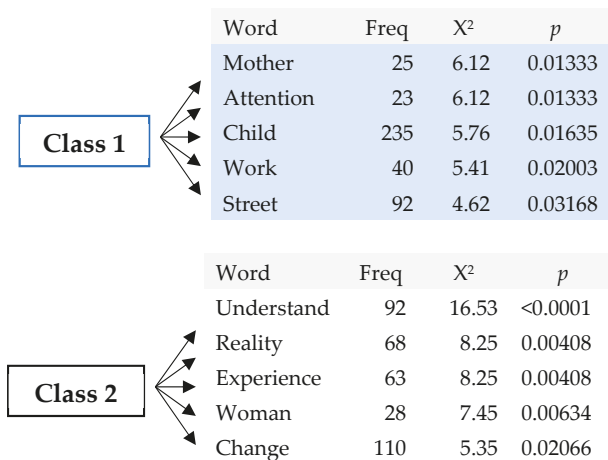


Figure 3. Distribution of classes and their respective units of meaning (DHC 1).

In order to more specifically identify the main reflections conducted in each class, a second DHC analysis of each group was carried out. The second DHC showed six classes for Group 1, and four for Group 2. The latter completely coincided with those found in the first group. Figure 4 shows the quantification of the classes and the statistical evaluation of the words in each group, based on their frequency, chi-square, and significance.

Class 5: volunteering				
	Word	Freq	X ²	p
Group 1	Volunteering	18	52.3	< 0.0001
	Personal	4	19.4	< 0.0001
	Contribute	4	19.4	< 0.0001
	Important	9	18.7	< 0.0001
Group 2	-	-	-	-
Class 6: experience on the border				
	Word	Freq	X ²	p
Group 1	Ceuta	28	114.1	< 0.0001
	Border	16	72.7	< 0.0001
	Fence	11	65.1	< 0.0001
	Chaos	6	43.8	< 0.0001
Group 2	-	-	-	-

Class 1: social realities				
	Word	Freq	X ²	p
Group 1	Say	189	95.4	< 0.0001
	Friend	15	44.0	< 0.0001
	Think	90	32.6	< 0.0001
	Bad	15	26.2	< 0.0001
Group 2	Education	10	66.3	< 0.0001
	Value	17	65.3	< 0.0001
	Base	8	46.1	< 0.0001
	Law	16	36.1	< 0.0001

Class 2: social projects				
	Word	Freq	X ²	p
Group 1	Child	144	103.3	< 0.0001
	Foster home	14	39.5	< 0.0001
	Work	22	19.6	< 0.0001
	Welcoming	7	19.5	< 0.0001
Group 2	Foster home	39	77.3	< 0.0001
	Family	37	52.4	< 0.0001
	Complaint	10	29.3	< 0.0001
	Abandon	11	27.9	< 0.0001

Class 3: possible changes				
	Word	Freq	X ²	p
Group 1	Time	61	100.7	< 0.0001
	Change	24	42.3	< 0.0001
	Conscious	7	24.9	< 0.0001
	Future	6	24.9	< 0.0001
Group 2	Life	46	23.5	< 0.0001
	Want	63	21.0	< 0.0001
	Experience	33	19.6	< 0.0001
	Continue	27	19.5	< 0.0001

Class 4: personal significance				
	Word	Freq	X ²	p
Group 1	Capable	9	44.8	< 0.0001
	Person	64	31.2	< 0.0001
	Motivate	6	22.2	< 0.0001
	Experience	30	20.4	< 0.0001
Group 2	Like	30	46.3	< 0.0001
	Different	22	34.3	< 0.0001
	Truth	34	24.0	< 0.0001
	Understand	66	22.6	< 0.0001

Figure 4. Distribution of classes and their respective units of meaning (DHC 2).

Next, the six classes (or lexical worlds) were broken down to gain an understanding of the different reflections shown by the individuals interviewed in each case. It should be noted that the analysis only highlighted those words with a significance level of $p < 0.0001$.

4.1.1. Class 1: Reflections on Different Social Realities

In this class (which consisted of 18.1% of the corpus), Group 1 reflected on its own privileges. In addition, Group 1 participants mentioned what they thought ($X^2 = 32.61$) people of very different realities were thinking: "Their life has to be very hard so that they have to think about all these things. Surely, they have lived experiences that are not even close to those I have lived at home or with my friends." (Participant 10, Group 1).

In Group 2, this class (which consisted of 13.3% of the corpus) placed value ($X^2 = 34.36$) on the right ($X^2 = 36.13$) to have health care ($X^2 = 32.95$) and public and accessible education ($X^2 = 66.37$). Likewise, this group reflected on the importance of achieving human rights in other countries so that social realities could be improved: "It would be interesting to create a residential center so that people do not live on the street and that guarantees them food and drink, as well as an education so that later they can have a dignified job that helps them to become self-sufficient." (Participant 21, Group 2). On the other hand, Participant 16 in Group 2 pointed out "I've become more aware of all reality, of everything. Because before I knew that there was poverty, that there were people on the streets sleeping... but until you see it in real life, you are not aware of the truth, of everything."

4.1.2. Class 2: Reflections on the Work Carried Out in the Projects

The second class, with 23.6% of the corpus in Group 1 and 23.9% in Group 2, was oriented toward reflections related to social projects.

Regarding the Dar Al Baraka project of Casa Nazaret for people with special needs, the reflections of Group 1 were oriented toward the work ($X^2 = 19.62$) carried out with people with special needs ($X^2 = 18.15$). Those of Group 2, however, were oriented toward the family abandonment ($X^2 = 27.91$) suffered by these people ($X^2 = 52.47$). Thus, one participant emphasized: "It has been a month since they went out in the streets! It is incredible. I wouldn't even be able to stay in for three days in a row" (Participant 19, Group 2).

With regard to the work carried out in the Dar Tika project with girls in need of help and protection, both groups reflected on the importance of becoming aware of one's own privileges as well as of valuing and making better use of one's personal situation. "One night a girl from the foster home took us up to the roof (...) and said to me, 'Do you know what that is?' and I said 'no'. 'Spain ... I'm going there.' she said. I realized that people would give their lives to come to Spain" (Participant 6, Group 1).

Finally, in relation to the work carried out in the Padre Lerchundi project with children at risk of social exclusion, both groups highlighted positive and hopeful reflections on the participants: "Even with all the terrible things they go through, they can still provide you with food, make your day happier, smile, share and make you feel at home." (Participant 15, Group 2) and "I would extend my stay longer and I would like to spend more time with those children and get to know them better." (Participant 23, Group 2).

4.1.3. Class 3: Reflections on Possible Organizational, Personal, and Social Changes

With regard to class 3, in Group 1, with 13.6% of the corpus, reflections were linked to possible changes at the organizational level. Above all, in both groups (with 31.9% of the corpus), students highlighted time as the main limiting factor of the experience: "We got to know many projects, but we didn't have the time to get to know the place and the people who were participating in each project. If we would have had more time, I think it would have been better, more enriching." (Participant 3, Group 1).

Group 1 also became aware ($X^2 = 24.98$) of the importance of making changes ($X^2 = 42.36$) at a personal level to bring about social improvement ($X^2 = 15.91$): "Even if we don't like it, we are very (...) and I don't consider myself being so, but whenever you travel there you see how everything you are supposed to do well, you actually don't. You think we could all give a lot more." (Participant

13, Group 1), and make changes at the social level: "Teach everyone to be more supportive, more empathetic, more friendly, not to be indifferent . . . I believe that the necessary change in the society of the planet is educational." (Participant 9, Group 1). Group 2 reflected on changes that participants would like ($X^2 = 21.04$) to carry out on a personal level in their daily lives ($X^2 = 23.5$): "I am a person who goes very fast in my life and I am always thinking about the future and I don't think anything about the present, so I have to focus more on the present and live quietly day-to-day, not so disturbed nor looking at what I am going to do later." (Participant 14, Group 2), and on how to carry on ($X^2 = 19.56$) learning in other solidarity organizations.

4.1.4. Class 4: Reflections on the Personal Meaning of the Experience

Group 1 linked the fourth class (with 15.3% of the corpus) to personal reflections ($X^2 = 31.2$), encompassing how motivating ($X^2 = 22.28$) it had been to work with peers and other volunteers: "I used to say, 'What am I going to be able to do?', and there are people who are alone or with their partner and are doing everything they can, and it has made me think that 'I can also do something.'" (Participant 3, Group 1). Finally, Group 1 reflected on what they now needed in order to continue giving meaning to the experience: "Now I need to know what volunteer projects are here. I have seen what is being done in Tangier and Morocco, but what can I do from here?" (Participant 11, Group 1).

In the fourth class, Group 2 participants (with 30.9% of the corpus) reflected both on what the volunteering experience had meant on a personal level, and on how getting to know ($X^2 = 22.69$) different social groups had opened up new ($X^2 = 34.3$) professional perspectives: "Working with disabled people did not call out to me, it did not attract me much, it was seen as difficult and it is not an area that attracts me unlike immigrant children. Doing this experience has made me see that it is also an area that I like and in which I can participate." (Participant 17, Group 2). In any case, what is clear is that the experience was relevant to the students: "I believe that my way of thinking has changed... before I was still more likely to judge people without more, without even knowing them . . ." (Participant 23, Group 2). In addition, Group 2 participants highlighted personal limitations to continuing to give meaning to the experience: "I would like to be able to do something in September, but next year is my last year and between the final career project, afternoon classes, and practices, I do not see it and as much as I see the first semester, but of course, that depends on the theoretical load that have the subjects . . ." Participant 21, Group 2).

4.1.5. Class 5: Reflections on Volunteer Work Carried Out and Future Goals

The fifth class, with 17.1% of the corpus of Group 1, was linked to reflections on what it meant to participate in volunteer work ($X^2 = 52.37$): "It is as if you open your eyes that you do not have to go far to have to help or to take part in such projects, but that nearby there are also people who need help, you can lend a hand." (Participant 10, Group 1). In addition, Group 1 also reflected on how they could continue to have experiences that allowed them to contribute ($X^2 = 19.47$) on a personal level ($X^2 = 19.47$): "We are already thinking of going to Aitor (Aitor is the coordinator of the area of Solidarity and Cooperation at the University of Deusto) so that he can tell us what volunteer projects there are here." (Participant 6, Group 1).

4.1.6. Class 6: Reflections on the Lived Experience on the Border of Ceuta

In the sixth class, with 12.2% of the corpus, the participants reflected on the situation of chaos ($X^2 = 43.83$) that they experienced on the border ($X^2 = 72.7$) of Ceuta ($X^2 = 114.11$): "There is a difference between me coming here just for a day and these people living in a mountain during winter time to get through the fence." (Participant 2, Group 1) and "You realize that children are the future and they are living in very bad circumstances... Then... I would guarantee them the things they need so that they could have a dignified standard of living and have a future. What life can all these children have with such a hard experience on the border, many of them without a family to protect them?" (Participant 21, Group 2).

4.2. Mixed Methods Analysis of the Perceptions Expressed in Questions 8 to 10

The first analysis was carried out to identify the frequency of coded segments in each category. An initial approximation of the presence of each category in the corpus was then possible (see Table 3).

Table 3. Frequency of coded segments in each category.

Categories	Group 1		Group 2	
	Frequency	% Percentage	Frequency	% Percentage
Importance of knowing the projects to develop reflection	19	43.18	28	41.79
Importance of living the experience with peers to develop reflection	15	34.09	28	41.79
Importance of the instructor's role in developing reflection	10	22.72	11	16.41

In order to deepen each category, an analysis of the coded segments in each category and their frequency is presented below.

4.2.1. Importance of Knowing the Projects to Develop Reflection

In Group 1, 92.30% of participants stated that the volunteer experience had proven to be a very useful tool in the development of their reflective skills. In Group 2, all participants highlighted its usefulness (see Figure 5).

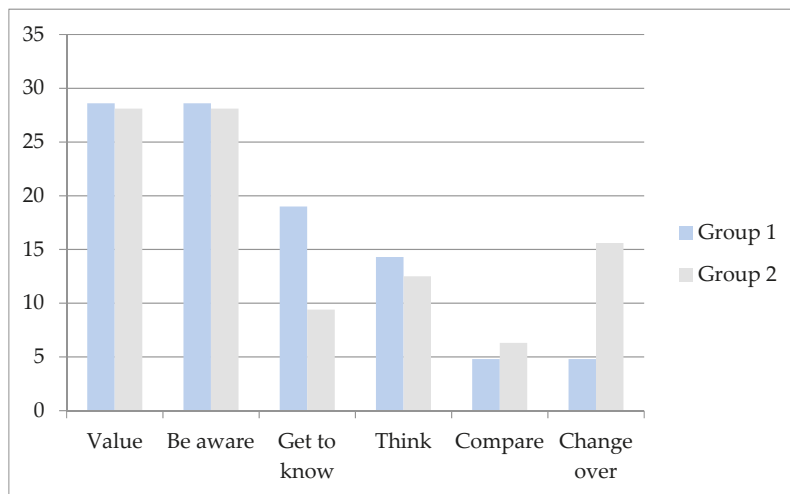


Figure 5. Frequency of codes in the category "Importance of knowing the projects to develop reflection."

Participants cited that it helped to be aware (28.6% of respondents in Group 1 and 28.1% in Group 2) of different social realities and to value one's own privileges (28.6% in Group 1 and 28.1% in Group 2). Thus, as one participant emphasized: "The experience has taught me how to reflect on what I have and how lucky I am. It has also taught me how to value things more and now I see that you can just be happy with so little." (Participant 1, Group 1). "Visiting the projects so closely, meeting the people who work there dedicating their lives, has made me see my life in a different way..." (Participant 12, Group 1). In addition, some participants stated in this category that the experience had helped them to think about (14.3% in Group 1 and 12.5% in Group 2) and to know (19% in Group 1 and 9.4% in Group 2) other realities. In some cases, this enabled students to compare (4.8% in Group 1 and 6.3% in Group 2) the different realities of several countries and encouraged a change (4.8% in Group 1 and

15.6% in Group 2) of perspective: “It has helped me to get to know one of the most questioned religions in my country from within, being able to broaden the perspective I have of Morocco.” (Participant 11, Group 1).

4.2.2. Importance of Living the Experience with Peers to Develop Reflection

Participants valued the experience as a very positive opportunity to reflect with their peers. In this category, participants focused on how important it was to create a space in which each person could contribute with different perspectives, thoughts, or ideologies (52.9% in Group 1 and 35.7% in Group 2): “My colleagues always showed me another point of view of the situations we lived there. I was able to get to know different ideologies of people of my age who see the world through different lenses.” (Participant 11, Group 1) (see Figure 6).

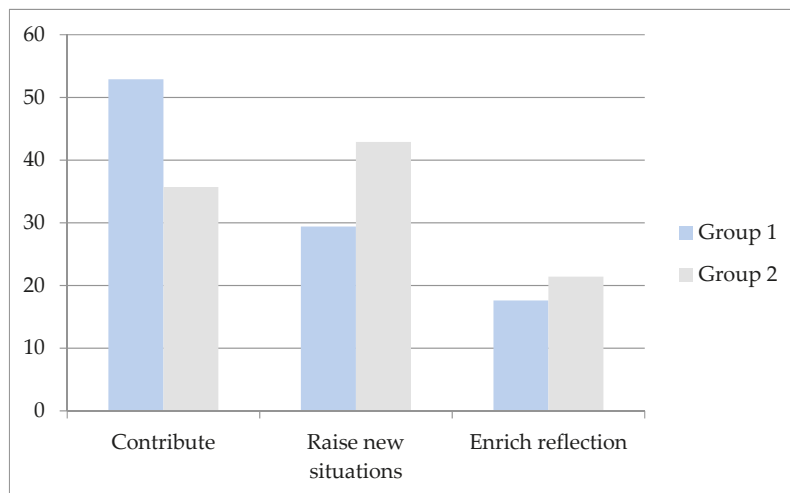


Figure 6. Frequency of codes in the category: “Importance of living the experience with peers to develop reflection.”.

In addition, contributions from colleagues proved useful, on one hand, to raise new situations (29.4% in Group 1 and 42.9% in Group 2): “When exchanging opinions with them, I realized how significant many situations and ideas that I overlooked were, and vice versa.” (Participant 10, Group 1). “It has been crucial for me to share this experience with my colleagues... Seeing them react, being able to contrast what we were each feeling... It has been a brutal experience, and my colleagues have played an important role in not feeling alone . . . ” (Participant 5, Group 1). On the other hand, such contributions enriched reflection (17.6% in Group 1 and 21.4% in Group 2): “As we expressed our ideas and thoughts together, it also gave me the opportunity to speak, be heard and reflect on what others have experienced. This made the experience more enriching.” (Participant 18, Group 2).

4.2.3. Importance of the Instructor’s Role in Developing Reflection

The participants pointed out that the role of the instructor was very useful in guiding their reflections (42.9% in Group 1 and 45.5% in Group 2): “After dinner, we wrote down in a notebook what we have seen, felt, reflected on, lived, and observed during the day. This way, we had the opportunity to recall again what we had experienced during the day and to give it a second thought and to internalize it.” (Participant 18, Group 2) (see Figure 7).

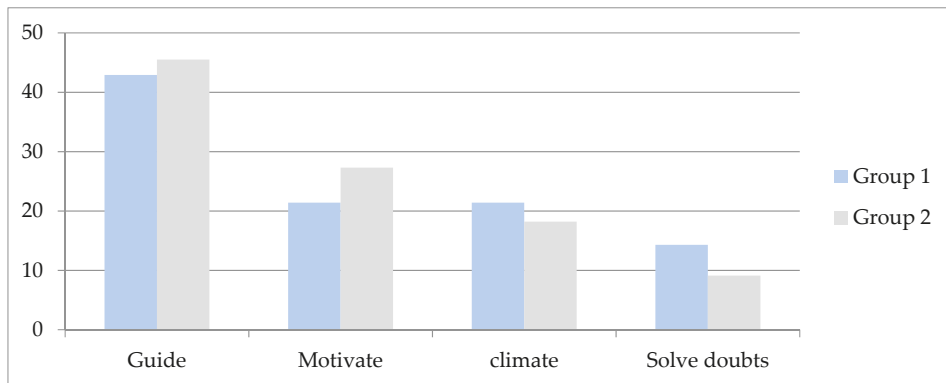


Figure 7. Frequency of codes in the category “Importance of the instructor’s role in developing reflection.”.

In addition, it was noted that the instructor had managed to motivate (21.4% in Group 1 and 27.3% in Group 2) the participants to reflect by creating a climate of trust and freedom (21.4% in Group 1 and 18.2% in Group 2): “I believe that Aitor has been a support and a guide, but I consider that the reflection was up to each one of us, how to carry it out, and how to interpret it. I consider that the role of the instructor has been based on an accompaniment on which we have been able to rely, if necessary.” (Participant 5, Group 1).

Finally, there were those participants who believed that the instructor played an important role in solving doubts or clarifying ideas (14.3% in Group 1 and 9.1% in Group 2): “Aitor has made the whole experience easier for us on a daily basis. He encouraged us to make a reflection at the end of the day that helped us clarify our ideas.” (Participant 7, Group 1).

5. Discussion and Conclusions

Returning to the objectives outlined at the beginning of this paper, the research involved a two-pronged approach:

- The global range of reflections experienced by Spanish students participating in a voluntary activity in Tangier, Morocco with people with special needs and minors at risk of social exclusion.
- The students’ perceptions of the value of this experience in developing their reflective skills.

Taking into consideration the findings of the descending hierarchical analysis, regarding students’ reflections on their participation in the project and their daily guided reflection, six distinct themes emerged. Four of these themes were found among the participants of both Group 1 and Group 2. These are: (1) reflections on different social realities; (2) the work carried out in social projects; (3) possible organizational, personal, and social changes that should be undertaken; and (4) the personal meaning of the experience. Two themes were found only among the participants of Group 1. These are: (1) the reflections on the voluntary work carried out; and (2) the lived experience on the border. The reason for this may be because the students of Group 1 visited the border between Morocco and Spain, while those in Group 2 did not. In their reflections, the students asked themselves why the social and economic reality in a place so close to Europe is so different. They wonder about the social, personal, and organizational changes that this type of societies requires. In their reflections, they showed how they had become truly aware of the lack of sustainable development on the ground. If sustainable development has most often been operationalized through a triangular vision of sustainability, which includes ecological, social, or socio-cultural and economic aspects, the socio-cultural and economic elements leave much to be desired, and the ecological element is far from being present. One of the participants pointed out “How is it possible for so much rubbish to be visible on the city streets?”

(Participant 1, Group 1), another pointed out “... the number of unschooled children on the roads.” (Participant 13, Group 1), and another was impacted by “... the number of young people crowded on the border wishing to cross from Morocco to Spain in search of a new horizon of life.” (Participant 9, Group 1).

The voluntary extracurricular activity developed in Tangier allowed students to reflect on themes that help educate citizens to be aware of and committed to the achievement of the Sustainable Development Goals [2]. What elements of the economic, socio-cultural, or ecological dimension come into play when witnessing so much inequality, poverty, and misuse of natural resources? To what extent are these societies compromising the well-being of future generations? Many of these ideas appeared in the reflection guided by the instructor who accompanied the group of students in their experience. This voluntary extracurricular activity gave both groups the opportunity to face situations of uncertainty, which made them aware of the different social realities faced by people with special needs and minors at risk of exclusion on the other side of the European border.

These results are consistent with other research [15], as this experience invites students to reflect on changes they can make to their own attitudes and actions from a perspective of responsibility, which contributes to an effective and well-founded grounding in sustainability. Participant 14 of the second group claimed, “I have realized the importance of a society that cares for the elderly and the sick, which requires a degree of social justice awareness that I have not been able to see here.”. Other participants stated that the experience they had lived had made them change some beliefs “I have realized that schooling children is much more than preventing them from being idle in the streets and I wonder how much of the situation of this society is connected to the lack of education of children.” (Participant 14, Group 2). On the other hand, in line with [22], students, placed in a destabilizing situation [21], were able to examine their self-image. In particular, they were able to examine their beliefs about who they believed they were and how they could undertake or continue to build a reality that increased hope and opportunity for people around the world.

With regard to the second objective, there was a high consensus that the development of reflection was one of the main objectives of the experience. In order to develop their reflective skills, the students highlighted three elements: (1) the importance of participating in social projects (with 42.48% presence in the corpus); (2) the importance of living the experience in a group (with 37.94% presence in the corpus); and (3) the importance of the role of the instructor (with 19.56% in the corpus).

As mentioned in the literature review, several authors [26,32] have indicated that the reflective process can be carried out individually or with external feedback. In this experience, the two groups pointed out the greater importance of reflecting with their peers than with the instructor. Thus, in line with [6], the volunteers stressed that interaction with their peers allowed them to take new approaches and enrich both their reflection and their experience. However, in line with Colomer et al. [10] and Peltier et al. [33], the participants also stressed the importance of the role of the instructor in generating a safe space of support and trust that invited reflection. Thus, in both groups, the fundamental task of the instructor was to guide the reflective process so that students could better understand the situation they were living through, and identify methods to face certain situations.

In order for this extracurricular activity to have greater impact, we consider it interesting to have a better balance between women and men participating in the experience as well as a greater variety of student profiles. We considered that the inclusion of engineering or business administration students would be of great value for the group. Apparently the proposal of this extracurricular activity has more demand from students of education, law, psychology or languages, but we considered that other profiles such as engineering or business would be enriched by the experience, and could bring other perspectives to the group. Another interesting element would be to reinforce the previous preparation to the experience (in depth study of the projects that are going to be visited, deepening in the socioeconomic reality of Tangier, etc.). Finally, the subsequent accompaniment to the experience would also reinforce the change of beliefs detected, and would help to ensure that it does not remain an isolated experience, and that it is part of the process of developing the competencies of university

students. The possibility of creating a learning community later on, with a monthly or bimonthly meeting, and continuing to collaborate with other types of extracurricular experiences in the country of residence also seems to us to be of interest. On the other hand, we would like to mention some obstacles that were encountered. First, due to the curricular load of the students, the experience was limited to one week and several students insisted on the appropriateness of lengthening the experience. Second, many of the participating students did not speak French, which prevented direct interaction with the people living in the centers visited. Third, and as we have already mentioned, the experience would have been richer with more varied student profiles (engineering or business students, etc.).

The primary conclusion of this research is that extracurricular activities that expose the student to real experiences of inequality and precariousness are an interesting element to contribute to deep and meaningful learning. In addition, the role of guided reflection in those experiences is very relevant, contributing to the integral human and professional formation of the participants.

In other words, the volunteer experience not only provides practical content that can contribute to the professional development of the individual [64], it also helps to develop values and attitudes that can guide personal development when carrying out sustainable development.

The study did not seek to generalize results, as quantitative studies do, but rather explore the impact that participation in ECA has on the development of reflective abilities. The research provides a detailed vision of the reflections extracted by students from a volunteering experience in Tangier, Morocco, and their perceptions of the importance of this experience to the development of their reflective skills. In addition, it adds new perspectives to an area that is increasingly the subject of investigation.

In the study presented, in-depth interviews were conducted with all of the participants after the experience. We believe that it would have been interesting to ask the same questions before having lived the experience to see how the answers changed before and after the extracurricular activity. On the other hand, we consider that it would be very interesting to interview the students one year after the experience, to see to what extent the impact detected is maintained over time. It would also improve the design of the research if we conducted in-depth interviews with the people in charge of managing the projects in Tangier to find out their perception of the value of this experience. Their opinion about what they see, hear, and observe in the students would be of great interest for the improvement of the extracurricular program.

Further research might explore the content of the individual reflective diaries written by students each night during the extracurricular experience. However, it is feared that informing students of the subsequent analysis of their diaries could generate bias in their reflections. A possible hypothesis to be contrasted is whether the fact of having previously participated in extracurricular activities has any impact on the participant's assessment of the new experience and of what nature. Likewise, in-depth interviews conducted both before and after the experience could provide interesting data, as would conducting identical interviews with students who have not participated in the experience, to compare their thoughts and perceptions. Finally, the development of a quantitative longitudinal study, based on a set of students who have the opportunity to live this experience each year, would prove very useful.

The findings imply that the supply of quality and structured ECAs [47] in higher education needs to be expanded. This need lies in the importance of ECA in fostering lifelong learning and in promoting reflection that enables students to enhance their skills to become better people and better professionals [65].

With regard to the future implications of this research, we would like to point out how structured and quality ECAs [47] in higher education can be an adequate path for the integral development of students. ECAs contribute to promoting a kind of reflection that helps students become aware of realities and situations that can make them better people and better professionals [65]. Therefore, public institutions must create laws with curriculum guidelines, university management teams, and faculty that encourage and support participation in ECA for the development of reflective skills, in order to produce citizens capable of facing the sustainability challenges of the 21st century.

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Article

The Rich Picture Method: A Simple Tool for Reflective Teaching and Learning about Sustainable Food Systems

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Abstract: The World Food System Summer School is an innovative two-week course that seeks to develop the knowledge, skills and attitudes of the next generation of decision makers to build sustainable food systems. Meaningful learning, where the participant is able to relate new information to existing knowledge, is a critical part of education about complex systems and requires the integration of reflective approaches to teaching and learning. We adapted the rich picture method in three summer schools in Switzerland, South Africa and Côte d'Ivoire (74 participants with 29 nationalities) to support the reflection of participants on their knowledge gained on complex food systems. Coding and comparing 51 pairs of pre- and post-course pictures of food systems clearly demonstrated newly gained knowledge: The number of sub-categories drawn significantly increased from 11 to 19 in the post-course pictures, the largest increase occurred for environmental sustainability (57%). The rich picture method is a highly valuable and simple tool to gain insight into how participants' knowledge changes and where there are gaps in meeting the learning objectives. This is particularly useful within a highly diverse participant cohort, as it allows participants to discuss and reflect on their own learning experience in a personalized way. Additionally, the rich picture method provides insights for faculty to improve their approaches to teaching on food systems.

Keywords: food systems; sustainability; education; rich picture; reflective learning; reflective teaching; summer school

1. Introduction

The challenges facing food systems today are complex and pressing. Creating a more sustainable food system requires us to work across diverse disciplines, sectors and scales—competencies that are not often the focus of traditional tertiary education programs [1]. Education in this space needs to support learners to build these competencies by acquiring and integrating new knowledge, skills and attitudes that enable successful task performance and problem solving as applied to real-world challenges at the interface of food systems and sustainability [1,2]. Although the overall application of these competencies is of critical importance for graduates of education programs in this space, as faculty we still have an interest in assessing the gain of component parts—namely knowledge, skills and attitudes and how they change as a result of an educational intervention. This information can support us to reflect on the program design and delivery and what participants from different backgrounds are learning.

Much like sustainability education, learning about food systems is complex and the assessment techniques used need to reflect this complexity [3]. This is particularly crucial when assessing knowledge gained as a result of a course. In *How People Learn*, a comprehensive synthesis of research on learning, the authors argue that effective learning environments should treat people as individuals, understanding that they have different states of initial knowledge, perceptions, culture, language and sense making processes [4]. Furthermore, knowledge should be considered as an interconnected structure that is continually expanded, organized and refined, and that the learning environment should help people understand this process [5]. How this knowledge is then evoked while solving a particular problem is strongly influenced by an individual's own framing of the situation [5].

This makes assessing the knowledge gained as a result of an educational intervention challenging, particularly when the cohort is diverse in terms of cultural and disciplinary backgrounds. The challenge is similar when trying to gather an understanding of the knowledge and perspectives of multiple actors within a complex problem or issue. Rich pictures (RPs), developed as a part of Soft Systems Methodology (SSM), have been used in such situations for many years as a method to analyze a complex situation and define problems with a diverse group of actors [6]. The main developer of SSM, Peter Checkland, describes the approach as follows:

“Soft systems methodology (SSM) is an approach for tackling problematical, messy situations of all kinds. It is an action-oriented process of inquiry into problematic situations in which users learn their way from finding out about the situation, to taking action to improve it. The learning emerges via an organised process in which the situation is explored using a set of models of purposeful action (each built to encapsulate a single worldview) as intellectual devices, or tools, to inform and structure discussion about a situation and how it might be improved” [7].

RPs, as one tool within this SSM, were originally developed to structure and frame problems in complex socio-technical systems, for example in development cooperation projects, government policy design, information system planning, engineering and health care [6]. RPs are simple in concept—they involve a small group of people collectively drawing a freehand diagram of a particular situation. They are a diagrammatic representation of a perspective of a complex situation that can include objects, ideas, people, feelings, conflicts and prejudices [8]. As outlined by Bell, Berg and Morse [9], RPs are very specific to the people who draw them, reflecting their own ways of thinking and contexts. They thus act as a visual thinking device and a representation of people's perspectives of a situation.

Researchers working with RPs highlight that the value of this method is that it allows complexity to be captured in a way that is concise while still being rich in information [10]. Further, RPs allow elements to be captured that may never emerge in a verbal dialogue, such as spatial information, mood, symbolic meaning, relationships and emotions [11]. On this basis, we explored the potential to adapt this method and apply it within an educational setting that deals with complex systems, namely food systems and sustainability. Although usually applied in a group setting, with each RP drawn by a group of people, we employed the method as a tool for individual reflection of participants. With the exception of an example in *Teaching on Information Systems* from Horan [12], research on the use of RPs in an educational setting as a tool to understand knowledge gained as the result of a course is limited. In the work of Horan [12], the RP method was used as a tool to help people explore their understanding of the subject matter and how they were learning about it. The pictures were developed individually or in pairs and were used as a basis for people to reflect on and manage their own learning experience and to feed group discussions. Although this study was undertaken in the early 2000s, we were not able to identify any other examples of RPs being further evolved or researched in such a setting. Here, we adapted the application of the RP method, namely as a pre- and post-assessment of knowledge about the food system, completed by individual participants at the beginning and end of the course.

As there is no right or wrong depiction of a food system, each person's version of it will be inherently connected to their worldview and experience [7]. Thus, the RP method is useful in this context as it does not capture a description of the "real world" but is simply a device to capture individual perspectives and observe changes of a person's view. On this basis, we decided to utilize the RP method as a tool to assess how participants' knowledge changes as a result of an educational intervention—in our case, a two-week intensive course on food systems involving diverse participants from a range of disciplines and cultures.

The World Food System Summer School was launched in 2013 to offer an innovative approach to training the next generation of food system decision makers. To date, the course has been run seven times in four different countries, training 169 participants, i.e., graduate-level university students and young professionals, from 49 different countries. It has been built around twelve design criteria [13] that aim to make the experience rigorous, meaningful and impactful for the participants. The design criteria include: the promotion of cross-cultural exchange and team work; an awareness of the context specificity of challenges and solutions; the application of systems thinking; interdisciplinary, cross-sectoral and values-based approaches; a blend of experience, theory and skill acquisition; an experimental approach to program design; an exploration of agency and power of diverse actors; and the appreciation of participants as producers and users of knowledge. The course is enriched by the inclusion of a diverse participant and faculty cohort and by hosting the experience in unique locations that offer first-hand engagement with food system issues. The entire program is structured around Kolb's theory, outlining learning as a cyclical procedure involving concrete experience, reflective observation, abstract conceptualization and active experimentation [14].

As course designers, we have a specific interest in understanding, in a systematic way, the knowledge that participants gain during the course. This is challenging given the complex nature of food systems, the necessity to work across different disciplines, with multiple sectors and across different spatial and temporal scales, and the dynamic and diverse learning environment that we deliberately create. Such conditions make it inappropriate to apply a more traditional test with a pre-set list of questions only in written form. For this reason, we decided to conduct a pre- and post-course knowledge test for individual participants using RPs that allows them to individually capture their baseline understanding of the system and then reflect on and communicate how this understanding has changed. The RP tool has two purposes: (1) to provide participants with a structured process to reflect on what they have learned from a content perspective and (2) to support the faculty to understand what participants have learned and feed this back into the development of future courses.

The overall objective of this paper is to assess the efficacy of the RP as a tool in this context—firstly, as a means to investigate the knowledge gained by participants in the course; secondly, to explore how this information can be used in a reflective process to inform future course design and teaching. We conclude that, despite some limitations, the RP method is a highly valuable and simple tool to gain insight into how participants' knowledge has changed. It is thus also helpful to guide changes to the course or session design, including how other reflection methods are linked to the RP method. We have initial feedback from participants regarding the value of this tool for their own reflection. However, further research is needed to explore in more detail the participant perspectives on the RP method as a tool for their own reflective learning.

2. Materials and Methods

We began applying the RP method in 2016, the fourth year of running the World Food System Summer School courses. We conducted the RP method in the 2016 course in Switzerland, in the 2017 course in South Africa, and in the 2018 course in Côte d'Ivoire. Although each course followed a similar concept and framework, each context, cohort of participants and program was unique (Table 1). We developed a protocol for conducting the RP method with the participants, and it was administered by the same faculty member each time to ensure consistent execution.

Table 1. Overview of the three summer school cohorts.

Course Year	Course Location	Number of Participants	Approximate Number of Disciplines	Number of Nationalities
2016	Switzerland	23	18	17
2017	South Africa	25	12	17
2018	Côte d'Ivoire	26	9	14

For each summer school, we collected data at two points in time—pre-course and post-course. This translated to conducting the RP method on the very first and very last day of the course. The pre-course RPs were constructed just after the participants arrived, to ensure that we were collecting their baseline knowledge before any course inputs. Following the initial welcome and logistics overview, the participants were each provided with an empty sheet of paper (DIN A4) and a single colored felt pen. They were given 15 min to work individually and in silence to draw a picture of the food system, as they understood it at that exact point in time. They were specifically told to rely on images as much as possible, keeping text to a minimum and to use only one color felt pen. Participants were requested to add their first name, date and course to the back of the drawing.

At the end of the 15 min, the participants were broken into small groups together with a facilitator from the faculty team. During the next 20–30 min, the group went around one by one, explaining their picture and what was drawn. The facilitator made notes to support the interpretation of each of the pictures, and participants had the opportunity to discuss with one another questions or insights that arose. In this sense, the activity itself also provided the first content input, through being able to discuss and learn from the drawings of other participants.

Following the group discussions, the lead faculty collected all the pictures for safe keeping until the end of the course. At this point, a scan was made of each picture to capture the baseline picture. On the final day of the course, after the official program was finished, the same process was repeated (post-course RP). This time, the participants were given back their picture they had drawn on the first day of the course and instructed to take another color felt pen and add anything they had learned during the course. They were also allocated 15 min for this process.

The timing of the RP activity was important to make sure that the data represented the baseline at the beginning of the course and status at the end of the course. This created the challenge that any participant who arrived late or left early due to travel restrictions did not draw both pictures. In total, we collected 132 RPs from the three summer school cohorts. Among these were 56 pairs of completed pre- and post-course pictures. The remainder of the pictures were either pre- or post-course pictures of participants who arrived late to the courses or left early. We also collected auxiliary information about all summer school participants, namely gender, the highest degree obtained, and the field of study (natural or social sciences).

The RPs were anonymized before coding and analysis. For coding of the RPs, a set of six food system categories was defined, i.e., value chain, outcomes, actors, system elements, boundaries, and special topics, based on the key elements of food systems [15]. These six categories were further divided into a total of 38 sub-categories (see Table 3). The categories were linked to one of the knowledge-related learning objectives of the course, namely to understand food systems and their outcomes and challenges. The pictures were also scanned for emergent categories that were not included in this initial list. The (sub-)category definition process was conducted by two of the course faculty. Presence or absence of each sub-category in all RPs was coded as 1 or 0, respectively. All pictures were coded by the same person, a second person was consulted in cases of doubt. In cases where interpreting the drawn elements presented in the RPs was not possible without making many assumptions, therefore making coding arbitrary, the picture was not included in the analysis. Thus, after coding, a total of 51 pairs of RPs were analyzed.

For an initial analysis of the coded data, we computed a presence/absence (1/0) variable for each of the six categories, based on the presence or absence of sub-categories in the respective category. We summed up the number of categories represented in each picture and calculated the difference in the number of categories in the post-compared to the pre-course RPs for each pair (i.e., for each participant). Additionally, the average of this presence/absence variable represents the proportion of pictures that included drawn elements of the respective category. The number of categories in pre- and post-course pictures, the difference in categories represented in the RPs as well as the proportion of pictures containing elements of the different categories were used to broadly assess in which elements of the food system knowledge gain was highest. Similar to the categories, we also summed up the total number of sub-categories represented in each picture and calculated the difference in the number of sub-categories in the post-compared to the pre-course picture for each pair (i.e., participant). This difference was used as a proxy for overall food system knowledge gained in the course.

To identify sub-categories with a particularly low or high knowledge gain, we calculated the proportion of pictures containing each sub-category for the pre- and post-course pictures. This then allowed us to identify areas that could be given more emphasis in future courses to improve the food systems understanding of participants even further. Statistics were run using the R software version 3.6.0 Patched [16]. A generalized linear model (adjusted to the Poisson distribution) was used to test for differences between pre- and post-course pictures. To analyze the full dataset, we used a generalized linear model with course cohort, gender, highest degree, and field of studies as explaining variables.

3. Results

The participants fully engaged with the RP method and drew (and later added) their knowledge about food systems within the allotted time (for examples of RP pairs, see Figure 1). The number of overarching categories represented in the RPs increased from an average of 3.73 (± 0.15 SE) in the pre-course pictures to 5.31 (± 0.11 SE) in the post-course pictures (Table 2). The six categories of the food system were not equally represented in the RPs, particularly in those before the course. The value chain was the only category represented in all the pre-course pictures, i.e., the pre-course pictures all contained at least one sub-category of the value chain. Also actors were almost always represented (overall mean of 96%; Table 2). All other categories of the food system were represented less in the pre-course pictures. While system elements and boundaries were represented in considerably more than 50% of the pre-course pictures (in approximately 70%), specific topics were represented in approximately one-quarter of the pre-course pictures, and outcomes were only represented in 18% of the pre-course pictures. On average, all six categories were better represented in the post-course pictures (except for the value chain and the actors, which were already well represented in all the pre-course pictures; Table 2).

Over all three courses, 18.96 (± 0.57 SE) sub-categories were represented in the post-course pictures, while only 11.02 (± 0.51 SE) sub-categories were depicted in the pre-course pictures. Thus, course participants added on average 7.94 sub-categories (± 0.45 SE), which is a significant increase in sub-categories represented in the picture after taking the summer school course compared to before the course ($p = 0.019$; Table 2). Neither summer school cohort, nor gender, highest degree or field of study of the participants had a significant effect on the difference in the number of sub-categories represented in the pre- and post-course pictures ($p > 0.09$).

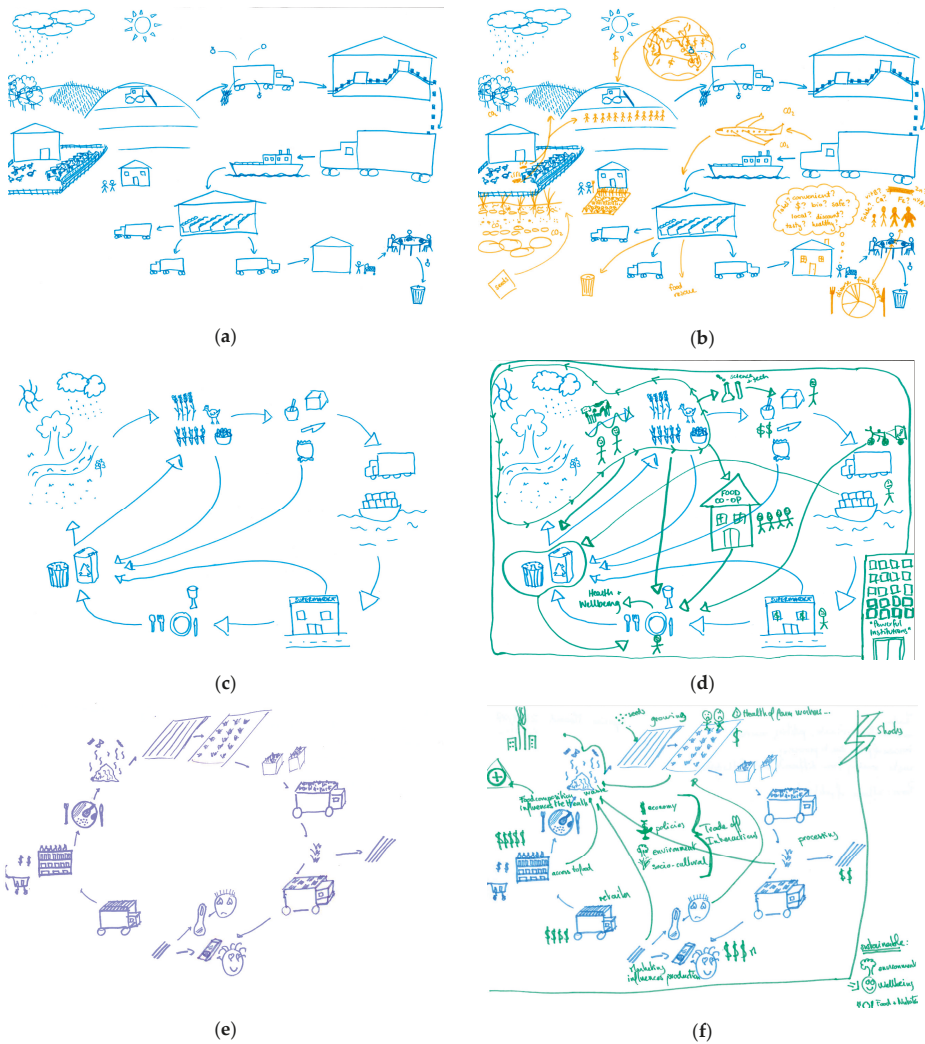


Figure 1. Pairs of rich pictures (RPs) drawn by participants in the World Food System Summer School. (a,c,e) were drawn before the start of the course (pre-course), while (b,d,f) were drawn at the conclusion of the course (post-course). Note that pre- and post-course RPs were scanned with different devices, leading to some discrepancies in colors.

The average representation of the different sub-categories in the pre-course pictures varied between 0 for the representation of actors from international organizations and 98% for the agricultural part of the value chain (Table 3). The majority of the summer school participants (i.e., more than 50%) included the value chain elements agriculture, transport and storage, processing and packaging, retail, consumption and resource inputs in their pre-course pictures. Farmers and consumers (from the actor category) were also represented in the majority of the pre-course pictures as well as some representation of interactions (from the system elements category). All other sub-categories were represented in less than 50% of the pre-course RPs. We observed very limited representation of special topics (like organic agriculture, diversity or labels), certain actor sub-categories (like non-governmental organizations and international organizations) and food system outcomes in the pre-course pictures (Table 3).

As a result of the course, the proportion of RPs containing a particular sub-category increased between 2% for the agricultural part of the value chain (that already had the highest representation in the pre-course pictures) and 57% for the food system outcome environmental sustainability. A number of sub-categories were substantially better represented in the post-course RPs, with representation increasing by more than 30% compared to the pre-course RPs. These were in particular sub-categories of the food system outcomes and the food system boundaries but also workers (from the actor category) and waste and losses (from the value chain category; Table 3).

Table 2. Average number of categories (\pm standard error) and proportion of categories represented in pre- and post-course pictures (\pm standard error) as well as average number of sub-categories represented in pre- and post-course pictures (\pm standard error) over all three summer school courses and for each of the three courses separately. N = 17, 18, and 16 in 2016, 2017 and 2018, respectively. SE: standard error.

	Overall		2016		2017		2018	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Number of categories present in pre- and post-course pictures								
Number of categories pre-course	3.73	0.15	4.18	0.29	3.61	0.26	3.38	0.20
Number of categories post-course	5.31	0.11	5.59	0.15	5.39	0.16	4.94	0.21
Difference in number of categories (post-course–pre-course)	1.59	0.15	1.41	0.30	1.78	0.24	1.56	0.22
Share of pictures containing one or more sub-categories of the respective category pre-course								
Value Chain	1.00	0.00	1.00	0.00	1.00	0.00	1.00	0.00
Outcomes	0.18	0.05	0.24	0.11	0.28	0.11	0.00	0.00
Actors	0.96	0.03	0.94	0.06	0.94	0.06	1.00	0.00
System Elements	0.67	0.07	0.82	0.10	0.61	0.12	0.56	0.13
Boundaries	0.69	0.07	0.82	0.10	0.56	0.12	0.69	0.12
Special Topics	0.24	0.06	0.35	0.12	0.22	0.10	0.13	0.09
Share of pictures containing one or more sub-categories of the respective category post-course								
Value Chain	1.00	0.00	1.00	0.00	1.00	0.00	1.00	0.00
Outcomes	0.84	0.05	0.88	0.08	0.89	0.08	0.75	0.11
Actors	1.00	0.00	1.00	0.00	1.00	0.00	1.00	0.00
System Elements	0.88	0.05	0.94	0.06	0.94	0.06	0.75	0.11
Boundaries	0.98	0.02	0.94	0.06	1.00	0.00	1.00	0.00
Special Topics	0.61	0.07	0.82	0.10	0.56	0.12	0.44	0.13
Number of sub-categories present in pre- and post-course pictures								
Number of sub-categories pre-course	11.02	0.51	11.82	0.94	11.11	0.78	10.06	0.92
Number of sub-categories post-course	18.96	0.57	20.88	1.06	18.39	0.83	17.56	0.91
Difference in number of sub-categories (post-course–pre-course)	7.94	0.45	9.06	0.91	7.28	0.66	7.50	0.76

Table 3. Average representation of sub-categories in the pre- and post-course pictures as well as the average proportion of participants adding the sub-categories to their pictures after the course (i.e., difference in post- minus pre-course picture). SE: standard error.

Categories	Sub-Categories	Pre-Course		Post-Course		Difference (Post-Course-Pre-Course)	
		Average	SE	Average	SE	Average	SE
Value Chain	Agriculture	0.98	0.02	1.00	0.00	0.02	0.02
	Transport and Storage	0.65	0.07	0.80	0.06	0.15	0.05
	Trade	0.27	0.06	0.41	0.07	0.14	0.05
	Processing and Packaging	0.69	0.07	0.80	0.06	0.11	0.05
	Retail	0.76	0.06	0.88	0.05	0.12	0.05
	Consumption	0.88	0.05	0.96	0.03	0.08	0.04
	Resource Inputs	0.71	0.06	0.92	0.04	0.21	0.06
	Waste and Losses	0.41	0.07	0.76	0.06	0.35	0.07
Outcomes	Emissions and Pollution	0.37	0.07	0.57	0.07	0.20	0.06
	Food and Nutrition Security	0.04	0.03	0.51	0.07	0.47	0.07
	Environmental Sustainability	0.14	0.05	0.71	0.06	0.57	0.07
Actors	Social Wellbeing	0.04	0.03	0.41	0.07	0.37	0.07
	Agricultural Workers	0.20	0.06	0.51	0.07	0.31	0.07
	Farmers	0.69	0.07	0.76	0.06	0.07	0.04
	Transport and Storage Workers	0.06	0.03	0.20	0.06	0.14	0.05
	Processors and Packagers	0.06	0.03	0.16	0.05	0.10	0.04
	Traders	0.16	0.05	0.27	0.06	0.11	0.05
	Retailers	0.18	0.05	0.29	0.06	0.11	0.05
	Consumers	0.59	0.07	0.75	0.06	0.16	0.05
	Researchers	0.06	0.03	0.22	0.06	0.16	0.05
	Policy Makers	0.12	0.05	0.27	0.06	0.15	0.05
	Industry	0.04	0.03	0.24	0.06	0.20	0.06
	Non-Governmental Organizations	0.04	0.03	0.12	0.05	0.08	0.04
	International Organizations	0.00	0.00	0.08	0.04	0.08	0.04
	Relationships/Power between actors	0.06	0.03	0.24	0.06	0.18	0.05
Animals	0.49	0.07	0.59	0.07	0.10	0.04	
System Elements	Interactions, Feedback and Cycles	0.53	0.07	0.80	0.06	0.27	0.06
	Trade-offs	0.02	0.02	0.22	0.06	0.20	0.06
	Scale	0.27	0.06	0.45	0.07	0.18	0.05
Boundaries	Economic Boundary	0.37	0.07	0.71	0.06	0.34	0.07
	Environmental Boundary	0.49	0.07	0.82	0.05	0.33	0.07
	Social Boundary	0.10	0.04	0.59	0.07	0.49	0.07
	Political Boundary	0.20	0.06	0.57	0.07	0.37	0.07
	Drivers	0.08	0.04	0.29	0.06	0.21	0.06
Special Topics	Organic	0.02	0.02	0.24	0.06	0.22	0.06
	Diversity	0.14	0.05	0.33	0.07	0.19	0.06
	Nutrient Cycles	0.12	0.05	0.27	0.06	0.15	0.05
	Labels	0.02	0.02	0.24	0.06	0.22	0.06

4. Discussion

This research explored the suitability of the RP method as a tool for understanding the knowledge gained by participants in an intensive two-week summer school course and to support faculty in reflecting on the course design and teaching. To our knowledge, this study is the first to apply the RP method to teaching about food systems. The results of the RP analysis gave detailed insights into the knowledge categories for which significant changes were observed as a result of the course. At the beginning of the course, there were nine sub-categories present in the majority of the RPs drawn by participants (indicated by presence in >50% of RPs). These were sub-categories representing key elements of the food value chain (namely agriculture, transport and storage, processing and packaging, retail, consumption and resource inputs) as well as farmers, consumers and some system interactions. This highlighted that the knowledge most participants had when they came into the summer school course was based on a rather simple concept of what a food system is, with little reference made to the intended outcomes of the system, the diversity of actors involved, the boundary conditions it is embedded in or the forces that shape it. Based on the post-course RPs, there was a substantial increase

in knowledge in nine sub-category areas, namely the three key food system outcomes (food and nutrition security, social wellbeing, and environmental sustainability), the four food system boundaries that influence how food systems function (environmental, social, political and economic boundaries), food waste and losses, and farm workers as actors in the system. Thus, using the RP method, the faculty was able to easily identify if one of the key learning objectives of the course, i.e., to explain the elements of a food systems, the desired outcomes and the challenges, was achieved.

There were also a large number of sub-categories for which there were no substantial differences in knowledge before and after the course. This included agriculture, which was depicted in 98% of all pre-course RPs and added in the post-course RPs by the remaining 2% of participants, or consumption, present in 88% of pre-course and 96% of post-course RPs. Further, some sub-categories were not often present in either the pre- or post-course RPs. These included a large number of the possible actors that could have been included, the depictions of scales and tradeoffs as a part of the system, as well as special topics like labels. It remains unclear why these latter sub-categories were not included. It may be that the participants gained new knowledge on these aspects, however considered it less relevant for a general, i.e., hypothetical food system, or that they simply found it too difficult to draw. Alternatively, it could be that these participants did not learn or retain any new knowledge on these topics. As outlined by Schneider and Stern [17], there are many factors that need to optimally interact for learning to occur, the knowledge a person has can only be directly assessed by this person and is only made sense of when interpreted in the light of prior knowledge. This means that to understand in detail why certain sub-categories were omitted we would need more detailed data from each individual, which is not possible to gather for all participants due to limited resources (namely, time and faculty). In this sense, the RP method allowed us to collect high-level information from all participants that indicated the knowledge at the forefront of each participant's cognition at the end of the course.

From the perspective of the course faculty, a number of sub-categories were more important to be conveyed during the teaching program than others. For example, the understanding of food system outcomes and boundary conditions as well as their interactions, was a key part of the food systems concept explored in the courses. The analysis of the RPs indicated a substantial lack of knowledge in all these areas before the course which were closed with the course, clearly indicating that the course was successful in building knowledge in these areas. Another sub-category that was very under-represented in the pre-course RPs was the diverse range of actors within the food system. The post-course RPs saw a substantial increase in participants including farm workers as actors, in addition to the farmers who were often already depicted in the pre-course RPs. However, there was a large number of other actors and institutions in the system which were still not widely depicted in the post-course RPs, despite the role of these actors being explored in the program and integrated into interactive activities like stakeholder mapping. Although it is not our expectation that the final post-course RPs include an exhaustive mapping of all actors, their absence in the post-course RPs helps faculty reflect on why this may be the case, and consider how this could be better embedded in the program. Regardless, the addition of farm workers was a very positive step considering that the majority of participants came from a natural sciences background and had not been exposed to many social science topics.

Moreover, this change in the RPs clearly demonstrated a knowledge gain by the participants, which would have potentially gone unnoticed to the faculty without the employment of the RP method. Assessment methods in higher education are often 'feedout' (rather than 'feedback') in nature, in that the main objective is to grade people at the end of the course to act as a performance indicator for faculty and future employers or admission departments [18,19]. Grades from such assessment methods, typically in the form of exams or end of course assignments, often do not reflect the amount of learning occurring among the people during a course [18]. The RPs could be considered an alternative to this, a type of Classroom Assessment Technique (CAT), which is carried out for the purpose of learning and not for grading [20]. In this manner, the RP offers a tool to gain insight into what people are learning and to collect information in a manner that can be personalized yet broadly interpreted.

Importantly, it has the nature of a pretest/posttest, which helps establish knowledge gain in the context of prior knowledge [21].

Our experience with the RP has highlighted it is a method that is aligned with several of the ten cornerstone findings from cognitive research on learning outlined by Schneider and Stern [17]. Firstly, it allows participants to create the new knowledge structures themselves, as they are completely free to draw and amend their diagram how they choose. Secondly, it allows the participants to make sense of new information by linking it to prior knowledge. By amending their pre-course RPs, they are making sense of new information by interpreting it against their prior knowledge. The RP also helps participants to create relationships between the individual pieces of knowledge they acquire in the course, which is a requirement for successful learning [17]. Constructing the RPs requires the drawer to break down a complex system into its component parts, which can also help support the learning process. Thus, although we did not directly collect data from the perspective of the participants regarding if and how the RPs supported their reflection on their knowledge gained, considered from the cognitive perspective of learning, the method has the additional role of supporting their learning process through reflection. This is supported by a substantial amount of anecdotal evidence from participants, in the form of verbal feedback to faculty, that they found this tool a very useful method to gauge their own learning and to capture the new knowledge they gained.

The insights from the analysis of the RPs has also informed the course design in terms of how participant reflection should be integrated into the course. In the last couple of courses, we thus have increased the number of reflective sessions with the participants and begun to trial a number of different formats to help them reflect on what they are learning at more regular intervals. We do this through a number of methods, for example daily journaling, daily plenary discussions on “What are we learning?”, back reflection sessions, and reflective artwork or creativity, which allow participants to reflect more broadly on their overall experience. This includes not only the knowledge participants are gaining, but also the skills they are building, values and attitudes they are developing as well as capturing anything that is coming up for them emotionally and psychologically during this intensive learning experience. We now see an opportunity to better link these intermittent activities to the final RP activity, so that this acts as a recap and culmination of what is being learned, rather than as a stand alone activity. Reflecting on the RP as a form of CAT, we identified that it could also be valuable to do the updates to the RPs at regular intervals during the course. This would offer an additional reflection tool for the participants during the course, and would allow faculty to evaluate these assessments and adapt the program in real time based on any gaps that are identified. This could also result in participants having a “richer” RP at the end of the course that they could refer back to.

To date, the RPs have been collected by faculty at the end of each course to be analyzed. Participants had the opportunity to take a photo of their picture if they wished. In the future, it could be beneficial to email a copy of the picture to each participant at a certain timepoint after the end of the course. In this way, the picture can act as a reminder of what they learned during the course, but participants could also be encouraged to use it as a template to continually add to as they learn more about the system. In this sense, it would help to better communicate that there is no “end point” per se to a RP, and the learning process. The picture can continually be iterated and used as a tool to capture new knowledge beyond the end of the course. In this way, the RP supports the understanding of knowledge as an interconnected structure that is continually expanding [5].

Through a structured analysis of the RPs, we were able to better understand the key areas where participants gained knowledge, and this helped us as faculty to reflect on which parts of the course were delivering the intended learning, and which parts needed further development. Interestingly, the comprehensive analysis of the RPs across three cohorts reinforced the information that faculty had picked up from informally reviewing the RPs at the time they were drawn. This experience encourages us to continue using the RPs without a comprehensive coding and analysis as a way to gauge the knowledge of the participants as they come into the course, and to understand what knowledge was gained or where there were gaps. As a process, it was helpful for faculty to see, very broadly, what

messages came across, where there was room for improvement and how that can be designed into the course and associated reflection sessions.

Interestingly, the analysis indicated that the summer school cohort, gender, or field of study had no significant impact on the number of additional sub-categories in the post-course compared to the pre-course pictures. This showed that despite differences in courses and participant backgrounds, using our course design principles [13], it was possible to create a learning environment and course program that benefited all participants in terms of increasing their knowledge of food systems.

The implementation and analysis of the RPs also allowed the identification of a number of limitations of this method as a tool to determine knowledge gained over the course. Firstly, by adding to the picture that was drawn at the beginning of the course, the participants were structurally constrained to the framing of the system as they originally understood it. Although they were able to completely change it, the time restraints and the point in time when it was undertaken (at the very end of the course) made it less likely that they did so since this activity coincided with the wrapping up of an intense two-week course and the process of closing a social dynamic that had been built. This means it was difficult time to keep the attention of the participants and, as faculty, we often found ourselves constrained by time pressure to get through the full day of closing the course. This has meant there was never adequate time to discuss the changes to the pictures in great depth, which would provide additional data to support the interpretation of the pictures. From this insight we could identify a need in future courses to allocate and structure time at the end of the course to do a collective reflection on lessons learned with the group, based on their individual pictures. Further, we see the RPs offering a good opportunity to discuss more openly with participants around questions of worldview, how we know what we know, and how any situation is perceived differently by different actors. Time for participants to sit together and compare their pictures and discuss these questions could potentially be valuable at the end of the course. In order to reintroduce the original conceptualization of the RPs as a participatory process, we could also have participants collectively draw a new RP at the end of the course, using it as an opportunity to explore knowledge, understanding, perspectives, values and blind spots, as well as to reflect on how they know what they have learned by attending the course. This more nuanced discussion may also give faculty additional information which can help in the interpretation of the RPs drawn by participants.

As has been extensively written about by Bell, Berg and Morse [6], the interpretation and sense making of RPs by a third party is inherently challenging. We took an approach of coding categories based on one of the key learning objectives of our summer school, thus identifying changes against a predetermined set of themes. This helped to obtain a high-level overview. However, this might mean that we lost the nuanced information in each individual picture. It could be interesting in the future to apply a form of content analysis called 'Educative Interpretation' proposed by Bell, Berg and Morse [6], where emergent themes are identified from the diagrams themselves. Either way, there is substantial risk of misinterpretation, subjectivity or bias on the part of the coder, even when great care is taken to avoid these things. Essentially, we are still interpreting the creative work of others which is always challenging without extensive dialogue with the creator of the work.

Generally speaking, we have found the RP method to be an effective and simple way to assess the knowledge gained by participants as a result of the educational experience they have during our two-week course. Although it has a number of limitations, it has allowed us to obtain a high-level overview of what knowledge participants have when they come into the course, what knowledge they have when they leave, and to identify any gaps where we may need to adapt the content and methods in the course. Additionally, this method is valuable as a reflective tool for participants to consider and structure what they are learning from a content perspective. This needs to be supplemented with additional reflective methods to allow the participants to consider learnings beyond only knowledge to include skills, attitudes, values and their own role in creating change. It would be valuable for future research to further explore the efficacy of this method as a tool for reflection for participants' learning in and about other complex systems. In our experience, the RP method is a simple tool that works

very well to support both reflective teaching and reflective learning in food systems education and we recommend its use in the sustainability education space.

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Article

Introducing ERP Concepts to IT Students Using an Experiential Learning Approach with an Emphasis on Reflection

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Abstract: The introduction of enterprise resource planning (ERP) concepts to IT students entails many challenges. Due to the system's complexity, newcomers need an extensive amount of time to be able to use it independently. Additionally, the learning preferences and characteristics of digital natives differ significantly from previous generations. Therefore, the use of alternative learning approaches is desirable. To achieve the best possible learning outcomes, it is advisable to implement learning approaches that require students' active participation, for example, an experiential learning approach. A variation is an ERPsim business simulation game, which we used within the ERP systems course. The game is implemented in sequential rounds, whereby each round ends with a review of the collected experiences. The simulation game was used at the beginning of the course to ease the introduction of ERP concepts for IT-related students. This paper is the result of three years of research into the perceived usability of SAP ERP introduced with the business simulation game, combined with the results of a study evaluating students' opinions, knowledge, and skills. Perceived usability was measured using a System Usability Scale (SUS), while the students' experiences were gathered using a self-evaluation questionnaire. The study revealed the positive impact of the experiential learning approach that was used. Students evaluated the usability of SAP ERP as OK, and empirical analysis confirmed that the use of the simulation game for introducing the ERP concepts resulted in anticipated knowledge and skills, while increasing the students' intent for future engagement.

Keywords: information technology; higher education; experiential learning; simulation game; ERP systems; usability; SUS; SAP

1. Introduction

The highest learning outcome is achieved when students are engaged actively in the learning process [1]. Therefore, the use of learning approaches requiring students' active participation is recommended. Schön [2] emphasized the importance of the learning-by-doing approach. He described it as an approach allowing us to "think about doing something while doing it" [2]. Based on the Learning Pyramid by National Training Laboratories Bethel, Maine, USA, learning retention when applying hands-on learning is approximately 75% [3]. This is important, especially in large-scale study courses. An example is a course, ERP systems, carried out within the master degree study program on Informatics and Technologies of Communication, aimed at introducing and deepening the knowledge of ERP solutions for IT students.

Enterprise resource planning (ERP) systems are comprehensive solutions integrating a wide range of business modules aiming to offer a uniform view of a business [4]. ERP systems emerged in order to offer effective IT support to organizations covering a variety of business domains [4,5]. Its widespread use began in the 1970s [4], during which time ERP systems were perceived as

an extension of manufacturing resource planning (MRPII) [5,6]. MRPII offered IT support for manufacturing, engineering, marketing, finance, and management. However, the full integration of modules was not achieved [6]. On the other hand, ERP systems provided complete business integration, while adding additional modules such as human resource planning, maintenance support, quality, and decision support applications [6–8]. ERP systems are presently offered as a commercial product by many vendors [4], e.g., SAP and Oracle, wherein SAP occupies the largest share of the ERP software market [9].

ERP systems integrate different information and business processes covering multiple business areas within an organization [10–12], while at the same time supporting configurability in order to meet the needs of users [4]. Due to the size, complexity, and diversity of functions, the introduction of ERP systems to students constitutes a challenging task. Teaching ERP systems is a demanding task for several reasons. In our case, the subject has a limited number of teaching hours when considering the breadth of the domain, especially when considering that the enrolled students do not have any previous knowledge or experiences with ERP solutions or with standard business processes such as planning, procurement, accounting, etc. If we also add the challenges related to teaching digital natives, then adding an innovative learning approach to existing learning approaches could have a positive impact on learning outcomes.

This paper is the result of a three-year study about the adoption of an experiential learning approach used for the introduction of ERP concepts. The aim was to facilitate the first steps in using a complex ERP solution, and to prepare students for further course assignments. We used a business simulation game, ERPsim [13], that is based on SAP ERP. The implemented variation uses a traditional SAP GUI. The game requires the active collaboration of students, and offers an opportunity for users to reflect on their experiences and then use the obtained information in the following rounds of the game.

To analyze the impact of the implemented learning approach, we designed research that would focus on two aspects. Since usability increases user satisfaction and has an important impact on the frequency of use, we researched the perceived usability of the used ERP solution, namely SAP ERP. The second aspect was the investigation of simulation game impact on ERP solution newcomers with regard to user experience and their perception of gained knowledge and skills in various domains. Therefore, the research was based on the following research questions:

- RQ1** What is the perceived usability of SAP ERP, when introduced via a simulation game, from the perspective of an ERP newcomer IT student?
- RQ2** Do students perceive that the use of a simulation game to introduce ERP concepts results in new knowledge and skills?
- RQ3** Do students believe that an introductory simulation game affects their intent in future course engagement?

The research relationships addressed within the study are graphically presented in Figure 1. The study explored the students' insight into using an experiential learning approach for the introduction of ERP concepts, focusing on their perception of obtained knowledge and skills and impact of the applied approach on their intent for future course engagement. We also looked into the perceived usability of SAP ERP, introduced with the experiential learning approach. The research questions were answered via the results of a three-year study, composed of a usability survey using an SUS questionnaire, and a survey composed of self-assessment statements evaluating students' acquired knowledge and experiences, as well as their satisfaction and intent for future engagement.

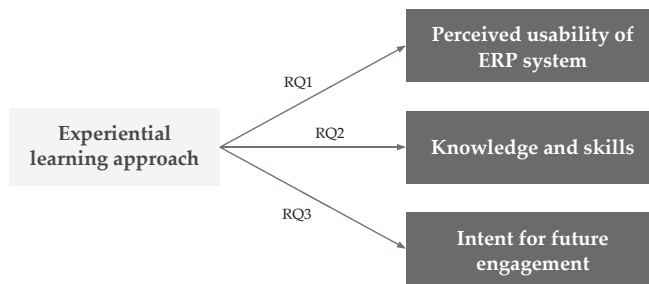


Figure 1. Research relationships.

The rest of the paper is organized as follows. Section 2 presents the theoretical background of experiential learning, presenting the meaning of a reflection phase. Further, the characteristics of digital natives are presented, and the concept of simulation games is introduced as an example of the learning-by-doing approach. Section 3 presents the related work and Section 4 presents a study methodology covering the context, participants, data analysis and data collection. Section 5 presents the results of the usability study, and the empirical results of the survey presenting students' feedback together with a discussion. Finally, the article ends with the limitations, conclusion and future work.

2. Experiential Learning Approaches and Digital Natives

Experiential learning theory defines learning as the “process whereby knowledge is created through the transformation of experience” [14]. Four abilities are needed for effective experiential learning: (1) concrete experiences; (2) reflective observation; (3) abstract conceptualization; and (4) active experimentation [14]. These abilities are joined into two dimensions, the first beginning with concrete experiencing and ending with abstract conceptualization, and the second one going from active experimentation to reflective observation [14]. This represents an idealized learning cycle with learners involved in the recursive process between experiencing, reflecting, thinking and acting, while responding to different learning situations [15]. To achieve the best possible learning outcomes, it is crucial that experiences are upgraded with participants' reflections [1,16]. Therefore, a reflecting phase represents an important part of experiential learning. Reflective practice was already highlighted by Schön [2], who described it as “a dialogue between thinking and doing, via which the learner becomes more skilled” [17], and interpreted by Osterman and Kottkamp [1] as a “means by which practitioners can develop a greater level of self-awareness about the nature and impact of their performance”. When reflecting, information can be gathered from the analysis of personal experiences, or collected from other research and practice sources [1].

Learning approaches are also an important topic in the domain of higher education. At present, students are effectively digital natives. The name digital natives was proposed by Prensky [18], who described these individuals as “native speakers of the digital language, computers, video games, and the Internet”. Digital natives encountered the digital technology in the early stages of their lives [19], and, as a result, the current generation of students have brought about significant changes in the learning environment [20]. Digital natives can learn at high speeds, since they are used to receiving information quickly [18,20]. They are prone to networking and game-oriented learning [18] and expect a quick response. Gaming has had a particularly significant impact on their educational expectations and opens up the opportunity for collaboration and competition in a goal-oriented environment [21].

The mentioned characteristics of digital natives engendered the need for incorporating new learning approaches into the existing educational process. Various attempts at experiential and reflective learning can be detected in higher education [17,22,23], wherein one of the variations of experiential learning are simulation games [23]. A subset of simulation games are also business simulation games, which started to be developed back in 1998 [24]. One of the representatives

is the ERPsim simulation game [13], designed as a learning-by-doing approach for teaching ERP concepts [25]. Students have to run their own business using an SAP ERP solution to develop an understanding about ERP concepts, to experience the integration of modules within ERP solutions and their benefits for the company, and, finally, to develop technical skills for using the selected ERP system [25]. The ERPsim simulation game [13] is available in nine different versions, where each game can be played in a different number of rounds. Each round consists of several steps. The debriefing step encourages students to reflect on gathered experiences and information from each round, culminating in the learning cycle defined by Kolb [14]. In the reflection phase, the participants review and reflect on obtained concrete experiences, which help them to draw a conclusion and act based on the information gathered from the previous round [23].

3. Related Work

Ruhi and Ghatrenabi [26], Ruhi [27] presented a review of ERP programs and teaching practices, among which, ERP simulations can be frequently found. They also proposed a conceptual template for integrating theoretical and applied teaching approaches that can be used within ERP business school curriculum design [26,27]. Another teaching concept was presented by Jaeger et al. [28], which was also designed for business students. Schwade and Schubert [29] presented the use of The ERP Challenge, covering simulation experiences with the ERP system Microsoft Dynamics NAV. The teaching approach was used throughout the semester and the evaluation was done by students from the study programs Information Management, Information Systems, Management and Psychology and Management and Economy. The survey shows encouraging results.

To achieve the best possible learning outcome, it is crucial that the implemented learning approaches are accepted by the participants. Darban et al. [30] examined the construct of a perceived knowledge update within the context of an ERP simulation game. They confirmed that team collaboration effectiveness positively affects individual effort and knowledge update, which leads to an increased intention to learn [30]. Another aspect was researched by Darban and Polites [31] to highlight the students' learning patterns. Their research model looked into the willingness to learn through perceived radicalness, which has a positive impact on students' willingness to learn [31]. Chauhan and Jaiswal [32] researched the behavioral intention of using ERP software training. The research partially confirms the UTAUT model in the context of ERP system training [32]. In studies by Darban et al. [30] and Darban and Polites [31], participants were undergraduate students in an introductory level IS course and undergraduate students enrolled in an Introduction to Enterprise System class, respectively. Chauhan and Jaiswal [32] conducted a study in a business school environment. On the other hand, different studies investigate students' attitudes and obtained abilities while using the ERPsim simulation game. For example, Seethamraju [33] revealed a significant impact of the simulation game on students' abilities, on the improvement of process orientation, acquisition of integrative skills and the game's positive contributions to deep learning. The study is based on experiences gathered through the whole semester in a business school, however a small percent of students were IT-oriented students [33]. Cronan et al. [34] measured the participants' experiences with simulation, learning ERP and their attitude. As the results indicate, business students evaluated the learning experience as positive [34]. In addition, the increase of students' attitudes towards SAP and ERP knowledge was confirmed by Hwang and Cruthirds [35], who took into account business oriented students. Cronan et al. [36] compared the learning outcomes in the domain of the ERP business simulation game obtained by objective measures with the self-evaluated perception of learning. As the results indicate, there is a significant correlation between self-assessed knowledge and the objective measures Cronan et al. [36], thus justifying the use of self-evaluation techniques when assessing the effectiveness of simulation game learning approaches.

However, despite the variety of available research, studies were not detected evaluating the impact of a business simulation game on the perceived usability of an SAP ERP solution. In addition,

studies using a simulation game only as an introduction and a supplement to already available teaching approaches in ERP system courses were not detected.

Monk and Lycett [23] concluded that it is desirable to have the basic understanding of the core business concepts before learning business processes, wherein understanding could be gained and accelerated via hands-on experience with ERP systems. This proved to be particularly significant when teaching ERP systems to IT-related students. Therefore, our research focused on facilitating the first steps of using the complex ERP solution and to efficiently prepare students for further course assignments. In comparison to related work, we used a simulation game approach only as an introduction to the ERP system course, wherein the continuation of the course was done using traditional learning approaches. In addition, our population was IT master's degree students, with high IT literacy, which was not the case with related studies. In the small portion of studies where IT students were used as a sample, they were undergraduate students and usually mixed with business students. Within the study, we measured both for future use and satisfaction, important factors, perceived usability and obtained knowledge and skills together with students' intent for future course engagement. If students perceive the usability of an ERP system as high, this can significantly improve the frequency of use of the evaluated system. On the other hand, the obtained knowledge and skills can significantly improve future performance and student satisfaction.

4. Methodology

4.1. Introducing ERP Concepts Using a Simulation Game Approach

To overcome the difficulties of introducing the ERP concepts to newcomers, the simulation game approach was used as an introduction of the ERP systems course carried out for a master's degree program in an IT-related field. The outline of the ERP system course is presented in Figure 2. The course started with an introductory part, where the experiential learning approach was applied in order to ease the continuation of the course. After the implementation of the simulation game, the course continues with the use of traditional learning approaches, lectures and lab work, and ends with the examination of obtained knowledge.

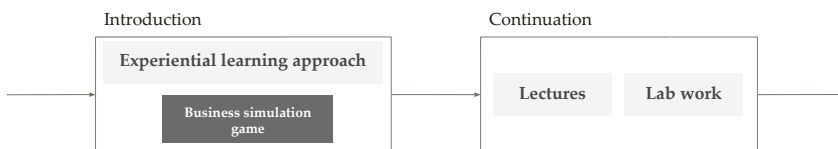


Figure 2. Outline of the ERP systems course.

Since the goal of the ERP systems course is to acquaint IT students with ERP solutions and not to focus on specific business-oriented knowledge, we decided to use the ERPsim Distribution Game as an introductory game. The Distribution Game is the basic ERPsim game, simulating a bottled water distribution company situated in the German market, selling six products in three different regions [37]. Students formed into teams of three or four, wherein the independently divided business roles covered the different business functions and execution of the corresponding transactions using a traditional SAP GUI. As recommended by Léger et al. [37], the business simulation game was played in three successive rounds, where each round simulates 20 days. In the first round, the participants started with the sales process, covering marketing and pricing. The second and third rounds added transactions related to the procurement and planning processes, allowing participants to forecast sales, and perform purchasing transactions together with material requirements planning (MRP). The game outline, together with available transactions within SAP ERP is presented in Figure 3.

Change Price: <i>Maintain Price List (VK32)</i> Marketing Expense: <i>Marketing Expense Planning (ZADS)</i> Stock levels: <i>Inventory report (ZMB52)</i> Financial Statement: <i>Financial Statements (F.01)</i> Sales and Market Sata: <i>Sales order report (ZVA05)</i> <i>Summary sales report (ZVC2)</i> <i>Price Market report (ZMARKET)</i>	Sales	Round 1	Procurement and planning	Round 2 and 3
Purchasing: <i>Automatic Generation of Purchase Orders (ME59N)</i> Purchase Orders: <i>Purchase order tracking (ZME2N)</i> Calculate Requirements: <i>MRP Run (MD01)</i> Forecast Sales: <i>Create Planned Independent Requirements (MD01)</i>				

Figure 3. Outline of the used simulation game, presenting rounds with the available SAP transactions.

To achieve the best possible outcomes, it is advisable to implement the business simulation game according to the recommended steps provided by Léger [25] and Léger et al. [37]. Each round of the Distribution Game consists of several sequential activities, as presented in Figure 4. Brief instructions at the beginning, which allow newcomers to get to know the basics of the upcoming tasks, are followed by concrete experiences, and active experimentation based on abstract conceptualization. While playing the business simulation game, participants gather the information and experiences by simulating concrete scenarios. The simulation game automates some repetitive tasks, allowing participants to focus on the creative part and business decisions, together with the associated functionality within an ERP solution. After 20 simulated days, where one day is represented by one minute, the game is finished and the business results are disclosed to students. The next activity is a debriefing, where the students rethink and reflect upon their decisions based on their experiences and considering the achieved business results. The debriefing is done in two steps, first, within each group, and, secondly, between participating groups, encouraging communication in order to share the obtained thoughts. The last activity in each round is designing the strategy for the next round, based on previously made reflections. With this, the participants are prepared for the next round, starting again at the beginning of the cycle.

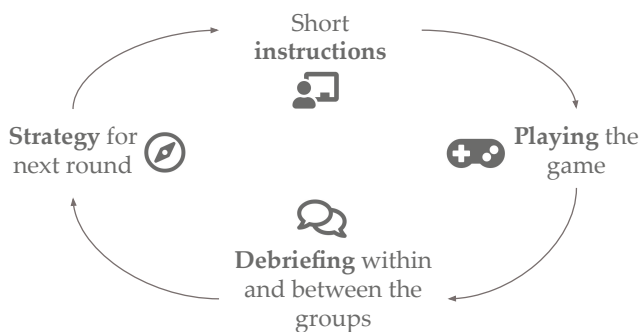


Figure 4. Activities within each round of the business simulation game.

The implementation of the experiential learning approach, namely, the business simulation game ERPsim [13], within the EPR system course, started in 2017, and is now running in the third cohort of students. The format and implementation of introductory lectures evolved based on the gathered feedback. In the first year, a three-day introductory workshop was carried out. The students' collected feedback was presented by Heričko et al. [38], and the impact of the introductory workshop on the students' perception on SAP usability was presented by Rajšp et al. [39]. In 2018 and 2019, the introductory simulation game was shortened to one day, and, in 2019, the experiential approach was extended throughout the whole course by using additional ERPsim simulation games, namely the Logistics Game and the Manufacturing Game.

4.2. Participants

The paper presents the results of the three-year research. The data were gathered from 53 master's degree students, wherein participation by years is as follows: in 2017, 18 students; in 2018, 14 students; and, in 2019, 21 students. Details about the participating students are presented in Table 1.

Table 1. Profile of the study participants.

Characteristic	
Number of the participants	53
Age of the participants	21–23
Study program	Informatics and Technologies of Communication
Study program degree	Master's degree
Year of study	1st
Experiences with ERP solutions	Newcomers
Knowledge about ERP solutions	None

All participants were master's degree students of Informatics and Technologies of Communication, in their first year of the study program. All participants had a high level of IT literacy. Their age varied between 21 and 23 and none of the participants had previous experience with, or knowledge of, ERP solutions.

4.3. Data Collection and Data Analysis

To collect data from the students, we used a survey. Surveys are suitable for gathering self-reported beliefs and opinions from participants [40]. According to the research questions, a survey questionnaire was developed. The development of a research instrument followed the good practices proposed by Neuman [40], and the final questionnaire is presented in Appendix A. The questionnaire consisted of three major parts:

- Part A—Personal data contained relevant information about the participants. The personal data were collected via open-ended questions about their name and surname, age, study program, study program degree and year of study and close-ended questions allowing the participants to self-assess their experiences with ERP solutions and their knowledge, both with the use of a five-point Likert scale.
- Part B—Perceived usability of SAP ERP measured students' perceived usability of the ERP system. This is done with the use of a SUS questionnaire with a five-point Likert scale.
- Part C—Opinion and feedback about simulation game approach collected students' personal opinion and self-evaluation regarding different concepts of the experiential learning approach. This part consisted of 13 statements with a five-point Likert scale, measuring the concepts of appropriateness of the approach, obtained knowledge and skills, motivation and competitiveness, debriefing actions, communication with the team and future engagement and commitment.

The data for every cohort were collected immediately after the business simulation game to gather actual and unaffected opinions from the students. The questionnaire was in an electronic form, using

an online survey tool. The analysis of gathered data was made based with exported answers using associated analysis techniques. Part A of the questionnaire was analyzed descriptively and for two questions the frequency of answers and an average value was presented. Part B of the questionnaire was analyzed based on SUS scoring rules provided by Brooke [41]. Part C of the questionnaire was analyzed using frequency analysis and average value. The analysis was done for each year separately.

5. Results

5.1. Impact on the Perceived Usability of the ERP System

Perceived usability is important for user satisfaction, and has a significant impact on the frequency of use. Many definitions of usability can be found, among others, the definition by Nielsen [42] and the definition provided in ISO 9241-11:2018 [43]. The ISO 9241-11:2018 [43] defines usability as “the extent to which a system, product or service can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use”. On the other hand, Nielsen [42] defined usability with the use of five attributes: learnability, efficiency, memorability, errors, and satisfaction.

Usability can be evaluated using a variety of approaches. An example is the System Usability Scale (SUS) [41], a widely-used questionnaire that is simple to implement and analyse. It was designed to gather the users’ subjective usability evaluation [41]. The SUS questionnaire consists of ten statements, evaluated with a Likert scale, which have to be evaluated immediately after the use of the system, even before the debriefings or discussion [41]. As shown in the surveys [44,45], SUS is the most commonly used standard questionnaire for measuring the usability of the serious game approaches.

Since SAP ERP is a complex solution combining multiple modules and having the user interface loaded with data and input fields, its use for newcomers can be a demanding task. When playing the ERPsim business simulation game, students worked with a real-life traditional SAP GUI interface. The aim of using the simulation game approach for the introduction of ERP concepts was to raise the perceived usability of SAP ERP by changing the students’ focus from the user interface to the game. Therefore, by using the SUS questionnaire, we answered the research question RQ1: “What is the perceived usability of SAP ERP, when introduced via a simulation game, from the perspective of an ERP newcomer IT student?”

The three-year SUS score is presented in Figure 5. The average SUS value in 2017 was 59.17; in 2018, it was 61.61; and, in 2019, it was 61.43. All three cohorts of students, altogether 53 participants, assessed the usability of SAP ERP with SUS scores around 60 out of 100. As presented in the box-plot in Figure 5, the minimal SUS value was 40.00 in 2017, and 52.50 in both 2018 and 2019. On the other hand, the maximum SUS value was 75.00 in 2017 and 2018, and 77.50 in 2019.

Although the SUS score ranging from 0 to 100 offers transparent information, the understanding of the results can be increased if an adjective is added to the score. An example of an adjective rating was proposed by Bangor et al. [46]. Based on the empirical research, they proposed the use of the following adjectives: worst imaginable (mean SUS score, 12.5; standard deviation, 13.1), awful (mean SUS score, 20.3; standard deviation, 11.3), poor (mean SUS score, 35.7; standard deviation, 12.6), OK (mean SUS score, 50.9; standard deviation, 13.8), good (mean SUS score, 71.4; standard deviation, 11.6), excellent (mean SUS score, 85.5; standard deviation, 10.4), and best imaginable (mean SUS score, 90.9; standard deviation, 13.4). Based on the gathered SUS scores, as presented in Figure 5, the students evaluated the usability of the SAP ERP as OK, with scores of 59.17, 61.61 and 61.43, respectively.

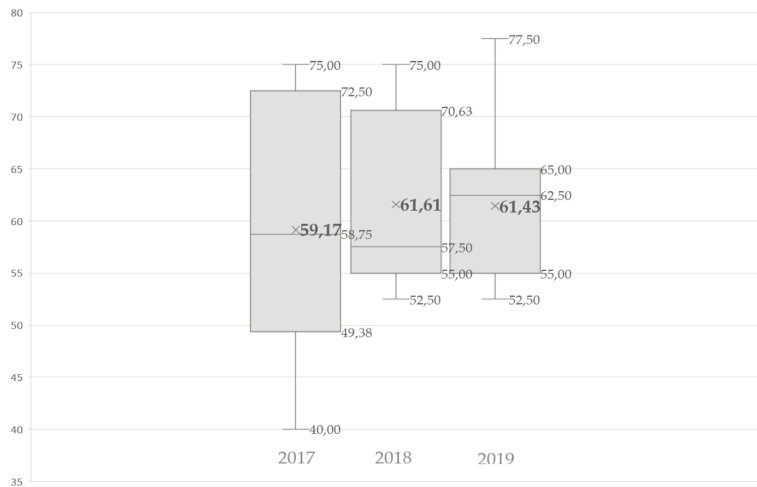


Figure 5. System Usability Scale (SUS) score of SAP ERP for three generations of students.

Since related works allowing a comparison were not detected, a comparison of results was made with a SAP usability study done in a different environment and domain. Danda [47] carried out usability research on 103 existing SAP ERP users, using the SAP Fiori user interface. As the results show, the average SUS score was 34.47 [47]. The results gathered within our research deviate significantly in a positive way, despite the fact that the interface used was a traditional SAP GUI. Participating students assessed the usability of SAP ERP as OK, while participants in the study by Danda [47] evaluated the usability of SAP ERP as poor. Due to the perceived differences, we can conclude that the introduction of ERP concepts using a simulation game results in a positive impact on the perceived usability of the SAP ERP system.

5.2. An Empirical Survey of Students' Feedback on Using Simulation Game Approaches

In addition to perceived usability, we also gathered students' opinions about the selected experiential learning approach, focusing on acquisitions. Table 2 summarizes the results of a three-year survey, providing the answer to research questions RQ2 ("Do students perceive that the use of a simulation game to introduce ERP concepts results in new knowledge and skills?") and RQ3 ("Do students believe that an introductory simulation game affect their intent in future course engagement?").

The questionnaire gathered students' opinions and experiences after playing the business simulation game. Students evaluated the given statements using a five-point Likert scale. The answer 5 stands for strongly agree, 4 for agree, 3 for neither agree nor disagree, 2 for disagree and 1 for strongly disagree. The empirical analysis of the results is presented in Table 2. The results are displayed by year, showing an average value for each year, followed by a detailed analysis presenting the frequency of each response in percentages.

As the results indicate, students have a positive opinion about the use of a simulation game approach for introducing the basic functionalities of SAP ERP, and also for learning the basic navigation and use of controls in SAP ERP. All three cohorts evaluated the mentioned aspect with average values from 4.4 to 4.6 on a scale of 1 to 5. The majority of students confirmed that the use of a simulation game contributed to the development of the technical skills necessary for using SAP ERP. In 2018 and 2019, all of the students agreed or strongly agreed with the statement, while, in 2017, the percentage of agreement was 83.34%.

Table 2. Empirical results of three year students' survey.

	Year	Average	5	4	3	2	1
Appropriateness of the approach							
simulation game is an appropriate approach for introducing the basic functionalities of SAP ERP.	2017	4.6	61.11%	38.89%	0.00%	0.00%	0.00%
	2018	4.6	64.29%	35.71%	0.00%	0.00%	0.00%
	2019	4.4	47.62%	47.62%	4.76%	0.00%	0.00%
A simulation game is appropriate for learning basic navigation and use of controls in SAP ERP.	2017	4.6	55.56%	44.44%	0.00%	0.00%	0.00%
	2018	4.5	57.14%	35.71%	7.14%	0.00%	0.00%
	2019	4.4	47.62%	42.86%	9.52%	0.00%	0.00%
Obtained knowledge and skills							
A simulation game contributes to the development of the technical skills necessary when using SAP ERP.	2017	4.1	27.78%	55.56%	11.11%	5.56%	0.00%
	2018	4.4	42.86%	57.14%	0.00%	0.00%	0.00%
	2019	4.2	23.81%	76.19%	0.00%	0.00%	0.00%
A simulation game demonstrates the need and benefits of the integration of different ERP modules.	2017	4.1	27.78%	55.56%	11.11%	5.56%	0.00%
	2018	4.5	50.00%	50.00%	0.00%	0.00%	0.00%
	2019	4.2	38.10%	42.86%	19.05%	0.00%	0.00%
New knowledge and skills were obtained about using SAP ERP.	2017	4.5	50.00%	50.00%	0.00%	0.00%	0.00%
	2018	4.7	71.43%	28.57%	0.00%	0.00%	0.00%
	2019	4.3	33.33%	66.67%	0.00%	0.00%	0.00%
New knowledge and skills were obtained about collaboration and coordination between roles.	2017	4.3	33.33%	66.67%	0.00%	0.00%	0.00%
	2018	4.7	71.43%	28.57%	0.00%	0.00%	0.00%
	2019	4.4	47.62%	47.62%	4.76%	0.00%	0.00%
Motivation and competitiveness							
The goal was not to win, but to obtain new knowledge.	2017	3.4	5.56%	55.56%	16.67%	22.22%	0.00%
	2018	4.1	42.86%	28.57%	21.43%	7.14%	0.00%
	2019	3.7	33.33%	33.33%	14.29%	9.52%	9.52%
The main motivation was getting the best possible result in comparison to other teams.	2017	4.6	55.56%	44.44%	0.00%	0.00%	0.00%
	2018	4.4	57.14%	28.57%	7.14%	7.14%	0.00%
	2019	4.1	42.86%	33.33%	19.05%	4.76%	0.00%
Debriefing actions							
The team followed a certain strategy.	2017	3.2	5.56%	33.33%	44.44%	11.11%	5.56%
	2018	4.0	28.57%	50.00%	14.29%	7.14%	0.00%
	2019	3.7	14.29%	47.62%	28.57%	9.52%	0.00%
The teams shared their experiences after each round.	2017	3.4	5.56%	50.00%	27.78%	16.67%	0.00%
	2018	3.0	14.29%	14.29%	42.86%	14.29%	14.29%
	2019	3.9	28.57%	47.62%	14.29%	4.76%	4.76%
The exchanged information after the rounds was useful, and contributed to a better result in the next round.	2017	3.6	16.67%	50.00%	16.67%	11.11%	5.56%
	2018	3.1	21.43%	7.14%	35.71%	28.57%	7.14%
	2019	4.0	33.33%	38.10%	19.05%	9.52%	0.00%
Communication within the team							
Communication between team members was good.	2017	4.3	38.89%	55.56%	5.56%	0.00%	0.00%
	2018	4.9	92.86%	7.14%	0.00%	0.00%	0.00%
	2019	4.7	71.43%	28.57%	0.00%	0.00%	0.00%
Future engagement and commitment							
The attendance of lectures will increase due to the simulation game.	2017	3.2	16.67%	22.22%	27.78%	27.78%	5.56%
	2018	3.9	28.57%	42.86%	21.43%	7.14%	0.00%
	2019	4.0	28.57%	38.10%	33.33%	0.00%	0.00%

When asked about the newly obtained knowledge and skills about SAP ERP use and collaboration and coordination between different roles, students in 2017 evaluated the statements with 4.5 and 4.3 out of 5, while in 2018 they evaluated both statements with an average of 4.7, and in 2019 with an average of 4.3 and 4.4. The statements looked into students’ perceptions of obtained knowledge, which contributed to answering the research question RQ2. The results are summarized and presented visually in Figure 6. All three groups, without disagreeing, confirmed that the use of a business simulation game resulted in anticipated knowledge and skills connected to collaboration and coordination between roles and for the use of SAP ERP. With regard to the findings provided by Cronan et al. [36] that there is a significant correlation between self-assessed knowledge and objective measures, the gathered results, due to the self-assessment type of questionnaires, seem to provide credible and valid results.

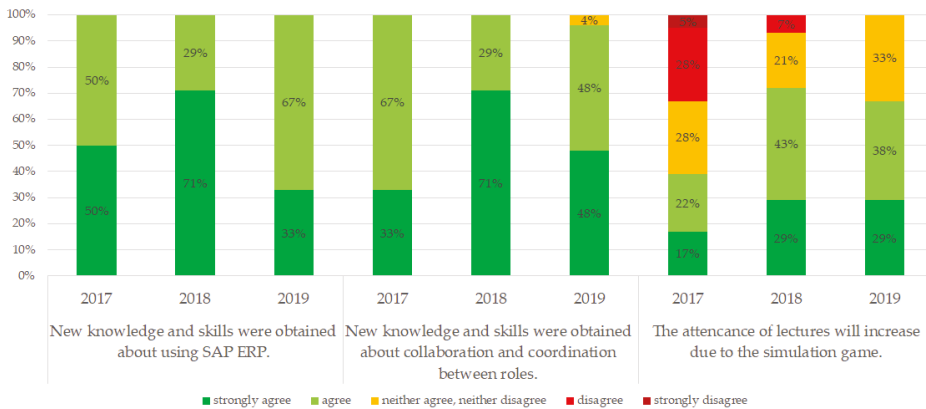


Figure 6. Evaluation of obtained knowledge and skills and students’ engagement.

Two of the statements in the survey evaluated the students’ competitiveness and motivation to win. As presented in Section 2, digital natives respond well to game-oriented learning [18], wherein competition in a goal-oriented environment suits their characteristics [21]. The results are presented in Table 2. The students from 2017, with an average value of 4.1, evaluated that their goal was to obtain new knowledge and not to win. In 2017 and 2019, the average values were lower, i.e., 3.4 and 3.7, reflecting the competitiveness of participating students. This was confirmed additionally within the statement measuring the motivation of getting the best possible results in comparison to other teams. The statement was assessed with an average value of 4.6, 4.4 and 4.1.

The debriefing phase in each round, aimed at reflecting the gathered experiences and, based on this, reforming the strategies used in a business simulation game. As the results demonstrated, in 2017, only 38.89% of participants followed a certain strategy during the game. In contrast, in 2018 and 2019, the percentage increased to 78.57% and 61.91%. In 2017, 55.56% of students thought that the teams were willing to share gathered experiences with others, while the number in 2018 is significantly lower, namely 28.58%. However, the average result in 2019 was even higher than in 2017, 76.19%. The mentioned results coincide with the results connected to the usefulness of the exchanged information. The result was the lowest in 2018, with an average value of 3.1, and the highest in 2019, with an average value of 4.0.

Regarding communication within the teams, the results suggest that the communication was good, with average values of 4.3, 4.9 and 4.7. This could be expanded upon with the findings presented by Hwang [48] that teamwork, where one of the dimensions is also interaction with teammates, has an impact on team satisfaction as well as on team effectiveness. The findings are based on the survey results, in cases where students were using the ERPsim business simulation game. Hwang [48] concluded that the used business simulation game is also suitable for teaching and learning teamwork.

The motivation for the use of new learning approaches could also be gathered from the statement where students evaluated their future intent for attending lectures due to the use of the simulation game. The statement contributed to answering the research question RQ3. The results are visualized in Figure 6. The average number increased through the years—3.2 in 2017, 3.9 in 2018, and 4.0 in 2019—showing the positive affect of using the simulation game in the ERP systems course. Since it is possible to detect a significant drop of attendance in lectures in recent years, the results show that the experiential learning approaches incorporated into traditional learning strategies could also increase the students' level of commitment and engagement.

5.3. Discussion

As the results indicate, the introduction of ERP concepts using a business simulation game was very well accepted by the students. They confirmed the appropriateness of the used experiential learning approach and confirmed that the obtained knowledge and skills were needed for the efficient use of ERP systems. More specifically, they confirmed that the gathered technical skills and knowledge needed for using the SAP ERP, and also the skills about collaboration and coordination between different roles in the organizations and benefits of the integration of different ERP modules. The results also provide insight into the other aspects that are part of experiential learning approaches, such as motivation, competitiveness, and actions within the debriefing phase together with communication between and within teams, whereby the results confirm that digital natives respond well to competitive environments. Another aspect that has a significant impact on satisfaction and frequency of use is the perceived usability of the software that was used. In the study, we calculated the SUS score based on the students' answers. The score displays the perceived usability of SAP ERP as seen from the perspective of an IT student and ERP newcomer. If the perceived usability would have been low, this would have a negative impact on frequency and satisfaction of use. However, based on the results, the perceived usability is OK, since, with the use of the business simulation game, the focus is transferred from the complex user interface to the simulation game. The student thereby unconsciously conquers the basic ERP concepts.

The main expectation of using a simulation game approach as an introduction to the course was to increase the attendance of the lectures. Trends show low motivation among enrolled students, a high dropout rate and low engagement. With the use of an approach that requires an active amount of student collaboration, the potential to resolve the above-mentioned challenges arises. Based on the results, the intent to attend lectures is higher every year. The students' positive attitude is also confirmed with the results of the official university students' survey. The results are presented in Table 3.

Table 3. Results of official students' survey.

	Before	After
Overall course rating	1.61	1.88
Cooperation with students	1.73	1.93
Learning outcome	1.55	1.87

The scale of the survey was a five-point scale, ranging from -2 to 2 , where -2 stands for very bad and 2 stands for very good. After the implementation of the business simulation game approach, the overall ERP systems course rating increased from 1.61 to 1.88 on a scale from -2 to 2 . Additionally, 93.3% of students evaluated the cooperation of teachers with students as a 2 , and 86.7% graded the learning outcome as a 2 , again on the five-point scale from -2 to 2 .

To ensure student engagement in study courses it is crucial that study materials and learning approaches are adapted to today's generations. Since the fourth goal of the United Nations Sustainable Development Goals is quality education [49], new and adjusted learning approaches are required when teaching digital natives. Therefore, the implemented study contributes to the theory and practice

of experiential learning in multiple areas. First, with the applied course outline, which was not used in any of the related studies. The outline predicts the use of experiential learning approach as the introduction of ERP concepts, before continuing with traditional learning approaches. This could increase the students' motivation and at the same time enough knowledge and skills are obtained to overcome the initial challenges connected to complex study materials. Therefore, the presented approach could be included in any existing study course without completely replacing the existing teaching methods and changing the study materials. Finally, an important contribution is also the measured usability of SAP ERP system as seen from the ERP newcomer IT students' perspective.

6. Limitations

The results of the implemented study can be affected by different factors. The limitations and potential threats to validity are subsequently presented. The results are biased due to the participants' subjectivity, since the questionnaires were based on self-assessment statements. The study presents a student's insights into the used experiential learning approach. The study was made in an academic environment, wherein the approach was used for the classroom introduction of ERP systems to ERP newcomers. The study was carried out in an IT-related study program; consequently, the perceived usability of SAP ERP may differ if evaluated by students with different backgrounds and previous knowledge. The study was done using an SAP ERP solution and the traditional SAP GUI, as the used business simulation game runs on SAP ERP. Therefore, the results cannot be generalized to all ERP solutions.

7. Conclusions

This paper summarizes the results of three years of research aimed at evaluating the appropriateness of the experiential learning approach to ease the use of a complex ERP system for newcomers. The learning approach was implemented in an academic environment with master's degree students. A variation of the experiential learning approach, the ERPsim business simulation game, was incorporated into the ERP systems course in the master's degree of the IT-related study program. The simulation game was used at the beginning of the course for the introduction of basic ERP concepts. The game followed an outline recommending the implementation in sequential rounds, focusing on the reflection of gathered experiences and use of the collected information for planning future business strategies. At the end, a survey was performed, measuring the perceived usability of SAP ERP and students' self-assessment of obtained knowledge, skills, and their intent for future engagement and collaboration within the ERP systems course. The presented results show that this experiential learning approach was positively accepted by the students and provided the expected knowledge and skills needed for the easier continuation of future assignments. At the same time, students shifted their focus from complex study content to a simulation game and unconsciously grasped the fundamental use of a complex system user interface. As the results show, all three groups perceived the usability of SAP ERP as OK, with scores of 59.17, 61.61 and 61.43. Furthermore, the results of the survey indicate that, with the use of a simulation game approach, students acquired new knowledge and skills in the domain of using SAP ERP, and also in the domain of communication and collaboration. The answers show positive feedback towards a reflection phase and its usefulness and, finally, confirmed the increased intent for future attendance of course lectures.

Since the result of the implemented study spoke in favor of adopting the experiential learning approaches as an addition to traditional learning practices, research in this area will be continued. As for future work, we will investigate the acceptance and appropriateness of additional ERPsim games. With this, the suitability of other ERPsim games could also be assessed. In addition, a test allowing an objective assessment of obtained knowledge and skills, focusing on detailed domains, would need to be prepared. With this, self-assessed knowledge could be compared to knowledge measured with an objective method.

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Appendix A. Survey Questionnaire

Participants' questionnaire

A. Personal data

Name and surname: _____

Age: _____

Study program, study program degree and year of study: _____

Do you have any experiences with ERP solutions (1—No, I am a newcomer, 5—Yes, I am an experienced user)?

1 2 3 4 5

If you have experiences, with which ERP solutions? _____

How would you rate your knowledge about ERP solutions (1—I have no knowledge, 5—I am an expert)?

1 2 3 4 5

B. Perceived usability of SAP ERP

Please score the following statements while keeping in mind the SAP ERP system. To answer, choose the corresponding score from a 5-point Likert scale (5 (strongly agree), 1 (strongly disagree)).

I think that I would like to use this system frequently.	1	2	3	4	5
I found the system unnecessarily complex.	1	2	3	4	5
I thought the system was easy to use.	1	2	3	4	5
I think that I would need the support of a technical person to be able to use this system.	1	2	3	4	5
I found the various functions in this system were well integrated.	1	2	3	4	5
I thought there was too much inconsistency in this system.	1	2	3	4	5
I would imagine that most people would learn to use this system very quickly.	1	2	3	4	5
I found the system very cumbersome to use.	1	2	3	4	5
I felt very confident using the system.	1	2	3	4	5
I needed to learn a lot of things before I could get going with this system.	1	2	3	4	5

C. Opinion and feedback about simulation game approach

Please score the following statements expressing your opinion and providing feedback about the used experiential learning approach. To answer, choose the corresponding score from a 5-point Likert scale (5 (strongly agree), 1 (strongly disagree)).

A simulation game is an appropriate approach for introducing the basic functionalities of SAP ERP.	1	2	3	4	5
A simulation game is appropriate for learning basic navigation and use of controls in SAP ERP.	1	2	3	4	5
A simulation game contributes to the development of the technical skills necessary when using SAP ERP.	1	2	3	4	5
A simulation game demonstrates the need and benefits of the integration of different ERP modules.	1	2	3	4	5
New knowledge and skills were obtained about using SAP ERP.	1	2	3	4	5
New knowledge and skills were obtained about collaboration and coordination between roles.	1	2	3	4	5
The goal was not to win, but to obtain new knowledge.	1	2	3	4	5
The main motivation was getting the best possible result in comparison to other teams.	1	2	3	4	5
The team followed a certain strategy.	1	2	3	4	5
The teams shared their experiences after each round.	1	2	3	4	5
The exchanged information after the rounds was useful, and contributed to a better result in the next round.	1	2	3	4	5
Communication between team members was good.	1	2	3	4	5
The attendance of lectures will increase due to the simulation game.	1	2	3	4	5

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Article

Pre-Service Teachers' Reflections on Cooperative Learning: Instructional Approaches and Identity Construction

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Abstract: This paper focusses on university pre-service teachers developing cooperative physical challenges within reflective and cooperative learning frameworks. The pre-service teachers were involved in reflection-in-action and reflection-on-action and contemplated their professional identity in both reflective narratives and focus group discussions. The students' reflections were scored using two rubrics. The first elements scored from the pre-service teacher's reflective narratives included the focus of the reflection, awareness of previous beliefs, knowledge, and experiences, inquiring and focusing on possible actions through questions and hypotheses, and arguing for concrete learning objectives. The second rubric scored elements of the pre-service teachers' professional identity, including self-esteem, task perception, job motivation, and expectations about future jobs. The results from the instructional cooperative approaches based on the reflections on the in-practice at a primary school disclosed the differences between them, with the non-structured approach scoring higher than the structured one. The cooperative challenges, when embedded in the reflection process, profoundly helped pre-service teachers to identify aspects of their professional identity that would ensure an effective intake of sustainable competences.

Keywords: cooperative learning; reflective learning; higher education; instructional approaches; professional identity

1. Introduction

1.1. Students' Cooperative Learning and Sustainable Development

Providing future generations of professionals with the skills for sustainable development relies mainly on integrating approaches and strategies into Higher Education Institutions and their systems [1–6]. Education for sustainable development, when developed in Higher Education, should enhance students to understand how their professional activity interacts with society and the environment in order to identify possible challenges, risks, and impacts [2]. Therefore, Higher Education Institutions should transfer sustainability competences to the teaching profession by developing curricula competences in education for sustainability, linking sustainability to both student learning and in-practice teaching [2,5]. It entails promoting student interaction and fostering relationships in socialization and learning [7–9]. Education for Sustainable Development is directed towards promoting the development of critical thinking, strategic action, and interpersonal relationships as well as collaboration, personal involvement, and tolerance for ambiguity [1,3], in which students

accept uncertainty and acknowledge dilemmas [10]. It empowers students to change their way of thinking and to work towards a sustainable future [2,3]. How students understand what they know and how they are progressing as they develop their knowledge through reconsidering what they learn in practice [11] is a fundamental element of sustainable education.

Education for Sustainable Development concerns sustainable actions at all educational levels, favoring the development of competences that allow people to think about their actions [2,3]. Competences integrate knowledge, skills, values, and attitudes [10,12–14], and a competence-based education is a type of education that focuses on the implementation, development, and assessment of competences [13,15–17]. Both cooperative and reflective learning are instructional practices that can activate and promote sustainable-oriented competences. For example, reflecting on beliefs, actions, and goals are the foundations of critical thinking and analysis. Sustainable-oriented competences also promote developing ideas and applying strategies, planning and executing projects, reflecting on risks, taking responsibility for motivating others; all of which form the basic principles of strategic action [13,18].

Cooperative learning is an educational methodology based on small (usually heterogeneous) groups of students working together. In cooperative learning, students join forces and share ideas and resources to learn something themselves and encourage other team members to learn as well. Cooperative learning activates peer-to-peer learning, which is defined as building both sustainable knowledge and skills through interaction. The five variables that mediate the effectiveness of cooperative learning are positive interdependence, individual accountability, promotive interaction, the appropriate use of social skills, and group processing [8]. Cooperative learning relies mainly on the interdependence of the students among each other, with the roles of the team members being clearly mapped out, although they can be negotiated. The students submit the complete group task at the end of the lesson and during the final group processing. In contrast, in collaborative learning, if this method is properly directed by the teacher, the students themselves can learn to manage the task with no further instruction. Most important, in collaborative learning, each student is responsible for their own individual work, separately. In general, authors see collaborative learning as a broader, more general concept covering multiple approaches on peer collaboration, among which, for example, is cooperative learning [14,16,18,19].

Cooperative physical challenges are cooperative learning activities that have a clearly defined objective and are posed as a collective (team) challenge in which the group, in the first stage, must resolve a specific problem by using multiple solutions and, in the second stage, reflect on the whole process. To do so, each team needs not only to agree on their actions as a group but, more importantly, to consider and value the individual characteristics of each and every one of its members to resolve the problem posed. While a specific response to completing the challenge may be valid for one team, it may not be for another. Cooperative physical challenges maximize the acquisition of competences through individual cooperation in teamwork, the intrapersonal construction of professional identity, and the definition of strategic decision actions [8,19].

Cooperation is the reciprocal relationship between people or groups, which are characterized by being heterogeneous, aimed at achieving a goal through a common effort [19]. Cooperation is also a principle that can guarantee a more creative and sound teaching process, provided the teacher and the student are involved in the construction of knowledge. Cooperative learning is an educational strategy in which students work together in groups to achieve a common goal that is characterized by a structure that promotes positive interdependence between the group members [8]. Students gain both academically and socially when they have opportunities to interact with others to accomplish shared goals [8,20–22]. In the process, students learn to communicate effectively by explaining the experiences in which they have been involved, and the language they learn to use to explain the experiences, in turn, helps them to construct new ways of thinking [23]. In addition, if students are encouraged to participate in group discussions, they demonstrate a more sophisticated level of discourse and intellectually valuable contributions [23,24].

The basic characteristics and conditions for cooperative learning were defined by Johnson and Johnson [8]. First is positive interdependence. This occurs when the learning of the different members of the group depends on the actions carried out by all the members of the group. There is positive interdependence when the team members can achieve a goal, but only when the other team members also reach it [19]. Second is individual accountability. This refers to the members of a group having to work together (face to face) at some point during the process. In doing so, not only are students encouraged to strive for more committed relationships within the group, but they also improve their adaptation and social competences. To do this, all the team members' contributions must be made possible and necessary and, thus, render learning visible [25]. Third, is promotive interaction. The members of the group cannot be successful based solely on the success of others. Therefore, each student is responsible for a part of the work, and the success of the other members depends on the participation of all the members. Fourth is the appropriate use of social skills in a small group. Students have to learn some abilities in order to achieve common goals, such as getting to know the other members in the group, communicating effectively, supporting each other, and constructively resolving conflicts. Fifth is group processing. For a cooperative group to function properly, the students need to reflect on how it works. Thus, in group processing, the members of the group discuss the achievement of the objectives, the effectiveness of their work methodology, and the relationships between themselves. This allows them to analyze what went well and what did not, strengthen their bonds, and improve their work.

1.2. Students' Identity Construction and Sustainable Education

Shaping pre-service teachers' professional identities is at the base of sustainable education. Professional identity is promoted in higher education through the delivery of pedagogical approaches and strategies by teachers [3] and through the understanding that the approaches must guide students to examine and mediate themselves in relation to context, for effective decision-making and action [3,26] and for acquisition of sustainability competences for sustainable development to perform personal actions as well as to bring about changes in society [2]. For pre-service teachers, reflection calls for critical evaluation of their teaching practice in schools, which may refine their self-understanding as future teachers [20]. Reflection encompasses pre-existing beliefs and examines students' practices for further actions and improvement [27]. Pre-service teachers can construct their identities in practice (in-action), discourse, and activity in the schools when developing instructional practices, actively. But, their emerging identities as reflective practitioners and adaptive experts should further be enriched and extended through reflective thinking and engagements [20]. Therefore, reflection after the action (on-action) is needed to gradually broaden and deepen a primarily descriptive reflective narrative [9–12].

Frameworks for reflective learning and reflective practice, guide personal and professional mediation. For instance, there are reflective approaches and methodologies in which individuals manage competing influences and deliberate about action [7,28]. Individual professionalism or scholarship of teaching is characterized by commitment and vulnerability, which may determine the degree to which pre-service teachers reflect and self-understand as future teachers [29]. The components of professional self-understanding that fuel teachers' identity construction are self-image, self-esteem, commitment, task perception, job motivation, and future perspectives. For pre-service teachers, however, the dimensions are reduced to self-esteem, task perception, job motivation, and future perspectives [29]. Self-esteem or the evaluative component of self-understanding may refer to students' appreciation of their job performance. Task perception encompasses students' ideas on what tasks and duties are required to do a good job. It deals with students' responsibilities in order to induce justice in learning outcomes. Job motivation refers to motives that turn students into professionals, and future perspectives reveal the students' expectations about their future in teaching.

This study proposes then, applying the rationality of cooperation and identity construction through structured, semi-structured, and non-structured instructional cooperative physical challenges that progressively and effectively favor the essential components of cooperative learning and the

intrapersonal construction of professional identity for pre-service physical education teachers. The study also proposes applying the logic of reflection-on-practice through the process of constructing reflective narratives on the results of implementing instructional approaches in the schools where the pre-service teachers had their teaching practice [29,30]. We formulate the characteristics that define the structured, semi-structured, and non-structured cooperative physical challenge approaches and the dimensions for students' reflections concerning both cooperative approaches and identity construction. Based on this multi-approach formulation, we construct three hypotheses:

H1: *Activating cooperative learning based on no-to-structured instructional approaches produces professional identity.*

H2: *Pre-service teachers can construct and transform their professional identities through reflective practice.*

H3: *Pre-service teachers, when engaged in individual and community reflection, may activate interpretation and critical competence evaluation of their teaching practice at schools.*

We consider community reflection to be the reflection resulting from dialogues between pre-service teachers or dialogues between pre-service teachers and students at the schools [20].

Although some effort has been made to understand the potential of designing curricula based on the delivery of sustainable-oriented competences, little is known about pre-service teachers' perceptions of the joint delivery of pedagogical approaches and sustainable competences, and the impact that such delivery has on their own construction of professional identity. Therefore, this manuscript aims to provide knowledge on the strategy of connecting cooperative and reflective learning through different pedagogical approaches and the pre-service teachers' resulting transformation in terms of construction of professional identity. The goals of the present study are (1) identify the ways in which pre-service teachers represented their professional learning through reflection on instructional teaching approaches, (2) ascertain whether and how pre-service teachers were reflective in their written narratives of on-school practices experiences, and (3) identify in which ways reflection by pre-service teachers fostered personal critical professional competence.

2. Methods

2.1. Context

The experiment was carried out with a group of fourth-year students taking the four-year bachelor's degree in Primary School Teacher Education at the University of Girona. This experimental study was carried out during a 75-h module in the Department of Specific Didactics at the University of Girona, Spain.

2.2. Participants

The study comprised two sets of students. The first set was made up of sixty-three fourth-year pre-service primary school teachers taking a bachelor's degree in Primary School Education (specializing in physical education) at the University of Girona. For the purposes of this study, the participants were divided into twenty-four PreServ groups: from PreServ1 to PreServ24. Thus, each PreServ group comprised two to three pre-service teachers. The pre-service teachers were randomly assigned to each group.

The second set of students comprised two hundred and eighty-eight students from six primary schools selected from the list of schools held by the Faculty of Education at the University of Girona. For the study, the forty-eight primary-school students in each school were divided into eight groups, each group comprising six randomly distributed students. In each school, the resulting groups were then labeled PrimSc1 through to PrimSc8. When the instructional cooperative tasks were implemented in the schools, each pre-service teacher group, composed of two to three individuals, was randomly assigned to two PrimSc groups, composed of six individuals each. Consequently, each PreServ group

carried out the activities associated with a specific approach with two PrimSc, at the same time, i.e., with twelve students.

2.3. Definition of Instructional Approaches: Structured Versus Non-Structured Cooperative Activities

The pre-service teachers had been informed that they would be participating in a study incorporating both collaborative and reflective methods. They attended eight seminars, six on collaborative learning and two on reflective learning, where they learned about the methodologies. Seminars were given by the members of the research group, and each seminar lasted two hours.

Each pre-service group came up with a cooperative activity to be implemented in a school. From a total of twelve activities proposed during one of the seminars, these were whittled down to eight once the class had evaluated the activities as a group. At the schools, each pre-service teacher group implemented, firstly, a collaborative activity designed by the group members themselves and, secondly, the eight collaborative activities chosen by the whole group. Therefore, each pre-service teacher group implemented a total of nine cooperative physical challenges for each group and school where they had their teaching practice.

In a second stage, and together with the research team of this study, the nine cooperative challenges were divided into three sets (Table 1). As such, the first three challenges were designed to be implemented in the schools using a structured instructional approach, challenges four to six were designed to be implemented using a semi-structured instructional approach and the last three a non-structured instructional approach. Thus, the study consisted of each pre-service teacher group organizing the nine cooperative activities (CA1 to CA9) for their corresponding groups from the primary schools. CA1 to CA3 were organized using a defined structure, including fixed materials and student roles (Table 1), whereas CA4–CA6 used a defined semi-structure, which included free-to-choose materials from the supplies provided but fixed student roles (Table 1). Finally, CA7–CA9 were non-structured activities where neither material nor student roles were defined (Table 1).

Table 1. Defining elements for each type of instructional approach.

CA1-CA3: Structured approach	Fixed provided material	Fixed Student Role
CA4-CA6: Semi-structured approach	Freely provided material	Fixed Student Role
CA7-CA9: Non-structured approach	Freely available material	Non-Student Role

Cooperative challenges are a structured technique that form part of cooperative learning in education and are carried out in small groups that demand the participation of all the components—a fundamental characteristic of cooperative learning. The teacher proposes the cooperative challenge, and it is the students who, in a consensual way, must share ideas, plan, question themselves, and propose the action required to solve the cooperative challenge.

In the first group of activities (composing the structured instructional approach to cooperative learning), the cooperative challenges were presented by the pre-service teachers to the primary-school students in a structured manner. That is, the material with which to carry out the cooperative challenge had already been arranged by the pre-service teachers in the space where the cooperative challenge was to take place. All the groups were asked to complete the same cooperative challenge at the same time, and the pre-service teachers set the limitations for the time taken and space used. Finally, the pre-service teachers defined the primary-school students' roles. In the semi-structured activities (CA4–CA6), the cooperative challenges were again to be presented to the primary-school students by the pre-service teachers, and they also defined the roles of the members in the groups. In this case, however, the materials and the temporal distribution order of each cooperative challenge, the space where it would be carried out, and the duration of each cooperative challenge were all defined by the primary-school students themselves. Finally, in the non-structured activities (CA7–CA9) the temporal distribution order of each cooperative challenge, the space where it would be carried out, and the

duration of each cooperative challenge, as well as the roles within the groups, were managed by the primary-school students themselves (i.e., not by the pre-service teachers).

2.4. Development of Cooperative Challenges

The cooperative challenges were held (one approach per week) once a week for three consecutive weeks. All the school groups were given 20 min to complete the cooperative challenge. The four pre-service groups assigned to the schools carried out the challenges proposed with two PrimSc groups at the same time. It was estimated that after discounting the travel times between the classroom and the playground, the cooperative challenge sessions (presentation of the challenge and definition of material and roles), the group reflections, and the clean-up time, the sessions lasted ninety minutes.

In each session, each PrimSc group encountered three cooperative challenges. A plastic sheet placed next to each challenge explained what had to be solved, what rules had to be followed, that the possible solution had to be agreed upon, and was then executed according to the rules. If the challenge was not initially overcome, the students could try again as many times as they wanted to solve it. If they were successful, the students would go on to the second challenge. The groups also had the option of surrendering if they understood that, for whatever reason, they could not overcome the challenge they were dealing with. During the challenge, the pre-service teachers observed the development, took notes, encouraged and ensured equal participation in the groups, introduced security rules before certain solutions were attempted, resolved any doubts at the time of understanding the approach to each challenge, and regulated any conflict or negative situations in the groups. (NB: the pre-service teachers never intervened to offer solutions or impose their criteria in the case of a conflict). At the end of each session, the students came together to reflect as a group. In the group reflection with four to six students, each PreServ teacher facilitated the session by introducing process questions and then took notes on the comments made by the primary-school students.

2.5. Reflective Narratives on Cooperative Activities and Identity Construction, Analysis, and Coding

Once the pre-service teachers had finished CA1–CA3, CA4–CA6, and CA7–CA9, they were asked to produce individual reflective narratives. This resulted in a final total of one-hundred and eighty-nine narratives.

The content of these narratives was analyzed using the Rubric for Narrative Reflection Assessment [30] (Table 2). This rubric is based on four elements of analysis, distributed into ten indicators. The degree of reflection for each indicator varied on a scale from 1 to 5, where 1 indicates absence or a low weighting, and 5 indicates the highest level of performance. The four elements corresponded to: (1) identifying the situation, activity, or experience that triggered reflection, (2) identifying prior conceptions and beliefs and, therefore, awareness of one's own previous beliefs, knowledge, and experiences, (3) focusing on and probing the focus of reflection, context, and professional context and (4) understanding the process of transformation; firstly through setting, arguing, and transferring students' concrete learning objectives, and then by implementing new action plans (Table 2).

The content of the narratives was also analyzed using a constructed Rubric for Identity Construction [29]. This rubric is based on four elements of analysis matching the categories of professional identity (Table 3). The degree of reflection for each indicator varied from levels 1 to 5, with 1 being the lowest score corresponding to not related: the student did not mention the component, or the content of reflection was not related to this component. Level 2 corresponded to descriptive writing: the student formulated the professional identity component and established it as their focus of reflection. Level 3 corresponded to a descriptive reflection/thoughtful action: the student reframed the professional identity component into their previous knowledge. Level 4 corresponded to reflection: the student evaluated different alternatives and integrated them into new settings and reviewed perspectives about their professionalism. Finally, level 5 corresponded to critical reflection: the students transformed the new social, cultural, and political reflections into ongoing professionalism.

The scoring of the one-hundred and eighty-nine narratives based on the two rubrics of students' assessment was completed independently by the members of the research team. Previously, and to obtain sufficient inter-rate reliability, sixteen narratives per approach (25% of the total) were evaluated together by the members of the research team. The assessment was openly compared and discussed. When the assessment created controversy between two members of the research group, the rating was adapted to the full agreement of the four members.

Table 2. Elements of the rubric for students' reflective narrative assessment.

Dimension 1: The focus of reflection
Situation, activity, or experience that triggers the reflective process.
1.1. Identifies and describes the focus of reflection in a contextualized manner.
1.2. Makes judgements about the focus of reflection.
Dimension 2: Prior conceptions and beliefs
Prior conceptions and beliefs: awareness of one's own previous beliefs, knowledge, and experiences.
2.1. Specifies, analyses, and elaborates on beliefs or ideas about themselves.
2.2. Specifies, analyses, and elaborates on prior beliefs or ideas about the context.
2.3. Specifies, analyses, and elaborates on beliefs or ideas about the discipline/profession.
Dimension 3: Inquiring
Inquiring and/or focusing: investigating possible actions of the students through focusing on questions and hypotheses.
3.1. Focuses on questions and hypotheses and makes inquiries about the focus of reflection.
3.2. Focuses on questions and hypotheses and makes inquiries about the context.
3.3. Focuses on questions and hypotheses about the professional action.
Dimension 4: Transformation
Transformation: set concrete learning objectives and future action plans and approaches to initiate a new reflective cycle. Argumentation of these changes or the need for them.
4.1. Specifies, argues, and transfers new learning goals.
4.2. Implements new action plans and supports them with arguments.

Table 3. Elements of the rubric for students' identity construction assessment.

Dimension 1': Self-esteem
Specifies professional appreciation of job performance and received feedback.
Specifies emotions, fulfilment, and job satisfaction.
Dimension 2': Task perception
Specifies, analyses, and elaborates on ideas, beliefs, and moral considerations regarding professional tasks and duties.
Dimension 3': Job motivation
Specifies, analyses, and elaborates on motivation or driving forces in the profession.
Dimension 4': Future perspective
Specifies, argues, and transfers expectations about future jobs.

2.6. Reflective Focus Group on Cooperative Learning

A focus group was formed from the pre-service teachers participating in the experiment. All those who had participated in the activities and the collaborative and reflective learning seminars were invited to join the focus group. Sixteen students responded positively to the invitation. In general, a focus group should have between six and twelve participants, and so, from among those who had agreed to participate, seven students were randomly chosen. These seven focus group participants then received information about the aims of the focus group and signed an informed consent guaranteeing anonymity of information.

Two members from the research team participated in the discussion; one directed it while the other acted as support. The procedure was as follows: a script was prepared, adapting a sequence of questions concerning the professional experience each pre-service teacher had in the schools. The focus

group met fifteen days after having completed the experience, and the session lasted approximately 90 min. The session was recorded on video and audio and then fully transcribed.

2.7. Statistical Analysis

Students' answers to the elements of both the rubric for students' reflective narrative assessment (Table 2) and the rubric for students' identity construction assessment (Table 3) were analyzed in terms of mean, standard deviation, two-way ANOVA analysis (Table 4), and items correlation (Table 7) and were carried out with SPSS Statistics 19.0. The reliability analysis was conducted to ensure the dependability of the answers as good development procedures may result in a reasonably reliable survey instrument.

3. Results

This section includes the results from both the quantitative and qualitative analysis. The quantitative is derived by analyzing the narratives from the three stages of the collaborative activity implementation (i.e., structured, semi-structured, and non-structured), as well as from the analysis from the focus group discussions.

3.1. Quantitative Analysis of Narratives on Cooperative Learning

Both the mean scores of the assessment on reflection (Figure 1a) and identity (Figure 1b) increased with the instructional approach (from A1 to A3) regardless of the four dimensions of the reflective narratives' assessment (Table 2) or the four dimensions of identity construction assessment (Table 3). The mean score for the reflective narratives' assessment was higher for dimensions 1 (R1—Focus of reflection) and 3 (R3—Inquiring) and decreased for dimension 2 (R2—Prior conceptions and beliefs) and for dimension 4 (R4—Transformation). Although not shown, the scale demonstrated fair internal reliability with the present sample, α varied from 0.895 for the whole reflection dimension for A1 to 0.834 for A3 and α varied from 0.915 for the whole identity dimension for A1 to 0.836 for A3.

Two-way ANOVA with replication tests for the reflective dimensions R1, R2, R3, and R4 provided F values above the critical F_{cr} , rejecting the null hypothesis (Table 4), and therefore, indicating that the means between the instructional approaches were significantly different (with a 99% level of significance) among them. The identity mean score also increased with the instructional approach (from the approach A1 to A3), with $F > F_{cr}$ in all cases (Table 4). These results indicated that the mean score between instructional approaches were significantly different (with a 99% level of significance) for each identity (Table 4). Differences were found between the mean scores for the identity construction assessment (Table 4), but in this case, with a 95% level of significance. The interaction between the instructional approaches and the reflective dimensions were not significant (Table 4) and, thus, indicate that there is no relationship between them.

Table 4. Summaries of the two-way ANOVA with replication tests for the four reflection assessment dimensions and the for the four identity assessments. Df represents the degrees of freedom, F is the variability coefficient, F_{cr} is the critical variability coefficient, and P is the level of significance.

Reflection	Df	F	P	F_{cr}
Instructional approach	2	32.87	2.09×10^{-14}	4.63
Reflection	3	176.83	1.55×10^{-86}	3.81
Approach \times Reflection (interaction)	6	1.91	0.08	2.83
Identity	Df	F	P	F_{cr}
Instructional approach	2	31.71	9.04×10^{-14}	3.01
Identity	3	4.35	0.013	3.01
Approach \times Reflection (interaction)	6	0.68	0.61	2.83

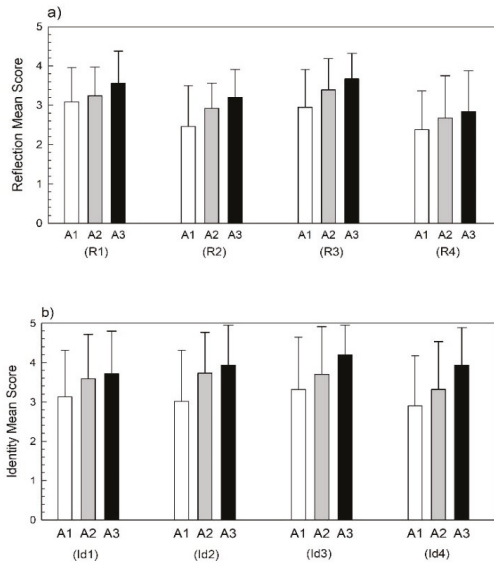


Figure 1. Mean and standard deviations for each instructional approach for the four dimensions of the reflection (a) and identity (b) assessment.

3.2. Qualitative Analysis on Reflection on Cooperative Learning

In support of the quantitative analysis, the analysis of both the written narratives and the discussions from the focus group provided insights into using the collaborative activities at the schools. As in the work of Colomer et al. [9], the first step in analyzing the contents of the written narratives of each student was to identify complete units of information understood, as a simple idea/concept or thought, about a particular learning process. Among the 63 narratives per approach describing the nine cooperative activities, in the structured approach corresponding to the first narrative, there were 480 units, while for the second narrative corresponding to the semi-structured approach, there were 531 units, and for the non-structured approach, there were 363. In addition, 58 units were obtained from the analysis of the transcribed focus group on cooperative learning. The corresponding assessment was undertaken by two members of the research team, and then they agreed on the information units to code [9,31]. The work was subsequently revised by the rest of the authors, who agreed on the approach analysis (92% for first narrative analysis, 96% for the second, and 93% for the third). For the five dimensions of cooperative learning, Table 5 presents the most significant comments extracted from the analysis of the students' narratives.

Table 5. Students' reflections on cooperative learning: dimensions, approaches, and associated explanations extracted from the students' narratives.

Dimension 1: Positive Interdependence

Approach 1: Structured approach.

'In some of the cooperative challenges, the groups competed to see who would finish first.'

'Some students got very cross when another student didn't assume their role well. For example, when the Speaker didn't read or explain the challenge clearly.'

'At the start of the activity, each one gave their own ideas without listening to the others, but they quickly understood that they all had to work together to solve the challenge and that they wouldn't find the solution unless everyone worked together.'

Approach 2: Semi-structured approach.

'At times there was a competition to grab the materials first. Some of the students didn't understand that they wouldn't need all the materials to solve their cooperative challenge.'

'Some students just did their own thing when it came to picking up the materials. I had to step in to help them reach a consensus on how to respond to the cooperative challenge.'

Approach 3: Non-structured approach.

'If you don't define the roles, the students quickly organise themselves and tackle the challenge head on.'

'The students organised themselves incredibly well, there was a lot of cohesion in the group and they dealt with the challenges really well.'

'I saw that the students clearly understood that achieving the challenge was the goal the whole group had in common.'

Dimension 2: Individual Accountability

Approach 1: Structured approach.

'I had to control some of the students because they were doing more than they had been assigned to do in their specific role.'

'I tried to encourage some students to value and encourage their groupmates.'

'The roles helped the students to organise themselves and understand that everyone had an important and vital part to play and that they were all responsible for tackling the challenge.'

Approach 2: Semi-structured approach.

'Some students were very proactive in their roles, while others tended to respond reactively to their groupmates' suggestions and ideas.'

'The students with fewer or weaker leadership skills in the group tended to take a back seat, while those with greater initiative took on the different roles themselves in order to solve the challenge.'

Approach 3: Non-structured approach.

'Some of the students argued vehemently over a particular role they wanted to play, which meant they wasted a lot of the other group members' time.'

'I noticed that there were students who wanted to be in control of the group's materials, which meant that, sometimes, the other students just didn't bother using the material that the first student was hoarding.'

Dimension 3: Promotive interaction

Approach 1: Structured approach.

'I noticed that there were some very motivated students, often with a very specific role, who encouraged and motivated their less active groupmates.'

'The more the students solved the challenges, the more involved and the more active they became as a group.'

Approach 2: Semi-structured approach.

'In the first challenge, I had to step in, especially when roles were being defined. In doing so, I was able to help guide the group members to reach a consensus over who would get which role.'

'I noticed that some groups needed to stop and rethink their actions and strategies. I encouraged them more than once to do so.'

Approach 3: Non-structured approach.

'When the students have had a meeting prior to tackling the challenge, they end up resolving it in a much more efficient way.'

'I had to intervene when I noticed that one of the group members was becoming very anxious and upset.'

'I was very pleased to see that some groups tried various alternatives to resolve the challenge.'

'The students realised that they had to encourage, talk to and help their teammates in order to resolve the challenge.'

Table 5. Cont.

Dimension 4: Appropriate use of skills

Approach 1: Structured approach.

'I think it was a good idea that I distributed the roles consecutively because it forced some students to have a clearer and more active discourse.'

'It's clear that knowing how to actively listen and respect your groupmates' contributions, exercise self-control and be responsible within the group etc., are fundamental attributes. The roles have helped develop interpersonal skills.'

Approach 2: Semi-structured approach.

'The cooperative challenges have undoubtedly helped students in the first year develop motor skills and communication skills. Carrying out the challenges helped the students develop social skills that cannot be monitored in class. The space, which is outside the typical classroom setting, where they resolved the challenges, has helped to ensure success with the challenges.'

Approach 3: Non-structured approach.

'The decisions the groups made about the materials they would use to tackle the cooperative challenge, helped bind the group together.'

'Discussing the roles each student in the group would take on helped promote interpersonal relationships within the group.'

'The students helped each other within the group and constructively resolved any conflicts they had.'

Dimension 5: Group processing

Approach 1: Structured approach.

'It was a mistake for me not to do an individual reflection first, as it prevents group members from discussing their work and that of the group members, and so they do it in a generic way, without taking into account group processing or self-evaluation.'

'I had to intervene because everything was positive, everything worked well. And they needed to see the aspects they could improve.'

Approach 2: Semi-structured approach.

'They defended their decisions to use some materials and not others very well.'

'One child said there should be less talking and more doing . . . that too much time was spent arguing and so they wouldn't be able to complete the challenge.'

'At first, it was a little bit difficult for them to reflect on the work they'd done and the results, as they felt it wasn't necessary to talk about what had happened and what needed to be improved.'

Approach 3: Non-structured approach.

'The children said that it was important to reflect first, talk, and suggest different ways to meet the challenge and to defend choices made, to think and then think again.'

'I asked them what reflecting meant and they told me, 'reflecting involves thinking and making joint decisions together.'

'During the joint reflection, they said that now they understood that reflecting and giving your own opinion is not the same as fighting or getting angry with each other.'

3.3. Qualitative Analysis on Identity Construction

We conducted an additional analysis of the sixty-three narratives per instructional approach to obtain information on the perceptions the pre-service teachers had on professional identity construction while describing the nine cooperative activities in the three approaches. The analysis of the first narrative on professional identity provided 73 units. Meanwhile, the second narrative, corresponding to the semi-structured approach, provided 67 units, and for the non-structured approach, the analysis provided 89 units. In addition, 43 units were obtained from the analysis of the transcribed focus group on professional identity. The corresponding assessment was also undertaken by two members of the research team, and then they came to an agreement on the information. The work was subsequently revised by the rest of the authors, who were in agreement with the approach analysis (88% for first narrative analysis and 90% for the second and third narrative analyses). Table 6 presents the most significant comments extracted from the analysis of the students' narratives for the four dimensions of identity construction.

Table 6. Student reflections on identity construction: dimensions, approaches, and associated explanations extracted from the students' narratives.

Dimension 1': Self-esteem

Approach 1: Structured approach.

"In the development of the challenges, the feedback I gave was well received. It improved kids' performance."

"I helped some kids in defining their role within a group. That interaction also helped me to increase my learning about cooperative learning."

"Watching the kids working together and being motivated because they had defined roles, really made me think that a good teacher should incorporate this type of approach."

Approach 2: Semi-structured approach.

"I was really happy with implementing the cooperative challenges. My self-esteem increased in the second week when I saw kids solving the challenges I had proposed in an organized way."

Approach 3: Non-structured approach.

"The kids loved working together without restrictions. I think I was as surprised as they were with what they could come up with in the short time they did the challenges. I was very engaged in the group processing, watching kids not hesitating before speaking and reflecting on the experience. That was the best moment for me."

Dimension 2': Task perception

Approach 1: Structured approach.

"If the primary students liked the tasks they were doing, I also felt enthused. The kids needed to be prepared to or taught how to work cooperatively together. Once the roles were formulated and put into practice in the first challenge, cooperation was highly activated in the following challenges."

"I found that the kids got involved in democratic decision-making when they perceived a specific role as being necessary for the group. Some kids approached me to ask if they were doing well in the development of the task."

Approach 2: Semi-structured approach.

"Challenges were accomplished in shorter time spans when kids managed themselves. This is similar to what happened when we designed a challenge in terms of materials and roles. In my case, I performed better being an encourager. I think this role is inherent when teaching a real class."

"Some kids felt uncomfortable about choosing the material without really knowing the capabilities of using each item. There was no trial and error in terms of choosing the material".

Approach 3: Non-structured approach.

"I proposed the challenges with enough open-ended variables for the kids to put in their own organization, ideas, and solutions. Some groups came up with more than one solution."

"One group didn't come up with any solution. To avoid any anxiety on their part, I asked the kids to reflect on the problems they had encountered, and I guided them towards some new proposals."

Dimension 3': Job motivation

Approach 1: Structured approach.

"After applying the cooperative challenges, I do think my competence as a teacher has increased through this gained experience."

"In my teaching practice at the school, I felt motivated since I discovered that a teacher is not a teacher. I found myself being a supporter, a listener, an assistant, a provider of solutions."

Approach 2: Semi-structured approach.

"I think we should have done better at choosing the material and to analyse the relationships with the roles. The success of the teams depended on the teamwork and the intelligence of the members of the team as a single unit."

"Those teams that learned from the failures had very strong one-to-one relationships. This was crucial in solving some of the most difficult challenges."

Approach 3: Non-structured approach.

"In using such an open approach, I discovered that I was never absolutely prepared for being a teacher. I doubted myself all the time and I keep self-assessing my degree of implication. The implementation of any approach needs a solid base of preparation, analysis and discussion with other pre-service teachers."

"It is clear to me that to become a good teacher I need to know my limits, to reshape my beliefs and also, and most importantly, to understand my feelings."

Table 6. Cont.

Dimension 4': Future perspective

Approach 1: Structured approach.

"I would like to comment that it is very important that the teacher believes in and is confident about what he does, because if the teacher believes in it, the students believe in him and the chances of success multiply."

"For me, and as a future teacher, it is very important that students feel committed to the challenge as a group, I think that is what grabs them and motivates them to overcome it no matter how. That is why a good teacher must know how to provide the right information and feedback, understand what motivates them and that the students believe in the success of the challenge."

Approach 2: Semi-structured approach.

"As a future teacher, I have to keep in mind that each cooperative group has its characteristics, some groups want to get more attention from me than others, but I cannot let myself be absorbed by just one group. I need strategies to manage my attention for all the groups according to their needs. I have to help the more dependent groups to be more self-reliant."

Approach 3: Non-structured approach.

"I enjoyed seeing children take the initiative for their learning. I have seen them as protagonists who enjoyed the freedom they had when it came to making decisions about the challenges. But I have to look for strategies to accompany them in their learning, sometimes I felt that I did not know what to do or that the students did not need me. I am sure that is simply due to my lack of experience. I must learn how to motivate, guide and give feedback so that students feel that they are accompanied by me, that I am interested in and value what they are doing."

"A positive aspect of the unstructured session was that since the groups worked alone, I had more freedom to intervene when I saw that I could help, and especially to be with those students who were more motivated. This type of task, I think, is more suited to my profile as a future teacher".

"I think that this format demands more from the students, stimulates them more and therefore their learning will go beyond the driving force. I think that I see myself as the future teacher choosing this type of activity when it comes to presenting the challenges. "

3.4. Correlation Analysis between Reflection and the Dimensions of Professional Identity

For the three cooperative instructional approaches, the whole assessment of the narrative reflection (added scores of the ten reflective dimensions) was correlated with the students' assessment of the four identity dimensions: self-esteem (Id1), task perception (Id2), job motivation (Id3), and future perspectives (Id4) (Table 7). When considering all the correlation slopes and the corresponding confidence interval of reflection assessment with identity reflection, similar correlations were obtained between the reflection on the instructional approaches (A1, A2, and A3) and the categories of students' reflection on professional identity (Table 7).

Table 7. Results of the linear regression analysis between the sum of the scores of the reflective narratives on the instructional approaches (A1,A2,A3) and the four categories of professional identity (Id1 to Id4). Note. ** $p < 0.01$.

	Id1 (Self-Esteem)	Id2 (Task Perception)	Id3 (Job Motivation)	Id4 (future Perspectives)
Reflections/A1	0.072** (0.039–0.106)	0.112** (0.082–0.143)	0.074** (0.036–0.113)	0.098** (0.066–0.130)
Reflections/A2	0.132** (0.103–0.161)	0.098** (0.066–0.130)	0.127** (0.092–0.162)	0.129** (0.082–0.156)
Reflections/A3	0.114** (0.079–0.150)	0.083** (0.046–0.121)	0.088** (0.065–0.111)	0.107** (0.069–0.146)

4. Discussion and Conclusions

4.1. Activating Cooperative Learning Based on Non- to Structured Instructional Approaches Produced Identity in Practice

The pre-service students were generally motivated towards implementing cooperative physical challenges in physical education classes in the schools, especially in the creative aspect of designing and implementing the physical challenges, since this implied considering others and coordinating the skills of group members to overcome individual limitations. This finding has also been documented in other studies promoting cooperative learning where the composition of the groups, the task the group was to undertake, the social skills training needs, and the assessment of both the learning and the instructional practice [32–34] (especially when studies focus on primary school children [3]) have been reported.

Regardless of the reflective dimensions, there were significant differences between approaches, with the assessment scores of the R1 (The focus of reflection) and R3 (Inquiring) to be higher than R2 (Prior conceptions and beliefs) and R4 (Transformation), as shown in Figure 1. Results also showed that the non-structured instructional approach was scored higher than the structured and semi-structured instructional approaches (Figure 1). Therefore, the pre-service students' scores were higher when they reflected on identifying cooperative teaching challenges and on focusing on questions and hypotheses about professional action. This was highly scored when they carried out the cooperative challenges with no established materials or student roles in the group.

Qualitative analysis of reflective narratives indicated that, while the pre-service teachers had positive experiences with cooperative challenges (there were only six dropouts), a number encountered difficulties with implementing them in the classrooms. Issues identified included students socializing during group activities, individuals' poor awareness of being a member of a group, and poor regulation of roles. Similarly, Gillies and Boyle [23] reported that teachers found some difficulties in the classroom when implementing cooperative learning. These included time management, the organization required to implement cooperative learning, and a reported concern with socializing in the groups.

The qualitative analysis of the reflective narratives also helped the pre-service teachers' perceptions of cooperative learning. All concurred that they, as well as the children, had had positive experiences. They talked about the children confronting new experiences, distributing roles themselves in the non-structured approach, learning how to communicate, and managing to interact with each other more effectively. As pointed out by Slavin [21], when cooperative learning is well structured, students understand how they are to work together to achieve their group's goal, which benefits students socially and academically. When implementing the non-structured approach, in particular, positive interdependence was enhanced when dual responsibility was achieved, that is, when students understood that they were not only required to complete their part of the challenge but to ensure others did likewise [23]. Other key elements that were critical to the effective implementation of the cooperative physical challenges included the pre-service teachers facilitating promotive interaction for the whole group, promoting responsibility for contributing to the groups' challenge, and demonstrating that dialogical intrapersonal bonds helped the groups to progress.

4.2. Pre-Service Teachers Can Construct and Transform Their Professional Identities through Reflective Practice

Regardless of the instructional approach, there was a significant association between reflection and professional identity. Reflective practices offer opportunities for pre-service teachers to engage in active and meaningful problem identification, evaluation, and innovation, through which they can hone and develop their identities [20]. Activating cooperative physical challenges in the three instructional approaches and the associated reflection was positively correlated with the four dimensions of professional identity defined by Kelchtermans [29], that is, self-esteem, task perception, job motivation, and future perspectives. Students' reflections primarily broadened and deepened perspectives on professional identity and impacted positively in the latter stages of implementing the cooperative

challenges in the schools. Key elements that were critical in transforming the pre-service teachers' professional identity were: promoting feedback, motivation, and engagement with the members of the teams, which, in turn, increased pre-service teachers' self-esteem, demonstrating that being implicated in democratic decisions helped students in the task perception, and proving that continuous practice at schools is needed to gain job motivation, i.e., their subjective feeling of competence increased because they gained experience with collaborative learning in educational practice [32].

Pre-service teachers were positioned in relation to both reflecting on cooperative teaching and personal consideration about professional identity. Research has shown that the transformation of professional identity becomes a powerful learning experience when it is articulated through reflective narratives [26,35], and particularly when it is shared and discussed in the process of dialogical and collaborative reflection. Indeed, our results showed the need to mix quantitative and qualitative methods to reduce misunderstandings of purpose [35] and that professional practice can indeed improve the knowledge of the discipline and the contexts in which we work, but are also about the self-awareness of how we conduct ourselves to deliberate and take action as professionals [26]. Our findings suggest that pre-service teachers shaped their identities not only over practice at schools but also through individual and community dialogical structures. K rkk  et al. [34] and Yuan and Mak [20] posit the fact that in order to transform professional identity, the highest level of reflection is gained when pre-service teachers have viewed the matter of reflection in several ways and decided on a course of action. Engaging pre-service teachers in reflection in-action (during the action) and on-action (after the action) is a way for them to establish a renewed perspective of their professional identity.

4.3. Pre-Service Teachers, When Engaged in Individual and Community Reflection, May Activate Interpretation and Critical Competences Evaluation of Their Practice

By reflecting, the pre-service teachers reported the aspects that either helped or hindered them when carrying out the associated instructional activities in the schools. First, the relationship between the theory given in the seminars on collaborative and reflective learning and the professional teaching practice itself. Secondly, the role of using collaborative and reflective methodologies to improve their level of self-awareness as both individuals and future professionals. The usefulness of using collaborative and reflective methods in identifying strengths, weaknesses, or gaps in their training was evaluated highly as well as the need to formulate activities based on new methods not only in their training as individuals but also as future professionals. Aspects they highlighted as being positive were: the development of both inter- and intrapersonal skills and the need to organize and implement the collaborative activities in the semi- and non-structured approaches in which the non-assignment of student roles or materials were highly evaluated.

When the pre-service teachers carried out the cooperative challenges in the initial stage, they worked to learn and at the same time, were responsible for their peers. When the pre-service teachers oversaw teaching physical activity cooperative challenges at the school, they were responsible for the PE students' learning outcomes. Among other skills, when the pre-service teachers developed cooperative challenges in a group, each student co-constructed knowledge and skills that were based on mutual dialogue, respect, help, cooperation, thinking before acting, learning to reflect and share ideas, proposals, and doubts. When the pre-service teachers designed and developed a cooperative challenge, these were to develop cognitive, psychological, and motor skills. The cooperative physical challenges were designed taking into account that the participation of all the students had to be possible regardless of the motor capabilities of each student. There had to be positive interdependence to achieve the common goal, i.e., all the members of a team had to work together to overcome the cooperative challenge.

In the teaching execution of a cooperative challenge at the schools, the pre-service teachers always gave instructions to generate a positive interdependence among the PE students of a team, especially when they were aware of the differing motor skills some group members had. Furthermore, it was essential that the challenges could be solved in a number of ways, so that dialogue, creativity,

and trial-and-error could be promoted. The roles for the primary-school students were defined to fulfill the most efficient way to execute the cooperative challenge. The roles facilitated the group deploying both social skills and academic abilities. The roles also enabled the group to solve the cooperative challenge in a satisfactory way with regard to academic knowledge while practicing social skills such as conflict resolution, negotiating, effectively communicating ideas, respecting the views of others, reaching a consensus from collective responses, and taking advantage of time. The roles reduced the prospect of some students adopting passive or dominant attitudes within the group and created an interdependence among the members of the group.

The pre-service teachers were motivated by the cooperative educational proposal in the physical education classes, fundamentally valuing the fact that they could provide the primary-school students with enough resources to develop social competences. It is recognized that education should also include aspects such as encouraging others to participate, listening to others, encouraging and supporting all peers who participate in a group, criticizing ideas and not persons, and expressing satisfaction for the success of others. Self-regulated learning through the promotion of structure and motivation encourages students to increase the ability to control and influence one's learning processes positively [36]. Both cooperative and reflective learning, when embedded in the development of cooperative physical challenges, represent educational strategies in which the learner's competences are promoted. In this respect, both the pre-service teachers and the primary-school students were involved in structured and non-structured instructional approaches in which values, attitudes, and beliefs contributed to sustainable, effective, and grounded sustainable learning [2,9,37–40].

All in all, we have identified the ways in which pre-service teachers represented their professional identity through reflection on instructional teaching approaches by maximizing the intake of competences, such as solving cooperative challenges, critical thinking through continuous self-assessment of professional practice, and communication through providing didactic instructive approaches. The cooperative physical challenge approaches helped pre-service teachers to identify aspects of their professional identity that ensured not only an effective intake of the sustainable competences but how to develop, understand, and self-assess professional practice experiences that at a later state fostered personal critical professional competence [20,34,38–40].

4.4. Limitations of the Study

The data presented in this research are consistent with the analysis performed, although there are some limitations that should be taken into account in future studies to obtain more generalized results and conclusions. One aspect that we consider fundamental for later studies is to expand the number of physical challenges in relation to each of the planned instructional approaches (structured, semi-structured, and non-structured), in order to carry out a longitudinal study that would allow us to understand how the development of individual professional identities evolves. Another aspect to consider would be to provide feedback with each of the student's cooperative groups once each of the sessions at the school had finished, in order to help the pre-service teachers in their process of self-knowledge and reflection in relation to their professional identity. In relation to the research instruments used, it would be convenient that, in addition to using the narratives centered on the cooperative learning dimensions, associations between the dimensions of cooperative learning are considered quantitatively with each of the dimensions of professional identity for each of the pre-service teachers to establish individual professional identity profiles. In future studies, we also intend to develop other research instruments, such as rubrics and questionnaires, focused on each of the aspects that make up professional identity and to understand in greater depth how cooperative physical challenges influence pre-service teachers' personal and professional development.

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Article

University Students' Perspectives on Reflective Learning: Psychometric Properties of the Eight-Cultural-Forces Scale

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Abstract: This study emerges from the development of higher-order thinking skills recognised as influential attributes to be considered for quality of learning in preservice teachers; hence, this quantitative research is a systematic attempt to obtain metric-quality pieces of evidence for identifying university students' perspectives on reflective learning standards throughout their initial training period utilising an adapted cultural-forces scale. The earlier mentioned tool is an adaptation of Ritchhart's scale (2015) for the assessment of cultural forces from the model of the Culture of Thinking. The selected sample of preservice teachers encompasses 700 university students of education from 7 faculties of education in Spain. Research results reveal that the use of the scale displayed high reliability and suitability. Similarly, significant statistical differences were observed in the eight scales of cultural forces assessment, where the prime-valued by the students were interactions, expectations, environment, language and time. Apropos of statistics, research results manifest as relevant. Such significance reveals how classroom culture and practical strategies acquire meaning and show connections with learning purposes—likewise with the developmental encouragement of cognitive skills and dispositions towards reflective learning.

Keywords: psychometrics; metacognition; reflective learning; culture of thinking; cultural forces; higher education

1. Introduction

Higher-order thinking skills (HOTS) are recognised as influential attributes for the quality of teaching and learning in higher education institutions around the world [1]. HOTS are defined as a set of neurocognitive abilities required to involve goal-oriented thoughts, actions and emotions control [2–4]. HOTS involve cognitive flexibility (thinking about something in various ways), working memory (taking information into account and, usually, manipulating it in some way) and inhibitory control (deliberately suppressing attention process to provide a response to something [5,6]). These skills not only allow students to learn more effectively but also help them to transfer the previously acquired knowledge to real situations in their daily lives. Thinking skills are essential for analysing situations or problems, making predictions, identifying patterns and representing conclusions. During the teaching and learning process, facilitating students' HOTS helps them become more aware of their own thinking processes. Though self-awareness implies metacognitive and reflective thinking skills, it also encourages in students the development of other intellectual skills, making it possible for them to transfer the previously acquired scientific knowledge and apply it to new situations, favouring learning acquisition [7–9].

Reflective thinking is a type of higher-order thinking (HOT) defined as a form of thinking aimed at determining the factors affecting the level of learning and the methods of solving problems by students [10]. Reflective thinking presupposes a state of perplexity, hesitation or doubt, and mental difficulty. It is also an act of inquiry—a sophisticated search for the finding of solutions and decision making [11]. Metacognition is a high-order thinking ability defined as the awareness and control of self-thinking. It is an executive control system of the human mind that oversees a person's thoughts, knowledge and thinking actions [12,13]. It comprises two components concerning knowledge and regulation. The knowledge component is referred to as the cognitive self-knowledge process. Constituents of this component are the knowledge of oneself as a thinker, the characteristics of a given task and the strategies required to carry out a compelling performance. The regulatory component refers to the actual strategies that are applied to control cognitive processes. Constituents of this component are as follows: planning on how to approach a task, monitoring understanding, evaluating progress, performance [14,15].

The link between the above-mentioned cognitive skills—knowledge and regulatory components—is explained by Halper [16]. This author states that when both critical and reflexive thinking is involved, students need to monitor their thinking process to verify if the goal is being achieved with precision—required functions for the activation of metacognitive skills. Consequently, metacognition is an undoubtedly central component in various forms of high-order thinking providing the understanding on how cognition works, and allows humans to develop intrapersonal skills related to understanding, argumentation, reasoning, self-reflection and other forms of higher-order thinking [17].

The culture of every educational organisation has a profound effect on the development of the aforementioned skills, as well as on its trainers and trainees, since it shapes the identity of both entities and groups and determines the dispositions, decisions and responses of individuals to circumstantial challenges [18,19]. Consequently, through classroom environment cultures, practical strategies display themselves as meaningful for the connection with learning purposes. This factor leads to the importance of creating a culture of thought that helps students recognise the social and environmental contexts in which both individual and collective thought are fostered and valued, focuses the attention on and access to resources and routine practices and promotes the cognitive processes during the construction of learning [20,21]. Such enculturation of thought makes reference to shared social practices in classrooms, which create thought dispositions, mental inclinations and habits that benefit students' productive thinking such as being reflective, seeking and evaluating reasons, exploring strategic solutions, constructing explanations, assuming risks and having dispositions to be metacognitive [18,22–24].

Considering the above-mentioned, Ritchhart [22] proposes the promotion of eight cultural forces to promote thought among those who learn and are present in any educational context. The cultural forces as the foundations on which the acquisition and development of students' critical and reflective thinking dispositions and skills are promoted. The promotion of the eight cultural forces is also shaped by the expectations about thinking and learning, the time to think, the interactions and the supportive relationships for the fostering of thinking, the modelling of thinking dispositions, the created opportunities for thinking, the thinking on language, the thinking routines and structures and the environment—factors encouraging expectations.

Expectations constitute a set of firm beliefs about future results or theories of action that influence humans' efforts concerning the achievement of established objectives and desired results [21]. In this particular case, expectations correspond to given demands from teachers towards students. Among the expectations that influence the required results are the orientation to the students in learning, the teaching for the understanding (instead of for mere rote knowledge), the promotion of deep learning, the promotion of the autonomy and independence of students upon the construction of learning and the promotion of thinking skills and cognitive flexibility [25]. In consequence, the language of thought

refers to the language used by teachers. Apropos of the vocabulary of thought and the reflexive process stimulations, the language of thought does also refer to its impact on students [23].

The aforementioned lexical-reflexive processes encompass different terms of action that also describe the states and mental processes of each subject (analyse, justify, reason). In the same way, lexical-reflexive processes describe products, such as the formulation of hypotheses, questions or statements, that manifest epistemic attitudes that reflect, in turn, the position of the person towards an idea (I consider, I conclude, etc.) [25]. In this sense, language takes on transcendent importance in providing feedback to people. The reason is that it helps to make teaching and learning visible entities in the classroom. Likewise, language helps to recognise the dispositions of thought and the power of the students during the process of feedback of learning [26]. For the stimulation of lexical-reflexive processes, time is a relevant element, as a cultural force that constitutes a set of measurable periods to manage learning strategies. The sequence of events, discussions and reflections on the actions allow the scaffolding and the creation of a conductive thread through articulated learning opportunities to create uniformity. When students endure time to think, opportunities are encouraged at the same time for them to deepen their responses, to seek considerable evidence of their reasoning and to build deeper learning [26].

Modelling is a necessary condition for a reflective practice, where conscious imitation allows the student to acquire the skills necessary to learn. By considering the modelling procedure and reflecting on it, students can acquire a conceptual understanding grounded in practice [27]. Likewise, modelling offers subjects the opportunity to accept different perspectives, as well as new ways of acting and thinking. Modelling thinking, learning and independence skills require identifying the different models of thinking. It also requires reflection on the actions of such models, characteristics, attitudes and behaviours, to incorporate them routinely in the development of tasks [26]. Creating opportunities implies clarifying the expected learning, applying the criteria of the novel application, meaningful research, efficient communication and the perceived value of the task. The purpose is to favour collaborative, autonomous and self-regulated learning [22]. Posing a variety of instructional formats or potentially meaningful and constructive tasks helps to activate the different cognitive processes, in addition to deepening the reflection and deep learning of the students.

The use of structures and routines to anchor and support the thinking and deep learning of students consists in creating strategies that demand a series of cognitive behaviours, orient the thinking of the learners, structure group or individual discussions and operate with curricular content. Such facilitation invites teachers and students to observe, record, interpret and share ideas, thoughts and understanding of the contents and discussions addressed. Similarly, such routines become behavioural patterns to deepen understanding, reasoning and reflection on self-learning [28]. Considering that student learning in higher education occurs in an environment of academic learning, where language, space organisation, the transmission of values and key information converge, the teacher must know the specific strategies to support and motivate students. Instructors must also know how to provide learners with valid learning resources that arouse their interest and curiosity, generate an excellent emotional climate and become the scaffolding of learning [11].

In addition to being an individual process, interaction as a cultural force is supported by the theories considering that the development of critical and reflexive thinking is mediated by social discourse [27]. From the previous reflection emanates the importance of teachers generating teaching situations that, in turn, cause new opportunities for inquiries. The formulation of generative questions soaking through higher-level thinking skills might provide interpretations and connections between previous knowledge and new knowledge in a shared and distributed way among students and teachers. From all the referenced shapes, students' ways of thinking and learning encourage the adoption of positive values and habits of mind. These shapes do also encourage learners to be aware of and sensitive to the contexts in which they are located, as well as to broaden their perspective and to develop flexible metacognitive thinking skills.

Current research findings reveal this is not the case, and that some students still leave college having acquired rather limited cognitive skills to meet the challenges of the global community nowadays [29–31].

Therefore, due to the relevance of the inculturation of thinking for the teaching staff and the implications for the improvement of their educational action based on university training programmes, the paper provides evidence concerning a validation study of the Eight-Cultural-Forces Scale [22] in a sample of Spanish university students of education.

2. Materials and Methods

2.1. Participants

A nonrandom sampling of an intentional peak was used on a sample of 700 education degree students from two Spanish public universities: Universidad de Castilla-La Mancha and Universidad de Valladolid. The nonrandomised sample selection was due to accessibility to the rooms where participants were grouped. Despite the authorisation of the leading professor granting access to implement the instrument, only 12 professors gave authorisation to it. In consequence, it was possible to access a total of 13 group-rooms within 7 Faculties of Education integrated into 2 public universities offering educational degrees in 7 different campuses. Participants' average age was 20.67 (SD = 3.19; range: 18–50). From the sample, 72.9% were female and 27.1% were male. Concerning university degrees, 45.9% of the participants were first-year students, 24.4% were second-year students, 18.3% were third-year students and 11.4% were fourth-year students.

2.2. Process

The selected scale was based on the theoretical approach of Visible Thinking [28] and the Culture of Thinking [22], pointing towards the promotion of HOTS [20,21]. As mentioned, the scale was adapted from the checklist on the self-assessment and the promotion of classroom thinking by teachers [12] used in research in different international contexts [23,32].

The procedure of transcultural adaptation of the items was carried out over the course of the year 2017, using the conceptual translation/retranslation method and following the recommendations of the scientific literature. Based on previous research [4,22,33], the implementation process was divided in two phases involving four actions as follows:

- (A) Translation of the original version and evaluation of conceptual equivalence.
 - Translation of the English version to Spanish for grammatical, linguistic, semantic and legibility analysis of the questionnaire.
 - Retro-translation.
 - Expert judgement.
- (B) (1) Piloting of the instrument adapted to Spanish students and (2) analysis of psychometric properties in a wider sample.
 - Administration of the questionnaire. It was administered to the students within the classrooms, along with lectures. Participants were informed by researchers on the goal of the study, as well as of the instructions. The nonrandomised selection of participants was as follows: (a) Official contact with the faculty members requesting the collection of data. (b) Planning and consensus of schedules, timing and places for the questionnaire implementation. (c) Application of the questionnaire.
 - Analysis and proposal of a Spanish version of the questionnaire. The adjusted analysis was used to evaluate the psychometric properties of the questionnaire, based on the data obtained with the fieldwork.

2.3. Instruments

The implemented of the Eight-Cultural-Forces Scale [22] was carried out to explore how students themselves perceive the enculturation of thinking being favoured during their preservice teacher training. Through a total of 40 items, grouped into 8 dimensions with 5 items each, the eight subsequent dimensions were registered (Table 1). The type of scaling presents a Likert-type numerical rating of 1 to 5, where 1 represents the lowest rating (referenced as Never) and where 5 represents the highest rating (referenced as Always).

Table 1. Dimensions and items of the Eight-Cultural-Forces Scale.

Dimension	Items
Expectations (E)	1 Teachers make a conscious effort to communicate to students that their classroom is a place where thinking is valued.
	2 Teacher establishes with his students a set of expectations for learning and thinking, in the same way as he would when setting behavioural expectations.
	3 The teacher stresses that thinking and learning, as opposed to “completion of work”, are the outcomes of our class activity.
	4 Developing understanding, as opposed to knowledge acquisition only, is the goal of classroom activity and lessons.
	5 Student independence is being actively cultivated so that students are not dependent on me to answer all questions and direct all activity.
Language (L)	1 The teacher makes a conscious effort to use the language of thinking in his teaching, discussing with students the sort of thinking moves required with such verbs as “elaborate”, “evaluate”, “justify”, “contrast”, “explain” and so on.
	2 The teacher seldom uses generic praise comments (“good job”, “great”, “brilliant”, “well done”) and instead gives specific, targeted, action-oriented feedback that focuses on guiding future efforts and actions.
	3 The teacher uses “conditional” phrases such as “could be”, “might be”, “one possibility is”, “some people think” or “usually it is that way, but not always”.
	4 The teacher tries to notice and name the thinking occurring in his classroom, saying things like “Juan is supporting his ideas with evidence here” or “María is evaluating the effectiveness of that strategy”.
	5 The teacher uses inclusive, community-building language, talking about what “we” are learning or “our” inquiry.
Time (T)	1 The teacher makes time for students’ questions and contributions.
	2 The teacher provides the “space” for students to extend, elaborate or develop the ideas of others.
	3 The teacher avoids disseminating an abundance of ideas without providing the time to process them.
	4 The teacher gives students time to think and develop ideas before asking for contributions.
	5 The teacher monitors the amount of time he talks so as not to dominate the classroom conversation.
Modelling (M)	1 Thinking (both yours and ours) is regularly on display in the classroom.
	2 The teacher demonstrates his own curiosity, passion and interest to students.
	3 The teacher displays open-mindedness and a willingness to consider alternative perspectives.
	4 The teacher states that he is learning too, taking risks and reflecting on my learning.
	5 Students model their thought process by spontaneously justifying and providing evidence for their thinking.

Table 1. Cont.

Dimension	Items
Opportunities (O)	1 The teacher ensures that rich thinking opportunities are woven into the fabric of his teaching and that students are not just engaged in work or activity.
	2 The teacher focuses students' attention on big subject matter issues, important ideas in the world and meaningful connections within his discipline and beyond.
	3 The teacher provides students with opportunities to direct their own learning and become independent learners.
	4 The teacher takes pains to select content and stimuli for class consideration in order to provoke thinking.
	5 The teacher provides opportunities to reflect on how one's thinking about a topic has changed and developed over time.
Routines (R)	1 The teacher uses thinking routines and structures to help students organize their thinking.
	2 The teacher uses thinking routines flexibly, spontaneously and effectively to deepen students' understanding.
	3 The teacher is good at matching a routine with appropriate content so that students are able to achieve a deeper level of understanding.
	4 Thinking routines have become patterns of behaviour in his classroom; that is, students know particular routines so well that they no longer seek clarification about the mechanics of the routines.
	5 Students use routines and structures to further our understanding and as a platform for discussion, rather than as work to be done.
Interactions (I)	1 The teacher ensures that all students respect each other's thinking in his classroom. Ideas may be critiqued or challenged, but people are not.
	2 I make it clear that mistakes are acceptable and encouraged within my classroom.
	3 Students are pushed to elaborate their responses, to reason and to think beyond simple answers or statements (for example, by using the "What makes you say that?" routine).
	4 The teacher listens to students and shows a genuine curiosity and interest in their thinking. It is clear that he values their thinking.
	5 The teacher listens in on groups and he allows us to act independently, rather than always inserting himself into the process.
Environment (E)	1 Displays in the room communicate positive messages about learning and thinking, to inspire learning in the subject area and connect students to the larger world of ideas.
	2 The teacher arranges the space of his classroom to facilitate thoughtful interactions, collaborations and discussion.
	3 The wall displays have an ongoing, inchoate and/or dialogic nature to them; they are not merely static displays of finished work.
	4 The teacher uses a variety of ways, including technology, to document and capture thinking.
	5 A visitor would be able to discern what I care about and value with respect to learning.

2.4. Data Analysis

The Kappa index (k) was used for the cross-cultural validation of the questionnaire. The nonparametric Kendall W test was considered for consensus by expert judgement ($n = 10$). Similarly, the INFLESZ Scale, to evaluate the readability of written texts, was considered to quantify the degree of difficulty in the translation. The expert judgement for validation provided significant

input for fitting the scale ($n = 10$; $W: 0.991, p < 0.01$). After that, the research team debated on these contributions to reach a consensus on the grammatical, linguistic, semantic and legibility dimensions of the scale, measuring the legibility throughout the INFLESZ Scale, obtaining a value >0.40 .

All of the statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS, version 22) (IBM, Armonk, NY, USA), licensed by the Universidad de Castilla-La Mancha. The Kolmogorov–Smirnov test ($n > 50$) displayed a normal distribution of the sample. A descriptive analysis of the data was carried out obtaining Cronbach’s alpha, as well as Pearson’s correlations between measures and the analysis of the variance (ANOVA: analysis of the differences between the members of the groups based on the procedures developed by Fisher) for independent samples, to study the differences in the “academic year” variable, as suggested by Lloret-Segura, Ferreres-Traver, Hernández-Baeza and Tomás-Marcos [34]. A confirmatory factorial analysis has also been performed using structural equations with EQS Structural Equation Modelling Software, version 6.1 (MVSOFT, Los Angeles, CA, USA).

2.5. Ethical Considerations

The research was conducted in accordance with the following ethical considerations: (a) voluntary, confidential and informed participation of participants; (b) the final purpose of the validation study was to have a quality questionnaire to improve the impact of reflective learning at the university; (c) at all times, the research has sought scientific validity in its design, application and data analysis; (d) the commitment to share the results with the participants.

3. Results

3.1. Latent and Factorial Structure

Description and Reliability

The scale latent dimensions manifest response values within the range of 1–5. Means tend to fluctuate, displaying a maximum value of 3.32 on the dimension Expectations and a minimum average of 2.91 on the dimension Environment. In no case does the distribution of responses exceed more than one standard deviation. Table 2 reveals the descriptive statistics and the Cronbach alpha coefficients for each of the eight dimensions forming the questionnaire, that is, Expectations, Language, Time, Model, Opportunities, Routines, Interactions and Environment. As observed in the upcoming table, these values are satisfactory except for the dimension Language, which reveals a moderate value of 0.65.

Table 2. Descriptive statistics and test reliability.

Dimension	Minimum	Maximum	Media	Standard Deviation	Reliability Coefficient
Expectations	1	5	3.32	0.62	0.79
Language	1	5	3.14	0.58	0.63
Time	1	5	3.15	0.69	0.80
Model	1	5	3.20	0.70	0.82
Opportunities	1	5	3.23	0.72	0.85
Routines	1	5	3.03	0.76	0.87
Interactions	1	5	3.54	0.78	0.86
Environment	1	5	2.91	0.87	0.85

Concerning the confirmatory factorial analysis (Table 3), the approximation error to the theoretical model reveals a magnificent fitting (>0.05) on the eight dimensions. With the intention of verifying these results, the analysis of the single-factor model shows acceptable results, which leads us to differentiate the dimensions contemplated in the theoretical model.

Table 3. Confirmatory Factor Analysis indexes of the models.

Models	SBc2	df	NNFI	CFI	RMSEA	90% CI
Model 1Factor	2854.94 **	740	0.811	0.821	0.064	(0.061, 0.066)
Model 8Factors	1389.15 **	712	0.937	0.943	0.037	(0.034, 0.040)

** $p < 0.01$, SBc2 = Satorra–Bentler’s chi-square, df = degrees of freedom, NNFI = non-normed fit index, CFI = comparative fit index, RMSEA = root-mean-square error of approximation, 90% CI = confidence interval of RMSEA.

The saturation calculation (Table 4) of each of the 40 items showed that all the items present an adequate saturation in their corresponding factor (>0.40), except for the second item of Language (L-item 2). Specific feedback, which is slightly lower (0.34), and the third item of this same variable (L-item 3), make use of conditional phrases, reaching a value at the limit of 0.39. The highest saturation (0.84) has been obtained in the second item of the Routine dimension (R-item 2), using flexible, spontaneous and efficient thinking routines.

Table 4. Correlation indexes.

Variables	E	L	T	M	O	R	I	E
E-item 1	0.70							
E-item 2	0.73							
E-item 3	0.73							
E-item 4	0.63							
E-item 5	0.51							
L-item 1		0.57						
L-item 2		0.34						
L-item 3		0.39						
L-item 4		0.60						
L-item 5		0.58						
T-item 1			0.62					
T-item 2			0.74					
T-item 3			0.56					
T-item 4			0.75					
T-item 5			0.67					
M-item 1				0.57				
M-item 2				0.73				
M-item 3				0.72				
M-item 4				0.78				
M-item 5				0.86				
O-item 1					0.73			
O-item 2					0.71			
O-item 3					0.71			
O-item 4					0.76			
O-item 5					0.72			
R-item 1						0.78		
R-item 2						0.84		
R-item 3						0.78		
R-item 4						0.68		
R-item 5						0.71		
I-item 1							0.66	
I-item 2							0.76	
I-item 3							0.72	
I-item 4							0.81	
I-item 5							0.78	
A-item 1								0.78
A-item 2								0.77
A-item 3								0.77
A-item 4								0.54
A-item 5								0.75

The correlation analysis (Table 5) between each of the dimensions composing the questionnaire reveals that the highest correlation was obtained between Opportunities and Modelling ($r = 0.72$) and the lowest between Environment and Language ($r = 0.46$).

Table 5. Correlations between measured dimensions ($p = 0.001$).

Dimensions	1	2	3	5	6	7	8
Expectations							
Language	0.61						
Time	0.63	0.61					
Model	0.62	0.58	0.70				
Opportunities	0.69	0.65	0.71	0.72			
Routines	0.54	0.58	0.59	0.62	0.71		
Interactions	0.54	0.53	0.62	0.68	0.70	0.60	
Environment	0.50	0.46	0.49	0.55	0.60	0.60	0.53

Concerning the one-factor ANOVA, the average scores according to the course range oscillate between 2.2 and 3.68 points, on a maximum rating scale of 6. First- and second-year students are those revealing higher average scores, compared with third- and fourth-year students. In fact, it is the third-year students who feel that the promotion of cultural forces in their training is lower (Table 6).

Table 6. One-factor ANOVA. Independent variable: classroom level.

Dimensions	Class	Media	Standard Deviation	F	Sig	Eta ²	Dimensions	Class	Media	Standard Deviation	F	Sig	Eta ²
E	1	3.47	0.61	16.447	<0.001	0.066	O	1	3.39	0.66	16.340	<0.001	0.066
	2	3.33	0.61					2	3.24	0.71			
	3	3.05	0.58					3	2.90	0.75			
	4	3.18	0.60					4	3.10	0.69			
L	1	3.23	0.57	8.383	<0.001	0.035	R	1	3.12	0.73	9.125	<0.001	0.038
	2	3.19	0.57					2	3.06	0.74			
	3	2.98	0.59					3	2.72	0.79			
	4	2.98	0.57					4	3.05	0.72			
T	1	3.23	0.69	5.508	<0.002	0.022	I	1	3.68	0.78	15.982	<0.001	0.064
	2	3.16	0.71					2	3.64	0.69			
	3	2.96	0.70					3	3.20	0.77			
	4	3.09	0.55					4	3.32	0.76			
M	1	3.27	0.68	5.531	<0.001	0.023	E	1	3.03	0.85	8.543	<0.001	0.036
	2	3.26	0.72					2	2.87	0.88			
	3	2.99	0.73					3	2.59	0.82			
	4	3.13	0.67					4	3.04	0.87			

The Environmental dimension was the lowest rated by the students, with scores between 2.59 and 3.04 points, followed by the Language dimension between 2.98 and 3.23. The Interactions dimension was the best rated by the sample (3.20 and 3.68).

Considering the course of belonging, statistically significant differences can be seen along with the eight dimensions. Regarding the size of the effect, in general, a small size is appreciated (between 1% and 6%), although in the Expectations, Opportunities and Interactions, this size turns into a medium size of the effect (between 6% and 14%).

4. Discussion and Conclusions

The implemented scale reveals itself as a highly reliable instrument, a fact clearly related to the data in previous studies [4,22]. Scientific literature [35] suggests that in initial or exploratory studies, reliability values of up to 0.6 can be valid as well. In the same line of thought, Lowental [36] points out that in scales with few items encompassing a maximum of 10, a reliability of 0.4 can also be

acceptable. Considering these last words, there is only one of the implemented scales in this research with a reliability value close to 0.6, the Language dimension. This fact could be due to several aspects, but the one believed is that there is a possibility that items 2 and 3 were poorly defined. Similarly, item sensitivity to the sense of scale may be due to the fact that, in the university context, feedback is a barely common practice [37]. For example, the use of conditionals can be interpreted differently by pupils in those university contexts where a teaching culture oriented towards the development of reflective thinking is not deliberately disclosed [38]. In any case, this shows that in future applications of the questionnaire, the stability or variation of this indicator should be studied [33].

The evidence of validity reveals that the underlying relational structure of the questionnaire (RMSEA = 0.037; CFI = 0.943) is integrated by eight dimensions in coherence with the established theoretical model [24]. Thus, the number of items and their accuracy to measure the dimension account for their adequate stability [39]. The interaction of item commonalities and sample size are high, resulting in latent dimensions being very well represented [40]. The results of the AFC show that the conceptual reference is well defined. These results are highly comparable to previous studies [4,22]. In the same way, correlations between dimensions that present an adequate behaviour are displayed, leading to the observation that all the latent variables maintain a statistically significant correlation. This observable pattern is linked to the data obtained in a five-year longitudinal study in learning communities in Melbourne, where researchers stated that an exploration of these eight cultural forces provides the conceptual and practical backbone to focus the exploration of thinking for the active construction of student learning and to create a classroom culture [24].

In this validation study, it is possible to establish that the empirical criterion is ideal for the process of validation of the scale through a sample of university students. In consequence, three things can be concluded:

- (1) The instrument displays a high value to discriminate the impact of teacher training oriented to the promotion of reflexive learning. Such criterion represents the degree of adjustment for how the empirical model provides good evidence to the objectives of this study, which is mixed up with the theoretical criterion found in the “why” of the interrelation established a priori in an endorsement to be taken into account [40]. Hence, this questionnaire provides eight dimensions that make it possible to identify students’ perspectives of the enculturation of thought in their initial teacher training (appointment). Nevertheless, this fact should be carefully reviewed in future studies for better adjustment of items and the saturation in each of the dimensions, but especially in those linked to the latent dimension referred to as Language [22].
- (2) The instrument provides valid information to make teachers aware of whether or not they are addressing their students’ reflexive learning. The questionnaire also provides an assessment of each of the cultural forces fostering, at the same time, the development of thinking skills, expectations, language, time to think, modelling, opportunities to think, thinking routines, interactions and the environment. These dimensions represent worthy instruments for professors to get accurate feedback on how students perceive that the mediation of the learning process is favoured with the emphasis on the promotion of thought. The dimensions also provide lecturers information on how to facilitate the reflection of the teaching action, to optimise the educational quality since, as other research has shown, teachers need evidence that makes them aware of the importance of promoting routines and situations linked to reflective thinking [41–43].
- (3) The instrument complements the research efforts to improve the formative processes of university students around reflective learning. Consequently, the obtained results might amplify the intention along with other questionnaires like, for example, the Student Evaluation of Educational Quality scale [44]. Although the Student Evaluation of Educational Quality scale items are dissimilar from the ones implemented in our research, they evaluate eight similar dimensions: learning, enthusiasm, organisation, interaction with the group, updated presentation of the subject, interaction of the teacher with individual students, evaluation and feedback. Though

they are different items [45], they have also been used in a psychometric questionnaire for the assessment of (German) university students.

To sum up, the use of this type of questionnaire is essential to strengthen reflective thinking at university. It contributes to the implementation of successful teaching and learning models [22,24,33,46–49], that is, models that simultaneously facilitate the learning of conceptual domains and the development of cognitive skills such as thinking, language, communication, perception, comprehension and reasoning. Such models are also expected to promote the use of narrative methodologies [42] or the reflective narrative learning through writing [50,51] that expose students to real-life situations, allowing them to approach real problems, to participate in debates and to propose solutions to the given problems. In that matter, universities are responsible for helping future professionals to acquire the knowledge and to develop cognitive/mental skills and habits ensuring trainees to be able to reflect on their own beliefs and decisions. The reason is that trainees need to be aware and critical of their own assumptions, able to engage openly with different cultural forms and historical moments and able to develop problem-solving skills—all in a sustained paradigm of transformational, critical and reflective lifelong learning. Such expectations are established by potential employers expecting employees to own these skills [43].

The promotion of reflective thinking through the didactical implementation of cultural forces in the training of education degree students has little development from quantitative approaches [4,22]. Generally, the vast number of investigations approaching the topic qualitatively [20,38,42] have provided evidence on the benefits of training teachers and leading classroom learning towards reflexive learning about education fostering the professional development of the students. Fostering is barely promoted in quantitative guidance, where research is starting to experience more significant growth, although these studies are still moderate on the impact of reflexive learning of cultural forces [4,22,33].

5. Research Constraints

This research manifests a series of limitations that must be considered when interpreting its results, some of which have been reported in previous similar studies [4,33]. The study constraints are as follows:

- I. Sample limitation. The sample is relevant for the two Spanish university students' population—but only of two public universities—and participants are only students of education degrees. A larger sample with significant values will be part of further research.
- II. Technical limitations. One of the limitations attributed to self-report questionnaires is the possibility of collecting biased responses based on social desirability—these types of instruments tend to measure in retrospect, not in responses collected during the process in which they are generated. Nevertheless, as Tadesse, Robyn and Campbell [47] say, “empirical evidence shows that students are credible sources of information on matters related to what they have experienced in universities and how much they have benefitted from their learning experiences” (p. 10).
- III. Students' thoughts. Further research will be conducted on not only the opinion of the students, but also it would seem necessary to have a more adjusted idea on the promotion of what type of reflective thinking is done in the classrooms: (1) Know the opinion of teachers and contextualise the study, since there might be measures or methodological actions that may be influencing. (2) View complements by a qualitative approach to provide more information on the complexity of the phenomenon studied.

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Article

Academic Literacy and Student Diversity: Evaluating a Curriculum-Integrated Inclusive Practice Intervention in the United Kingdom

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Abstract: The sustainability of universities is based, among other aspects, on their ability to adapt to changes and the needs of students, an increasingly diverse population. In this sense, Academic literacy provision at universities tends to be centralized and to offer language support for general academic literacy purposes rather than language development that responds in a more nuanced way to the particular literacy needs of students' disciplines. Yet, in recent years, several studies have supported the integration of academic literacy into subject teaching outlining the principles of an inclusive model of academic literacy instruction. This paper draws on a theoretical framework developed by Wingate to evaluate a curriculum-integrated inclusive practice intervention in the United Kingdom with students from a first-year credit-bearing module at Middlesex University Business School. The study used a mixed methods approach that includes a literature review, secondary data, feedback questionnaire and a focus group to evaluate our teaching method and reflect on the collaboration of the team members to develop this inclusive pedagogical approach. The findings suggest that, on the whole, this intervention was perceived by both the module teaching team and students as positive, welcoming and often crucial for supporting undergraduate students into the disciplinary discourse of their subject of study. Yet, recommendations were made with respect to developing better guidelines for subject lecturers on how to deliver the integrated academic literacy as well as the importance of the participation of students, student learning assistants and graduate teaching assistants in the design of the intervention. This study contributes to the literature on inclusive practice intervention and pedagogical approaches to integrating academic literacy into subject teaching for a diverse student population, contributing to the social sustainability of the universities.

Keywords: academic literacy; curriculum-integrated design; inclusive practice intervention; student diversity

1. Introduction

Overcrowding, globalization, internationalization and the policies related higher education, have developed a complex and diverse student population in different parts of the world [1–3]. In this environment, the sustainability of universities, understood as their survival in the long term, involves attending to the diversity of their students and being inclusive. Students, entering universities, regardless of their linguistic, cultural and educational backgrounds, struggle to cope with the academic

communicative competence demands of their degree programs. In fact, most of the universities are implementing some form of in-sessional academic literacy support to develop their students' language proficiency [4].

The provision of academic literacy in universities tends towards centralization. Thus, linguistic support is being offered for general academic literacy purposes rather than language development, which responds in a more nuanced way to the particular literacy needs of student disciplines. However, in recent years, few studies have supported the integration of academic literacy into the teaching of subjects that describe the principles of an inclusive model of academic literacy instruction [5,6]. This is in line with Goal 4 of the Sustainable Development Goals (SDGs) that focused on inclusive education skills. In particular, objective 4.4 aims to “substantially increase the number of youth and adults who have relevant skills at different educational levels, including the university” [2]. Besides, this work is also aligned with objective 10 of the SDGs, which is reducing inequality within and between countries. Using inclusive policies in the university that allow students from many countries to access a quality university education reinforces equal development between countries.

Academic literacy refers to the ability to communicate competently in an academic discourse community (being competent in reading and writing on academic subjects). However, Porter [3] argued that this capacity requires the epistemological knowledge of the community, of the genres through which the community interacts, and of the conventions that regulate these interactions. This understanding of academic literacy has two main implications. First, academic literacy must be acquired by all students new in an academic context, whether native speakers or not. Second, outside of the community in which they operate, this literacy cannot be acquired. This means that experts from the discursive community must offer instruction and support to all students [4,5].

In the current university context in the United Kingdom, there is concern for long-term sustainability and there is a wide recognition of the need for student support in order to develop their academic literacy. Thus, an important body of literature has emerged that argues that academic literacy should integrate at the curricular level [4,5,7–10]. Specifically, in the 2017–2018 academic year, the total number of students enrolled in institutions of higher education (HE) in the United Kingdom amounted to 2.34 million. The growth of the sector has led to the configuration of increasingly diverse student populations on both issues, culturally and linguistically, reflecting the so-called “super diversity” [11].

In fact, there are currently 1.88 million students from the United Kingdom, 0.14 million from the European Union (EU) and 0.32 million from non-EU countries [12]. Therefore, there is increasing pressure on British universities to improve the retention, progress and performance levels of this population and to ensure that their academic offer recognizes diversity [12].

As a result, “student experience” has become a central concept in institutional planning. According to a study conducted in 2019 on the experience of freshmen in the United Kingdom, “lack of academic progress” is a key reason why a substantial number of undergraduate students drop out of their degree programs [13].

The integration of academic literacy in teaching subjects has been slow and, so far, the literature includes few examples of this, taken from the United Kingdom, Australia and South Africa [6,14–21]. These publications on educational initiatives of collaboration and specific discipline raise a series of questions. For example, there is no explicit explanation of the teaching methods and theoretical frameworks that support them [4,5]. Therefore, it is not clear to what extent literacy instruction is integrated within the curricula, or if on the contrary it is only a complement to them. In addition, little information is provided on the degree to which English language specialists for academic purposes (EAP), subject teachers and other related persons are involved in literacy. This lack of information makes it difficult for other institutions and individual professionals to learn from these examples and develop similar approaches [4,5].

2. Pedagogical Approaches to Academic Literacy: The Deficit and the Inclusive Collaborative Models

The most widely used approach in academic writing instruction is the Deficit or Skills model. This approach considers writing as a discrete skill and characterizes students as guilty of their “writing defects” [22,23]. Provision is usually carried out in generic workshops of extracurricular academic skills taught by centralized learning development units. These are usually located in the library or in student support services. The skills approach has predominated, as it offers a convenient and cost-effective reference route for “struggling” students. In addition, research on the effectiveness of generic skills workshops highlights that offering students opportunities and successful and enriching adaptive help is correlated with academic success [23–26]. However, generic workshops only capture superficial features of writing and do not address the “pluralistic nature of academic literacy” [27]. Therefore, they neglect the link between epistemology, discipline and language [13,27–29]. By separating writing from its disciplinary context, the skills approach places literacy on the periphery of university study. As a consequence, it contributes to the negative perception that both academics and students may have about their role in disciplinary teaching and learning [4,5].

The Inclusive Collaborative Model is the dominant critical framework for challenging the Skills or Deficit Model. This model emphasizes that literacies are socially located within their disciplinary contexts [28]. Within the disciplines there are very old and very differentiated literacy practices [29–32] in the construction of knowledge, such as research articles [33,34]. Similarly, the reproduction of knowledge has been performed through textbooks [33] and conferences [35]. Proponents of academic literacies affirm that the teaching of writing is most effective when it is within the discipline within which the literacy takes place [4,5,33,34,36,37]. In addition, the acquisition of academic literacy is an incremental process that requires frequent feedback on its development [38]. Therefore, academic literacy, an integral part of disciplinary thinking, is possibly more effective when integrated into the disciplinary culture and delivered longitudinally, using an inclusive and sustainable approach integrated into the curriculum.

Studies of literacy integration in the literature have typically focused on scheduled and specific academic writing interventions that are planned and delivered by teachers of the subject [5,12,39]. These are taught jointly by both professors of the subject and specialists in academic writing [5,40–42]. A common factor in these studies is the importance of collaboration between specialists in academic writing and subject teachers [13,40,43–45]. In fact, academic writing teachers, with their specialized knowledge in pedagogy and metalanguage, are important collaborative partners in the explicit articulation of the different disciplinary ways of building knowledge [13,43–45]. However, perfecting collaborative approaches to integrate academic literacy into subject teaching can be a gradual process. A study conducted in 2002 explained that, in the first instance, literacy specialists and subject teachers generally cooperate in the design of academic literacy materials that are integrated with the teaching of subjects [46]. Over time, this cooperation can lead to a close collaboration in the design of materials and, finally, to teaching as a team the specific academic literacy sessions of the subject.

The key benefit of developing a close collaboration is that writing is placed at the center of disciplinary learning and teaching, providing the best context to identify and address the specific difficulties students have when beginning disciplinary discourse [46].

In order for academic literacy to be integrated into higher education curricula, key stakeholders must be persuaded of the value and feasibility of systematic approaches integrated into the curriculum [45]. A starting point is that the institution’s literacy officers facilitate a better appreciation by all academics of the complexities of social and writing practices in their community and offer them a sustainable model of literacy integration [27]. Wingate [4,5] defends an inclusive model of academic literacy instruction, advocating the adoption of the language of socialization and sociocultural theory as analytical frameworks for interpreting both academic literacy instruction and the systematic and gradual mastery of students from various disciplines, as well as the social and academic background of the defining conceptual basis of university disciplines. For Wingate [4], academic literacy is the ability

to communicate competently in an academic discourse community. This study, as discussed later in the methodology section, used a framework developed by Wingate [5] for the curricular interaction of academic literacy (see Table 1).

Table 1. Framework for Curriculum-Integrating Academic Literacy.

Location	Delivery	Collaboration	Focus	Materials	Participation
Timetabled, credit-bearing (assessed component of content modules)	Subject lecturers; English for Academic Purpose (EAP) teachers	Input/advice from EAP teachers	Literacy conventions; Genres; Text features; Language for the creation of meaning and knowledge	Subject-Specific (Text tasks directly linked to classroom content)	Fully inclusive (Part of regular teaching, learning and assessment)

Source: Wingate (2015:60).

3. Context and Methods

3.1. Study Context: Middlesex University Business School in London

The Middlesex University Business School has a worldwide presence on the university's campus network in London, Dubai, Mauritius and Malta. Currently, only on the London campus, there are students of more than 130 nationalities studying programs at the Business School. The university prides itself on the diversity of its student population. Its mission is to provide a global education that celebrates diversity while ensuring inclusion. In this way it will become a sustainable university. For almost a decade, the University Student Development Unit (LDU) has been collaborating with the staff of the subjects of the entire institution to incorporate academic literacy instruction in the teaching of the subject [47]. This support has normally been that members of the LDU have given ad hoc scheduled sessions on academic writing several weeks before deadlines. However, in 2013, in a review of the Business School programs, it was decided that academic literacy should be systematically integrated into the Business School curriculum. After several months of negotiations, it was agreed that the LDU team would co-design integrated literacy instruction with subject tutors from all departments of the school. The mentality at the faculty level has changed markedly and now the LDU has a central role in the curriculum of the Business School. In the case of the school's largest degree program, BA Business Management, academic literacy would be integrated into a central module in each year of study (first, second and third year).

Our study reports on the literacy intervention integrated in the curriculum in the first-year undergraduate module, with more than 300 students: HRM1004—"Management organizations", in the business management program of the University of Middlesex, London. Integrated literacy was taught in the form of classroom activities and online activities of own access. The materials were co-designed by the LDU tutor and the module leader. Students attended a mandatory 2-hour weekly workshop (around thirty students per workshop) as part of their first-year module, held between October and May 2016. In these sessions, the professors of the subject explored the theory and practice related to entrepreneurship, leadership and management, and organizational behavior. The tutors integrated 6 academic writing activities in class that were directly relevant to the content of the subject and the essay assignment, which was the main written evaluation of the module and represented 50% of the final grade (see Table 2).

The sixth and final literacy session was planned as a consolidation of previous activities to prepare for the presentation of the essay. The pedagogy employed and the integration planning were based on the literature on the integration of academic literacy in the teaching of subjects [12,37,39], but aligned within the Wingate framework [5] for integrated academic literacy in the curriculum.

Table 2. Description of in-class activities and self-access online activities.

In-Class Activities (Delivered by Subject Tutors)	Description
(1) Assessments at university	An introduction to university assessment generally, with a focus on the assessments in the first year of study. This session outlined a clear rationale for the integration of academic literacy in the module.
(2) Reading critically	Students explore differences between a journal article (knowledge construction) and a textbook chapter (knowledge reproduction) from the module-reading list, both texts relate to the topic of 'personality'.
(3) Learning Techniques	Students reflect on their prior learning experiences and relate them to their learning on the module.
(4) Planning and Structuring your Essay	Using models of good practice from student assignments in previous years, students explore the genre features of essay writing and discuss, at a conceptual level, how they might structure their essays.
(5) How to paraphrase, cite and reference	Students explore the features of effective paraphrasing and summarizing and build an understanding of the conventions of the Harvard system of referencing
(6) Literacy session	A consolidation of previous activities to prepare for the presentation of the essay
Self-Assessed Online Activities (compulsory)	Description
(7) Time Management Questionnaire	Introductory online activity designed to introduce the students to the online materials interface and allows them to reflect on their previous learning experience.
(8) Reading at the University	Additional self-access online activity linked to in-class reading activity.
(9) Learning style questionnaire	Additional self-access online activity linked to in-class learning techniques activity.
(10) Referencing tutorial	Additional self-access online activity linked to in-class referencing activity.

Source: compiled by the authors.

In applying the Wingate framework [4,5], the literacy component focused on literacy conventions, genres, text characteristics and language for meaning creation. Everything was directly related to the content and evaluation of the subject Business Management. Unlike other previous studies on the integration of academic literacy in the context of the United Kingdom, our study involved not only the collaboration between writing instructors and subject tutors, but also included the contribution of the postgraduate teaching assistant (GTA) and student learning assistants (SLAs) in the module. This is an additional aspect to the framework developed by Wingate. Student learning assistants are other experienced students who have previously been identified by their academic tutors as highly motivated and capable students. They work in conferences, seminars, workshops and small group sessions to help students in their learning. Graduate teacher assistants are graduates of Middlesex University who work to assist academic staff in providing additional support for students, such as face-to-face sessions, online support and assistance to academic staff in the development, production and delivery of materials of the program and the collection of data and information from programs and modules.

All integrated activities were directly linked to the criteria for qualifying the trial (see Table 3). An additional 30% of the final grade consisted of two online tests (in December and April), which assessed students' knowledge of the content of the classroom and independent study. The remaining 20% was participation, which included academic literacy activities online, in class and self-access.

Table 3. Linking the essay marking criteria with academic writing activities.

Criteria	Excellent +70%	Good 60%–69%	Average 50%–59%	Pass 40%–49%	Fail –39%
Introduction: your introduction provides a clear idea of what your essay will be about, what theories will be presented and what structure the essay will take (4)					
Theories are relevant and considered appropriately to answer the question. Show good understanding of theories and reading related to the topic (2, 3, 8, 9)					
Evidence and Use of Research: Academic sources are used appropriately to support argumentation (2, 5, 6,10)					
Appropriate use of academic writing (5, 6)					
Focused on question set (1, 4, 6)					
Citations and references are used adequately (5, 10)					
Conclusion: there are logical arguments and ability to respond to the main question (4, 7)					
<i>General Comments</i>					
Final Grade					

Source: compiled by the authors.

As seen in Table 2, the interactive online materials were created as a follow-up of classroom activities, providing students with more independent learning opportunities, facilitating both information acquisition and knowledge building [48]. It was also considered that students would welcome the integration of technology into the learning environment [42], as several studies have shown that students believe they benefit from the inclusion of technology in their learning [49] and “They appreciate the contributions that technology can make to improve their undergraduate education” [50]. The software used for online self-access materials was “Articulate Story Line”, a program designed for non-expert technologists to develop interactive materials for teaching and learning.

3.2. Methodology: Participants, Procedures and Data Analysis

The study was conducted in four phases for twelve months. In the first phase, a literature search was conducted to obtain a common understanding of the conceptualizations and approaches of academic writing in higher education. This served to design the research methodology. In the second phase of the study, an analysis of the secondary data of student participation in online activities in class and self-access was carried out, along with their qualifications in their academic essays. A scale of 1%–100% was used, where 40% is a pass and 70% is a first or distinction. We presume that student participation in online writing activities, both in class and freely accessible, is associated with their grades in their academic essay.

Of the 324 students in the module, 166 participated in the study. The sample surveyed was composed of 88 women and 78 men, with an age of 18 to 45 years. 38% of the sample were mature students (over 21 years old). More than half (53%) of respondents were residents of the United Kingdom, 29% were residents of the EU and 12% did not belong to the EU. Only 6% of the sample did not answer the question about their residence. In relation to the “ethnic” dimension of the sample of respondents, 34% of the students were white, 31% Asian and 28% African black from the Caribbean,

followed by 2% Arab and 2% from other ethnicities. This indicates the diversity of the cohort and is representative of the wider student population of the University of Middlesex.

During the third phase of the study, we conducted a feedback questionnaire with 166 students (the same sample as in Phase 2). A 5-point Likert scale (1 = strongly agree and 5 = strongly disagree) was used to assess the effectiveness of online and classroom access. The questionnaire was completed in class and the students voluntarily completed it. First, students completed a data form designed to obtain information about their gender, ethnicity, residence and age. The remaining questions were related to whether literacy content in class and online activities was presented at an appropriate level, if there were clear instructions, if activities were increasing interest in writing and if these activities were helping students with their academic studies and writing development. An open space was provided in the questionnaire where students were asked to write about their general perceptions and attitudes about integrated literacy content in class and online, as well as recommendations for future cohorts.

In the fourth phase of the study, a group discussion was held with the module's teaching team, which included the module leader, two subject teachers, an LDU academic writing teacher, a GTA and an SLA. The focus group schedule included open-ended questions and participants answered questions related to students' academic literacy and their participation in online class and self-access activities. The six participants were asked to take turns discussing the questions. The focus group was used to complement and contrast the information obtained from Phases 1, 2 and 3.

Ethical approval was obtained from the University of Middlesex and the participants, which included informed consent, confidentiality and "responsible" research practice. The information collected in the focus group was recorded and transcribed. The statistical package for the social sciences (SPSS) was used to analyze the relationship between student participation in online activities and in self-access class, and grades in the academic essay and student perceptions taken from students' feedback questionnaire data. Thematic analysis was used for qualitative data to identify topics through an iterative process of comparison and juxtaposition in a smaller number of higher order categories. The key issues were identified from the feedback questionnaire and the focus group and were refined as the analysis evolved. This analysis was a recursive rather than linear process that involved a constant round-trip movement between the entire data set, the issues and extracts of the data we identified and the data produced. The qualitative results were organized into four main themes: (1) the experiences of the students and the teaching team, (2) the preference for certain activities, (3) access to additional writing resources and (4) the experience of teaching academic writing in collaboration.

4. Research Findings and Discussion

4.1. Experiences of the Students and the Teaching Team

In general, students' comments indicated that they saw both classroom and online activities in a very positive way:

'The activities helped me to build my self-confidence with writing', 'helpful activities', 'I strongly recommend them', 'they were enjoyable and interesting'.

Of the 166 students who answered the feedback questionnaire, 75% felt that both their own online access and class activities were enjoyable, with only 16% of the sample disagreeing and 9% of the sample neither agreeing nor disagreeing. In addition, of the 166 students who participated in the feedback questionnaire, 77% stated that class and online activities were performed at the correct level. Only 18% of the sample did not agree, and a small number of students (5%) did not agree or strongly disagreed. Generally, students felt that the integrated activities had contributed significantly to their academic literacy development [4,10–13]. As one student pointed out:

“The online and in-class activities were great, so clear and simple to understand each aspect. We learn how we could successfully write the essay; this really helped me in this module as well as in my other modules. It was just amazing.”

However, a small minority did not find the writing activities as useful or necessary for their academic literacy development and requested that these activities be additional learning material available outside the module. For example, a mature student commented:

“On occasions, I felt that some of the activities were the wrong level. While I appreciate that the course must cater for all students, I expected more content in the module, rather than instructions on how to write essays.”

In this sense, this small number of students perceived academic literacy as a separable skill, distinct from disciplinary teaching and learning [22]. However, most of the students felt the benefits of having literacy activities integrated in the teaching of the subject [4,5,33,34,36]. Respondents in the discussion group were also interested in emphasizing the beneficial aspect of students participating in online and classroom writing activities. As one of the professors of the subject observed:

“Well, I can see that students have benefited from these activities, their academic essays have a better quality than of students from previous years.”

Another example of this is found in a statement made by the GTA who commented:

“I think we all agree that there is a need to develop writing skills for 1st year students and the idea to incorporate writing within the workshops is a really good idea because it introduced them with writing at university and gives them confidence in developing skills.”

This supports the well-established argument that today's students need support with their academic literacy development and that the provision must be integrated into the subject teaching [4,5,10–12]. However, the SLA that participated in the focus group discussion highlighted the differences between the expectations of mature students and their younger counterparts:

“We need to take into account that there is a clear difference between mature and non-mature students as the mature students find the academic writing activities unnecessary, but the others as well as international students find this crucial, it is very difficult to keep a balance as you have different type of students with different needs.”

Exploring the topic further, a subject lecturer replied:

“Well, I think some students have benefited more and others less, but overall I can say that even mature students needed academic writing skills, after looking at the first submission of their essays I could see that they didn't understand the nature of the questions, even if they were mature, they didn't have the experience in academic writing.”

This supports the view that both systematic and inclusive models of academic literacy integration can benefit all the students [4,10–13].

One aspect not captured by the feedback questionnaire, but that was identified by the focus group discussion, was that sometimes, students underestimated the importance of the development of academic literacy and the complexity involved in the processes and practices involved in the academic essay production. Thus, one of the professors commented:

“I think they don't understand the importance of what we teach, it looks a bit basic, they find this a waste of time, and I think they take it for granted that it is one of the most fundamental things to learn at university . . . they should appreciate that we are explaining this because it will help them at university and beyond.”

In this respect, the findings suggest that although subject lecturers understood the importance of academic writing in the curriculum, some students underestimated its significance. Following this and to explore the extent to which students benefited from the academic writing activities, a correlation Pearson's analysis was conducted looking at the relationship between students' participation in the in-class and self-access online activities and essay performance. As observed in Table 4, the Sig. (2-Tailed) values are 0.003 and 0.019. With this value at less than 0.01, we can conclude that there is a statistically significant correlation between students' participation in the self-access online and in-class activities and essay performance. These findings are consistent with previous studies that suggest that students who have participated in writing activities had made progress in their assessments [12,41]. However, the findings show a weak relationship between in-class activities and essay performance ($r = 0.228, p > 0.01$). Moreover, there is a weak correlation between the variables online activities and essay performance ($r = 0.183, p > 0.01$).

Table 4. Correlations.

		Essay Performance
Online activities participation	Pearson Correlation	0.228 **
	Sig. (2-tailed)	0.003
	N	166
In-class activities participation	Pearson Correlation	0.183 *
	Sig. (2-tailed)	0.019
	N	166

** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed). Source: compiled by the authors.

4.2. Preference for Certain Activities

It is interesting to note that students rated the activities in class as more useful than the online activities of their own access. While 79% of the students agreed or strongly agreed that class activities helped them develop their academic literacy, only 66% of the sample did so with online self-access activities:

"With the in-class activities we were able to learn more actively and also it kept us engaged with the tutor."

"The in-class activities were more useful than the online games. In fact, the online activities needed better instructions and there were some technical problems. Well, the layout was not very good as you had to scroll to the sides to see the questions."

This is in line with Wingate and Dreiss [42], who suggested that, although online tools can offer useful development opportunities for students, face-to-face support is also needed. The results of the feedback questionnaire indicated that the vast majority of students spoke of clear instructions in academic writing activities, with a better response for classroom activities (76%) than for online activities (73%). This was also raised in the focus group discussion, where one of the professors argued:

"I think the main problem is that with the online activities, students have a weekly commitment to work outside the classroom to complete the activities; that is why I think they don't like the online activities."

From the comments of the interviewees, it became clear that they considered that some activities were more useful than others:

"I have had a look at students' feedback and I can say that some students highlighted that there were several activities that were very useful, for example the workshop that was delivered by the tutor from the Learner Development Unit as well as the one about structuring your essay. Well, regarding the

online activities the activities that students liked most were referencing and citations and adequate vocabulary for academic writing."

The results of the feedback questionnaire revealed that the class activities students considered most useful were: evaluation in the university (86%), planning and structuring of their essay (82%), learning (77%), teaching on how to cite and reference (71%), followed by how to use academic words and reading in college (67%) and how to paraphrase (60%). On the other hand, in terms of online activities, the activities that were considered most useful were: reference tutoring (70%), university reading (66%), learning styles (65%) and time management questionnaire (59%).

4.3. Access to Additional Writing Resources

Another emerging issue was the notion that students accessed different additional writing resources outside their study program. In particular, the LDU professor who participated in the focus group discussion mentioned that he noticed an increase in the students of the module who reserved academic writing tutorials in his department:

"I notice from this module a considerable number of students were booking tutorials and it appears that in comparison with other 1st year business and management modules, we have more bookings, specifically after they got their feedback from their first submission. I don't mean hundreds of students but just I notice a considerable number of them which is good because it indicates to some extent that the LDU working on their modules and programs has an impact on engagement."

This evidence shows that a significant number of students considered their academic literacy development as an integral part of the development of their disciplinary knowledge. They also recognized the LDU as a useful development resource for seeking self-directed help [24,25]. However, focus group participants highlighted some recommendations to further improve student participation. As the module leader noted:

"I think we need to promote what we are doing. I don't see many people accessing the online activities, so maybe from module leader and tutors, to promote that side of learning and structure of the activities, and what they will gain from the activities. And if they see a rationale behind it they will be more motivated."

Regarding online activities, the study suggests that the low participation of students was due to the low level of participation of teachers in online activities [42]. In addition, participants in the focus group discussion considered it crucial to reevaluate class and online activities in a participatory approach for the next academic year. They also emphasized the importance of including students in the design of academic literacy integrated in the curriculum in the module. One of the tutors of the module suggested that:

"We need to include students in the design of the module, well we need to reflect on how to improve the activities, we need to include more activities on how to structure your essay, and help on how to get a good grade and language style, maybe less on assessments at university."

4.4. The Experience of Teaching Collaboratively Academic Writing

Another interesting topic identified by the participants in the focus groups was the experience of subject teachers who teach academic literacy. During the academic year, an LDU writing teacher prepared the academic writing materials in collaboration with the module leader. The module teaching team then delivered the integrated materials following the instructions and guidance provided by the LDU. The discussion that arose was related to whether the professors of the subject were skilled enough to teach academic literacy:

"I think X's [LDU staff member] session was good, this leads me to the idea that the integration of writing skills is very important but wonder whether we are the right people (module tutors) to teach

that topic, because yes, we have written essays, and we know what is required for academic writing but teaching is different and I wonder if it is better to get X or somebody else like him to run those sessions."

Another subject lecturer responded to the issue slightly differently by commenting:

"To be honest, I am quite happy to carry on like this, to keep the in-class activities because they are first-year students and they may agree that obviously people from the LDU can do it better than us, but these are first-year students and the material is going to be quite basic anyway."

These findings demonstrate that refining collaborative approaches to integrate academic literacy can be a slow and heuristic process [46]. It also highlights the importance of close collaboration between writing instructors and subject tutors in the design and delivery of integrated literacy [13,40,44,45].

5. Conclusions

Sustainability in the study programs in universities involves addressing tasks such as inclusive academic literacy. This study provides evidence of the evaluation of an inclusive academic literacy intervention integrated into the curriculum [4] that combines multiple delivery methods (classroom and online activities).

In general, the integrated activities were perceived by both the staff of the subject and the students as positive, welcoming and often crucial to support the induction of university students in the disciplinary discourse of their subject matter [10,28]. Statistical data show that there is a relationship between student participation in activities and essay performance, although this relationship is weak. However, the study was limited to the first year of the program and, therefore, was only able to measure the early stages of initiation in disciplinary discourse, an incremental process that involves frequent comments on development [30].

Another interesting finding was the increased participation of students with academic literacy development opportunities outside their study program, suggesting that the integration of literacy at the curriculum level made students more aware of the importance of academic literacy in their learning in general and created greater opportunities for success seeking adaptive help [25,26,34].

The findings also draw attention to the need to reevaluate online activities in the classroom and self-access. Additionally, the possibility of redesigning the module in a participatory approach, using data from the questionnaire, student feedback and the comments and recommendations of the broader teaching team of the focus group discussion, must be considered. In fact, some participants recommended several improvements that could be made to writing activities. In particular, these recommendations were related to the importance of developing better guidelines for subject teachers on how to offer the integrated component of academic literacy, as well as advocating for student participation in module design [12,46].

In addition, the results demonstrate that perfecting collaborative approaches to integrate academic literacy by being a slow and heuristic process requires close collaboration between writing instructors and subject tutors in the design and delivery of integrated literacy [13,40,44,45].

Therefore, this study contributes to the literature on inclusive procedural and pedagogical approaches to integrate academic literacy into the teaching of the subject. Here, we demonstrate that inclusive and innovative ways of leaving no one behind can have significant repercussions for the teaching–learning process, for the student’s experience and for the reputation of universities [1–3]. Based on the findings, it can be argued that there is a need to develop inclusive and sustainable collaborative teaching patterns and practices that can help subject teachers integrate academic literacy into their curricula and reflect on the importance of including a broader teaching team (for example, SLA and GTA) and students in the design of literacy integrated into the curriculum. These contributions are in line with the demands of the United Nations, which pay attention to the sustainable development in teaching at universities [51,52].

In addition to practical concerns, we believe that longitudinal research should be conducted to better assess the development of student academic literacy throughout the program's life cycle (for example, during the duration of their bachelor's degree program). More qualitative and quantitative studies should also be performed to review and compare the different levels of integration of academic literacy in different disciplinary areas of higher education in the United Kingdom and worldwide in order to identify the characteristics of 'good practice' so as to ensure an inclusive collaboration practice of the intervention.

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