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Article

Competencies in Education for Sustainable Development: Exploring the Student Teachers' Views

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Abstract: In the context of higher education, over 100 universities have signed international declarations and have committed to embed sustainability within their operations, outreach, education and research. However, despite the declaration of good intentions and policy developments at the national, regional and international level, little has been achieved in terms of embedding education for sustainable development holistically in the curriculum. To date, a number of research studies have focused on the perceptions and views of university students in relation to sustainable development knowledge, skills and competencies; however, few studies have focused on student teachers' perceptions of education for sustainable development. The aim of this study was to explore the perceptions and views of a group of thirty-two student teachers in relation to education for sustainable development competencies. The research instrument used was a questionnaire. This study provides evidence on the education for sustainable development (ESD) competencies that student teachers would prioritize in a school project related to ESD: acquisition of knowledge and practical skills related to nature and natural sciences, to the detriment of other types of learning, such as the promotion of ethical values, positive attitudes towards sustainability and the management of emotions among their future primary school students. Existing ESD theoretical frameworks need to become more alive and integrated within the existing teacher education curriculum to promote the awareness and development of ESD competencies amongst student teachers.

Keywords: education for sustainable development; professional competencies; teacher education; student perception; higher education

1. Introduction

International and national agencies have recognized the role of education in building societies based on values of equity, social justice and sustainability and have developed strategies and action plans [1–3]. The declaration of the United Nations Decade on Education for Sustainable Development (UNDESD) 2005–2014 represented a lever for the integration of sustainability in all sectors of education across the globe. Several papers and publications have reviewed the policy context and contributions that different countries and regions are making to the UNDESD [4–6]. The UNDESD has encouraged and offered leadership, recommendations and guidelines to embed the principles of education for sustainable development (ESD) within educational policy and programs. However, it is not a mandatory law; hence, the systematic implementation and evaluation of advancements internationally and nationally remain great challenges [7,8]. While notable advances have been made in the area of ESD, the embedding of ESD holistically within the curriculum remains to be done [9], which means environmental management, curriculum greening, formal curriculum, social learning, students' competencies, ethos and organization. The potential of ESD to shape a sustainable future remains critical with the end of the UNDESD. In a world facing increasing complex sustainable development challenges, it is as important as ever to make use of the promise that ESD represents. The ESD journey will continue after 2014; the 2014 ESD World Conference in Nagoya (Japan) therefore not only marks the end of the ESD decade, but an important milestone for pointing the way ahead [10].

The principles of ESD have been widely discussed by several authors. These are those of futures thinking, critical and creative thinking, participation in decision-making, partnerships, interdisciplinary and systemic thinking [11]. In an expert review commissioned by UNESCO [12], key learning processes aligned with ESD are those of collaboration and dialogue, engagement with the "whole system", innovation and active and participatory learning.

Integrative and interdisciplinary teaching and learning approaches that can foster sustainability skills, such as problem solving, critical thinking, action competence and systems thinking, seem appropriate because of the complexity that sustainability presents [13,14]. Furthermore, transformative social learning is required to deconstruct existing ways of knowing and understanding, to critically reflect on the values, beliefs and worldviews that underpin them and to co-construct new shared meanings that can contribute to sustainability [15–17]. If we think about sustainability as a learning process, lifelong learning is essential as the means to learning to know, learning to do, learning to live together and learning to create generative learning communities towards sustainability [18,19]. Systems thinking has been widely discussed as a fundamental element of ESD. The ability to see the interconnections between different dimensions (environmental, development, social, economic, cultural) and the complexity of systems and situations can contribute to the effective problem-solving of sustainability issues [20,21]. ESD is about providing real-world learning opportunities, engaging people in the affective, cognitive

and practical domains, and it therefore requires a shift of current thinking, values and practices of individuals, organizations and society [22].

In the context of higher education (HE), over 100 universities have signed international declarations, such as the Taillores Declaration, Halifax Declaration and Lüneburg Declaration, and have committed to embed sustainability within their operations, outreach, education and research [8,9]. It should be noted that few of these declarations make a strong reference to the promotion of interdisciplinarity in the curriculum or students' experiences [23]. Despite the declaration of good intentions and policy developments at the national, regional and international level, little has been achieved in terms of embedding ESD holistically in the curriculum.

To date, a number of studies have been published on university students' understanding, perceptions, knowledge and attitudes relating to sustainable development [24–27]. This provides evidence for students' increasing interest in, expectations of and demands for learning about sustainability [22]. However, few studies have focused on the perceptions of student teachers regarding ESD competencies [28,29]. Exploring student teachers' perceptions of ESD is critical, because they are those in charge of leading and implementing educational programs and because of the need to provide evidence-based research that can inform teacher education and HE policy and practice in ESD [1].

This paper presents research conducted with 32 teacher education students with the aim of exploring: (i) student teachers' perceptions of ESD competencies; and (ii) the ESD competencies that they would prioritize in a school project. First, we review existing research related to learning outcomes, competencies and sustainability literacy. We also suggest a theoretical framework for ESD competencies. Second, we outline the method, the background of the study and the research tool used, a questionnaire distributed to teacher education students to explore their perception of ESD competencies. Third, we introduce the research results and the discussion. Finally, we provide the conclusions of this study and a set of key implications for studying the development of ESD competencies amongst teacher education students.

2. Learning Outcomes, Professional Competencies and Sustainability Literacy

Emergent research in the field of sustainability in HE has explored the learning outcomes and competencies that educational programs need to seek to develop in students for them to become change agents towards sustainability [30–33]. However, it is not possible to describe a mandatory set of competencies for sustainability, because of the variety of the definitions of the terms sustainability and competence in educational settings [30]. Despite the divergence in the usage of different concepts, such as abilities, learning outcomes and competencies, and the existence of some criticisms around the usage of these terms, there is a need to define competencies in sustainability and ESD in order to foster curriculum developments for ESD [33]. Wals [16] introduces the elements of sustainability competence, or *Gestaltungskompetenz*. This term has been used by German educators in the field of sustainability and is based on *Gestalt*, which means mind-set. It expresses the abilities and competencies of students in contexts of sustainability and can be defined as the ability to shape future scenarios by active participation in modelling and transforming society towards sustainable practices [34]. According to Wals [16], the elements of sustainability competence are: competence to think in a forward-looking manner, to deal with uncertainty; competence to work in an interdisciplinary manner; competence to

achieve open-minded perception, trans-cultural understanding and cooperation; participatory competence; planning and implementation competence; the ability to feel empathy, sympathy and solidarity; competence to motivate one's self and others; and competence to reflect in a distanced manner on individual and cultural concepts.

Developing these competencies amongst graduates is particularly critical to the development of sustainability literacy [14] and students becoming positive change agents in their workplace and personal lives [31]. The use of certain types of pedagogies and teaching and learning approaches and strategies fosters the competencies or skills necessary to deal with sustainability, such as critical and creative thinking, problem-solving skills, action competence, collaboration and futures thinking, therefore creating empowered and globally-responsible citizens and professionals who can become active change agents [16].

In terms of learning outcomes, Sipos *et al.* [31] developed the transformative sustainability learning (TSL) framework and conducted three case studies on courses related to sustainability and citizenship. They concluded that courses that were engaging students in a cognitive, psychomotor and effective sphere enhanced TSL [31]. Weik *et al.* [33] conducted a literature review of existing studies and frameworks of competencies in sustainability and developed an integrative framework of key sustainability research and problem solving competencies, namely "systems-thinking competence, anticipatory competence, normative competence, strategic competence, and interpersonal competence" (p. 205). Other research in the area has also developed competence frameworks for specific subject areas: engineering [35,36], teacher education [28,37] and educators at all levels of education by the United Nations Economic Commission for Europe (UNECE) [38].

Cebrián and Junyent [28] developed a theoretical framework of the professional competencies in ESD and elaborated seven key components:

- Future/alternative scenarios visioning: understanding the different scenarios, possible futures, promoting work with different visions and scenarios for alternative and future changes.
- Contextualizing: taking into account the different dimensions of a problem or action, the spatial dimension (local-global) and the temporal dimension (past, present and future).
- Work and live with complexity: the ability to identify and connect the ecological, economic and social dimensions of problems. Generate the conditions for systems thinking in the school environment.
- Think critically: creating the conditions for critical thinking to question assumptions and to recognize and respect different trends and views in different situations.
- Decision-making, participation and acting for change: moving from awareness to action; sharing responsibilities and engaging in joint action.
- Clarify values: values clarification and strengthening behavior towards sustainability thinking, mutual respect and understanding of other values.
- Establish a dialogue between disciplines: developing teaching and learning approaches based on innovation and interdisciplinarity.
- Manage emotions and concerns: promoting reflection on one's own emotions and as a means to reach a deeper understanding of problems and situations.

Research has also looked at the inclusion of sustainability competencies in the program descriptors of undergraduate degrees [36,39,40]. Thus, the relevance of developing key competencies in sustainability and ESD has also been acknowledged by international agencies, such as [1] and [41]. For this reason, UNECE commissioned a group of ESD experts to develop a framework of ESD competencies for educators [38]. However, as this is a relatively new and emerging area of research, little evidence exists on the development, outcomes and impact that courses introducing students to these competencies have [33,42]. Further empirical research is needed on the development and implementation of assessment tools for sustainability competencies [28,37]. A tendency has existed to focus on developing competencies' frameworks without paying sufficient attention to the individual and cultural context and an organizational change process required to achieve embedding ESD [30,43]. Developing innovative courses that consider sustainability competencies could foster transformative learning amongst students, but also engage stakeholders and the community and, in turn, contribute to generating organizational change in the context of HE by opening up innovative program designs [30].

3. Method

3.1. The Research Background

The Bologna process was started in 1998 in Europe. It was based on a set of ministerial meetings and agreements between European countries to ensure comparability in the standards and quality of higher education qualifications. From this process, the European Higher Education Area (EHEA) was created with the common goal of creating a European space for higher education in order to enhance the employability and mobility of citizens and to increase the international competitiveness of European higher education [44].

In Spain, similarly to what happened in other European countries, existing university degrees were reviewed and modified accordingly to European standards. The academic year 2009–2010 led to the final implementation of the EHEA. In the Faculty of Education at Universitat Autònoma de Barcelona (UAB), five university diplomas were converted into two university degrees: Primary Education and Pre-School Education. In the research presented in this paper, we focus on the Primary Education degree at UAB and aim to explore the student teachers' perceptions of ESD competencies. These students have not received specific training on sustainability or ESD. No specific ESD course or subject exists as part of the Primary Education Degree. There is a science education subject, which includes environmental issues and provides broad environmental knowledge, but without explicit reference to ESD processes and practices.

The renewed curriculum set a number of professional competencies that need to be developed throughout this university degree. These competencies were formerly identified by the Spanish Education Ministry [45] and described in the Verification Report of the Degree in Primary Education [46]. A total of 101 competencies are divided into general competencies from UAB (4 generic competencies in total); specific or professional competencies of the degree (18); transversal competencies of the degree (9); and competencies to be acquired in specific degree courses (70). Table 1 summarizes the competencies included in the Verification Report that make explicit reference to ESD.

Table 1. Professional competencies related to education for sustainable development (ESD) in the Primary Education Degree at Universitat Autònoma de Barcelona (UAB).

Official document	Competence description
Cross-curricular competencies recognized by the Faculty of Educational Sciences at UAB	Maintaining an attitude of respect for the environment (natural, social and cultural) to promote values, behaviors and sustainable practices that address gender equality, equity and respect for human rights.
Professional competencies of the Bachelor's Degree (Ministerial Order in Education–Ref. Num. ECI/3857/2007)	Value individual and collective responsibility in achieving a sustainable future.
Professional competencies in specific modules (Ministerial Order in Education–Ref. Num. ECI/3857/2007)	Recognizing the mutual influence between science, society and technological development and citizens' behavior relevant to promoting interest and respect for the natural environment and ensuring a socially and culturally sustainable future.

The creation of the EHEA provided the opportunity to incorporate sustainability competencies in the higher education curriculum. The new educational model offered by the EHEA focuses on student-centered approaches to teaching and learning and developing students' competencies. However, the incorporation of sustainability competencies in the formal curriculum has not necessarily translated into real change of practice towards embedding ESD, which involves promoting active and participatory learning, systems thinking, critical thinking, innovation and interdisciplinary practice [12].

3.2. Research Instrument

This research is based on an exploratory case study, where 32 teacher education students at UAB were surveyed. This study was exploratory, and a questionnaire was designed with the aim of exploring teacher education students' perceptions of ESD competencies. The questionnaire was distributed during March 2010. The research participants were a group of 32 students in their 3rd year of the Primary Education Degree at UAB.

The designed questionnaire started with an initial hypothetical situation of ESD at a primary education school (Box 1). No explicit reference to ESD was made in order to avoid influencing the answers of the students.

Box 1. The context proposed.

> I'm Martha, a primary school teacher. Last year, in a school meeting, the teachers of the science committee were asked to prepare a new thematic/monographic project for the next academic year.
>
> Right next to the school, there is a forest, so I thought it could be a good opportunity to design a project related to this space. My idea interested the other teachers, so this year, the guiding theme we are going to engage in will be "Let's make the forest more alive and smile!" This monographic is related to the primary education curriculum.

A total of six questions, related to the proposed context, were then asked of the students: three open questions to explore the perception of the students on ESD competencies, two questions to prioritize

and/or select competence elements and one descriptive question about sustainable schools. The questionnaire questions were the following:

(1) Imagine that you participate in this project. Could you define four learning objectives to be achieved in its development?
(2) What content do you think that students could learn in this project?
(3) Think about at least four professional competencies that you would need to mobilize as a teacher. Justify briefly why you have chosen these competencies.
(4) What do you think you should actively promote in this project? Prioritize from a high to low level of importance (from 1 to 12).
(5) Choose four competencies that should be developed by the students in an ESD school project.
(6) Imagine a sustainable school. Write 10 words to describe it.

This paper presents the results obtained from Questions 1, 2 and 4 of the questionnaire. The data obtained from Questions 1 and 2 of the questionnaire were analyzed together. The analysis process consisted of a qualitative thematic analysis and was based on an inductive-deductive process. The qualitative data analysis software Altas.ti was used to collate and analyze the data.

Learning objectives and content listed by the students in Questions 1 and 2 of the questionnaire were treated as separate units of meaning, excerpts written by students that have an explicit meaning by themselves and that any reader could understand and interpret in the same way. Therefore, each unit of meaning is a learning objective or content proposed by students. These elements provide information on what competencies the students would prioritize and/or promote in a professional situation close to real educational practice. Therefore, these questions allow us to explore their views and perceptions of ESD competencies.

The competence framework used to conduct the analysis was based on conceptualization of the term competence of the Organization for Economic Co-operation and Development (OECD) Program Definition and Selection of Competencies (DeSeCo). Therefore, the categories were established deductively from DeSeCo's definition of competence "the mobilization of cognitive and practical skills, creative abilities and other psychosocial resources, such as attitudes, motivation and values" [47]. Table 2 shows the competence' dimensions (the categories) and a brief description.

Table 2. Competence dimensions.

Knowledge	**Refers to the cognitive sphere, the fact of knowing certain concepts**
Practical skills	Refers to procedural, general work and problem solving skills. Other skills, such as communication skills, social change and action competence. Procedures, methods, strategies, tools and techniques that go beyond knowledge.
Ethical values	Refers to normative principles that govern and regulate the behavior of people at any time and situation. Values refer to how people think they should interact with other people, in the society and between society and nature.
Attitudes	Refers to the tendency to behave in a certain way in relation to specific stimuli, external or internal situations. For example, acquiring an attitude of valuing others, dialogue, participation and cooperation.
Emotions	Refers to self-awareness and knowledge of self, the feelings and emotions that govern us.

The subcategories (presented in Section 4.1 of the paper) emerged inductively from the data obtained. The results from the analysis were then linked to the theoretical framework on professional competencies in ESD elaborated by Cebrián and Junyent [28] (see Table 5 in Section 4.1).

In Question 4, students were asked to prioritize twelve competencies listed below (see Table 3). The list included: transversal competencies (4), ESD competencies (5) and science education competencies (3). The aim was to explore what competencies students would prioritize in a project not explicitly related to ESD. These competencies were distributed in a disorderly manner in the questionnaire.

Table 3. List of competencies in Question 4 of the questionnaire.

Competencies	Subcategories
Transversal competencies	• Promoting reflection and individual and collective responsibility. • Putting emphasis on the intellectual development of students. • Developing habits and attitudes favorable to the promotion of healthy lifestyles, at the personal and community level. • Working transversally from different perspectives and areas of a situation or problem and interrelating them.
ESD competencies	• Promoting the ability to act and make decisions. • Raising awareness and environmental awareness amongst students. • Thinking about different scenarios or alternatives to a situation or problem at a local and global scale. • Fostering in students a sense of belonging to the environment. • Promoting a critical analysis of some phenomenon or subject positioning one's self to argue for and respect different points of view.
Science education competencies	• Explaining and interpreting phenomena scientifically and identifying appropriate explanations and predictions. • Observing facts and/or phenomena, identifying evidence and contrast data. • Analyzing the impact of human activities on the environment and suggesting improvement actions.

4. Results and Discussion

The study results and the discussion are presented in this section. First, in Section 4.1, the results from Questions 1 and 2 are outlined. The correspondence between the subcategories emerged from the data, and Cebrián and Junyent's (2014) framework on professional competencies for ESD is discussed and presented in a summary table. Finally, in Section 4.2, the results obtained in Question 4 are presented.

4.1. Questionnaire Results: Perception of Student Teachers on ESD Competencies

Learning objectives and content listed by participating students in Questions 1 and 2 of the questionnaire were treated as separate units of meaning, excerpts from students' questionnaire responses that have explicit meaning by themselves.

Table 4 shows the categories and subcategories that emerged from the data analysis; in brackets are the total units of meaning for each category. Total units of meaning for each subcategory and exemplifications of students' quotations for each subcategory are also presented in the table.

Table 4. Results obtained in Questions 1 and 2 of the questionnaire.

Category (total units of meaning)	Subcategories	Units of Meaning	Students' Quotations
Knowledge (105)	Knowledge of the natural environment	79	"Knowing the natural environment close to the school." "Knowing some plant species of the forest." "Knowing the flora of the school environment."
	Knowledge of the environment and environmental issues	21	"Usages of forest by humans: recreational, industrial…" "Human actions that harm the environment." "Waste and pollution."
	Knowledge about how the environment interrelates with other aspects (social, economic, cultural, *etc.*)	5	"Knowing the benefits of the forest to the urban environment." "The benefits and functions of forests for the environment." "Participate in an interdisciplinary way with other areas."
Practical skills (95)	Identification and recognition of natural diversity	43	"Identify the plants and creatures that are in the forest." "Analyze the functioning of this ecosystem." "Explore, identify and experiment with the flora and fauna of the area."
	Ability to act	19	"Suggest ways to improve the forest's health." "The implication for improving the environment." "Develop actions of respect and care for the environment."
	Recognition of human-nature interactions and their effects	17	"Differentiation between a natural forest and a planted forest." "Analyze the health of the forest". "Assessing the human impact."
	General work techniques	12	"Monitoring and understanding of the scientific method." "Experimentation. Observation." "Working cooperatively."
	Resolution of environmental problems	3	"Identify potential environmental issues that affect or may affect the forest." "Analyze possible solutions to environmental problems." "Detect environmental problems."
	Communication skills	1	"Debate and dialogue. Conversations on issues related to the forest."
Ethical values (43)	Environmental awareness	29	"Raising awareness about the importance of maintaining the forests." "Identifying one's self with the environment to be aware that we must preserve it among all." "Raising awareness of the importance of the flora and fauna of the forest."
	Individual and collective responsibility	10	"Be aware and recognize the activities that are positive or negative for the forest." "The responsibility of society." "Recognize what actions are positive and negative for the environment to become aware of our responsibility as citizens."

Table 4. *Cont.*

Category (total units of meaning)	Subcategories	Units of Meaning	Students' Quotations
Ethical values (43)	Positive value for humans and society	4	"Identification/recognition of the beneficial contributions of the site to the health of the inhabitants." "Knowing the natural environment to appreciate the value to people's lives." "Benefits and values: the forest as a necessary environment for our life."
Attitudes (40)	Respect for the environment	16	"Respect nature and local heritage." "Learn to value and respect the environment." "To foster a positive attitude of respect for the forests."
	Commitment, involvement and active participation	13	"Propose actions to preserve the natural environment and personal involvement in these." "Implication to improve the environment." "Commitment and involvement in the care of the forest."
	Caring for the environment	4	"Reduction of waste in the forest, environmental cleaning…" "Things that we can do to take good care of the forest." "Awareness and care for the environment."
	Reflect on and improve the attitude toward the world	4	"Critical attitude to think, reflect and act." "Knowledge of the human impact on the environment to adopt a critical attitude to improve the world." "Critical attitude".
	Coexistence, living and sharing experiences with others	3	"Living with colleagues in a different space than the classroom." "Learning to share experiences and knowledge." "Coexistence".
Emotions (1)	Sense of belonging to the environment	1	"Learn to love the forest and its utility in our context."

Matters related to knowledge acquisition were noted a total of 105 times (105 units of meaning) and practical skills a total of 95 times. These are the learning objectives and content that prospective teachers would prioritize in an educational project as that proposed. Ethical values (43) and attitudes (40) remain in second place, while the management of emotions was only referenced once.

In relation to the knowledge dimension, mentioned a total of 105 times, students tend to focus on conceptual content related to the natural environment, natural diversity, flora and fauna (79 units of meaning). Only a few (21) assign importance to knowledge about the environment and environmental issues, such as pollution of natural spaces or the environmental impact caused by human action. A small number of students (five) emphasize the significance of working in an interdisciplinary way, integrating the environmental, social and economic aspects.

Referring to the practical skills dimension, students alluded to this dimension 95 times, and the focus of the participating students remains on skills related to the observation of nature or natural diversity. These skills are the observation, identification, recognition and analysis of the characteristics and peculiarities of nature or natural diversity (43). In second place, students emphasize the ability to act (19).

This includes suggesting innovative actions to improve the current situation of the space, knowing what to do to improve the conditions of the space and performing maintenance actions on the environment, amongst others. Moreover, student teachers also consider the interaction between human beings and nature, its impact and assessment (17), along with general work skills (12), such as experimentation, interpretation of phenomena, teamwork and the use of the scientific method. A low number of students take into account the resolution of environmental problems (three) and communication skills, such as debating and dialoguing with others (one).

Considering the ethical values, students referred to this dimension a total of 43 times. A high number of students make reference to promoting environmental awareness (29). Individual and collective responsibility (10) is another value to be promoted. A small number of students emphasize valuing a natural area as a positive element for human beings and society in general (four).

Matters related to the attitudes dimensions were noted a total of 40 times by students. Positive attitudes of respect for the environment (16) and the commitment, involvement and active participation towards sustainability (13) are the attitudes that future teachers would promote in their students. A few students took into account other attitudes, such as the preservation and care for the environment (four), coexistence, living and sharing experiences with others (three) and promoting critical attitudes and improving the world (four).

Finally, the emotions dimension (one) is almost un-highlighted by future teachers. Only one student made reference once to the sense of belonging to the environment (one). Therefore, promoting reflection and awareness on the emotional aspects, learning to manage emotions and to work with students on these aspects are not covered by the participating student teachers.

In short, future teachers assign more relevance to the promotion of conceptual and procedural content amongst students than to the promotion of other content, such as attitudinal, values clarification and working on emotions.

Participating student teachers tend to prioritize the acquisition of knowledge and practical skills related to nature and natural sciences, to the detriment of other types of learning. However, the science curriculum in Catalonia includes environmental knowledge, so the fact that students were provided a context related to the science committee of a school could have influenced these study results.

Table 5 shows the relationship between the subcategories emerging from the data and Cebrián and Junyent's (2014) framework for professional competencies in ESD.

Based on the relationship established between the subcategories that emerged and the ESD competencies framework [28], student teachers highlight promoting values clarification, the ability to work and live with complexity, as well as decision-making, participation and acting for change (see Table 5). Conversely, the ability to contextualize a problem, critical thinking, fostering dialogue between disciplines and the management of emotions and concerns are competencies that are almost not considered by future teachers. Envisioning future/alternative scenarios is considered a critical process in ESD [1,12,37]; this was not mentioned at all by students.

As pointed out earlier, in the project proposed to the students, no explicit reference was made to sustainable development or ESD. The data obtained indicate that a holistic view of the environment and ESD competencies does not necessarily exist amongst student teachers.

Table 5. Relation between professional competencies in ESD and the subcategories that emerged.

Professional Competencies for ESD [28]	Subcategories Emerging from the Data
Clarify values	1. Environmental awareness 2. Individual and collective responsibility 3. Positive value for humans and society 4. Commitment, involvement and active participation 5. Respect for the environment 6. Caring for the environment
Work and live with complexity	1. Recognition of human-nature interactions and their effects 2. Knowledge that the environment is interrelated with other aspects (social, economic, cultural, *etc.*) 3. Knowledge of the environment and environmental issues
Decision-making, participation and acting for change	1. Ability to act 2. Resolution of environmental problems 3. Commitment, involvement and active participation
Contextualizing	1. Recognition of human-nature interactions and their effects 2. Knowledge of the environment and environmental issues
Think critically	1. Reflect on and improve the attitude toward the world
Establish dialogue between disciplines	1. Knowledge about where the environment interrelates with other aspects (social, economic, environmental, *etc.*)
Manage the emotions and concerns	1. Sense of belonging to the environment
Future/alternative scenarios visioning	*No related category emerged*

4.2. Questionnaire Results: Competencies' Prioritization by Student Teachers

The results obtained from the prioritization made by students of different competencies are presented in this section. This corresponds to Question 4 of the questionnaire "What do you think you should actively promote in this project? Prioritize from a high to low level of importance (from 1 to 12)".

The competencies' prioritization by the student teachers (n = 32) was analyzed using a frequency table (see Table 6). The numbers in the table show the total number of students that prioritized each competence and the order of priority that they assigned. For example, the ESD competence, promoting the ability to act and make decisions, was prioritized in the first place by nine students, in the second by six and in the eleventh and twelfth by none of the students.

The list of competencies is presented in relation to transversal competencies, ESD competencies and science education competencies. It should be noted that in the questionnaire, these competencies were mixed, and the students did not know to which group each competence listed corresponded.

Table 6 allows us to observe the frequency for which a competence is chosen by the participating students. This enables us to see the competencies that are prioritized for the proposed project by the students. Table 6 shows that in relation to ESD competencies, the most chosen competencies in the first and second option by student teachers are the ability to act and make decisions and the raising of awareness and environmental awareness amongst students.

Table 6. Competencies' prioritization and total number of students.

	Total number of students in relation to order of priority (n)											
ESD COMPETENCIES	**1st**	**2nd**	**3rd**	**4th**	**5th**	**6th**	**7th**	**8th**	**9th**	**10th**	**11th**	**12th**
Promoting the ability to act and make decisions.	9	6	4	2	3	1	2	2	0	3	0	0
Raise awareness and environmental awareness amongst students.	5	4	4	6	0	4	1	3	3	1	1	0
Thinking about different scenarios or alternatives to a situation or problem at the local and global scale.	0	2	1	1	5	3	8	3	3	3	3	0
Foster in students a sense of belonging to the environment.	2	2	2	0	4	3	3	1	3	3	4	5
Promote a critical analysis of some phenomenon or subject positioning one's self to argue for and respect different points of view.	2	1	4	4	4	4	2	3	2	2	2	2
Subtotal students (n)	**18**	**15**	**15**	**13**	**16**	**15**	**16**	**12**	**11**	**12**	**10**	**7**
TRANSVERSAL COMPETENCIES	**1st**	**2nd**	**3rd**	**4th**	**5th**	**6th**	**7th**	**8th**	**9th**	**10th**	**11th**	**12th**
Promote reflection and individual and collective responsibility.	4	6	4	3	3	3	3	1	2	2	0	1
Emphasizing the intellectual development of students.	1	0	2	0	1	0	1	4	2	2	3	16
Develop habits and attitudes favorable to the promotion of healthy lifestyles, at the personal and community level.	0	1	3	3	3	2	3	2	5	4	5	1
Work transversally from different perspectives and areas on a situation or problem and interrelate them.	3	0	4	2	3	5	3	3	3	2	3	1
Subtotal students (n)	**8**	**7**	**13**	**8**	**10**	**10**	**10**	**10**	**12**	**10**	**11**	**19**
SCIENCE EDUCATION COMPETENCIES	**1st**	**2nd**	**3rd**	**4th**	**5th**	**6th**	**7th**	**8th**	**9th**	**10th**	**11th**	**12th**
Explain and interpret phenomena scientifically and identify appropriate explanations and predictions.	0	5	1	6	1	0	1	4	2	4	3	5
Observe facts and/or phenomena, identify evidence and contrast data.	3	0	2	1	2	2	2	2	4	5	8	1
Analyzing the impact of human activities on the environment and propose improvement actions.	3	5	1	4	3	5	3	4	3	1	0	0
Subtotal students (n)	**6**	**10**	**4**	**11**	**6**	**7**	**6**	**10**	**9**	**10**	**11**	**6**
TOTAL STUDENTS (N)	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**

In reference to the transversal competencies, the most chosen by student teachers in the first, second and third option is the promotion of reflection and individual and collective responsibility. Finally, for the science education competencies, the most selected in the first and second place is analyzing the impact of human activities on the environment and the proposal of improvement actions.

In contrast, the least prioritized competencies, in eleventh and twelfth place, are: to foster in students a sense of belonging to the environment (ESD competencies); emphasizing the intellectual development of students (transversal competencies); and to observe facts and/or phenomena, identify evidence and contrast data (science education competencies).

If we focus on the subtotals obtained from students for each group of competencies, it can be observed that the most chosen competencies in the first, second and third place are ESD competencies (48), while transversal competencies (28) and science education skills (20) remain in second place. A tendency can be observed in that students prioritize in first, second and third place ESD competencies and transversal competencies, while those prioritized in ninth, tenth, eleventh and twelfth place are transversal competencies and science education competencies. This is probably due to the nature of the context and educational project proposed to the students. Therefore, further empirical research needs to be conducted using other educational scenarios to explore students' perception and the influence that the proposed project has on students' perceptions in ESD competencies and their competency prioritization.

The study findings show a discrepancy between the students' responses to Questions 1 and 2 and Question 4 of the questionnaire. While students assign more importance to knowledge and practical skills related to natural sciences rather than environmental issues in Questions 1 and 2, the reverse findings are obtained for Question 4, as students rank ESD competencies higher than science education competencies. This suggests that in Questions 1 and 2, students were mainly considering the context proposed, which relates to the science committee in a school. In Question 3, a more global and transversal perception of competencies is provided. This is probably due to the fact that students were given a comprehensive and explicit list of competencies, which facilitated choosing ESD competencies amongst science education or transversal competencies. This aspect needs to be further explored in future ESD competency perception studies.

5. Conclusions

This study provides evidence for the ESD competencies that student teachers would prioritize in a school project related to ESD. The student teachers participating in this study tend to prioritize the acquisition of knowledge and practical skills related to nature and natural sciences, to the detriment of other types of learning, such as the promotion of ethical values, positive attitudes towards sustainability and the management of emotions among their future primary school students. The fact that students were provided a context related to a science committee of a school could have influenced the study results. However, the science curriculum in Catalonia includes environmental knowledge, and student responses could have been influenced by the context proposed, therefore opting for more science conceptual content, rather than environmental aspects or interdisciplinary work, amongst others. Further studies need to be conducted, providing other educational contexts, to explore the extent to which the context influences students' responses and perceptions.

Students also highlight as relevant aspects related to the environment, the human-environment interaction and its impact, in conjunction with the ability to act, environmental awareness, individual and collective responsibilities and attitudes of respect and care for the environment.

Problem-solving of environmental issues, communication skills, critical thinking or the sense of belonging to the environment are interdisciplinary elements nearly not considered by student teachers in their future educational practice in this study. These elements are considered critical to ESD practice in the literature. The findings from this study show a disconnection between existing theoretical frameworks related to sustainability or ESD competencies of student teachers and the actual awareness and views of students in relation to ESD. It seems reasonable to suggest that existing ESD theoretical frameworks need to become more alive and integrated within the existing teacher education curriculum to promote the awareness and development of ESD competencies amongst student teachers. This is critical to ensure ESD integration and practice within all of the different levels of education.

This study suggests that student teachers understand ESD as an education that focuses mainly on the natural environment, instead of providing a more integrated vision, where the social, environmental, economic and cultural aspects are interrelated and essential to work in the school environment to provide students with a more holistic and complex worldview. The challenge is to consider more deeply the competence vision on ESD of future teachers and to continue in this line of research.

The outcomes of this study show the need to elaborate on and specify a second level of concretion of the competencies' framework. This would enable a more practical approach to ESD competencies in student teacher training and, at the same time, work on the elaboration of evaluation tools that can inform the different levels of achievement in the acquisition of competencies.

Four key implications for studying the development of ESD competencies amongst student teachers can be drawn from this research:

- The development of teaching and learning processes and evaluation strategies towards the improvement of ESD learning is an essential step to contribute to better teacher training in this area at the university level.
- Future research needs to develop evaluation tools that can provide information on student competence mobilization in a context close to their professional practice. This would enable the exploration of the ESD competencies of student teachers and the opportunities and challenges they face when trying to promote these in schools.
- Interdisciplinary work and practice, critical thinking, creativity, values clarification, management of emotions, social interaction and teamwork need to be enhanced through teacher education studies to integrate ESD in in-service teaching.
- Envisioning alternative future scenarios and developing future-thinking competency amongst students promotes the challenging of existing worldviews and assumptions in ESD, fosters responsibility and commitment and leads to innovation and action strategies for change.

The student teachers should be able to acquire the ESD competencies that enable them to cope with the different sustainability challenges that current society is facing. Therefore, it is necessary to assess whether this training provides them with the knowledge, practical skills, tools, attitudes and ethical values that will allow them to deal with these challenges. ESD competency frameworks should be enhanced and embedded in teacher training institutions in the particular context of each institution.

The EHEA provides the opportunity to incorporate sustainability competencies in higher education curriculum, as well as being a convergence point to share innovations and good practices in ESD within European higher education institutions.

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Author Contributions

The authors have contributed equally in the work, conceptualizing and designing the study, collecting and analyzing data, discussing the results and drawing conclusions.

Conflicts of Interest

The authors declare no conflict of interest.

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