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Educators' competences, motivations and teaching challenges faced in education for sustainable development: what are the interlinkages?

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ABSTRACT

Educators' competences in Education for Sustainable Development (ESD) is a growing field of study. Still, critics warn that competence frameworks should not be used as a technical prescription without reflecting on the complexity of the educational setting. This study aims to shed light on the competences that educators in ESD, across both formal and non-formal educational settings, perceive as necessary for their role while analyzing how their motivations and challenges are interlinked with their ESD competences. These issues are explored through 18 online interviews with ESD educators within the Barcelona Metropolitan Area in Spain, where multiple and diverse ESD settings co-exist. Atlas.ti was used for the content analysis. Results show that a diverse set of competences was persistently perceived among participants as necessary. Across both formal and non-formal contexts, the role of competences such as *Transdisciplinary* and *Empathy* was especially interlinked with their motivations and challenges. Nonetheless, competences such as *Systems* were more relevant in the formal setting, while *Participation* was emphasized in the non-formal context. We discuss the various ways that educators perceive ESD competences as necessary, which are influenced by their working settings (e.g. formal and non-formal), but also their particular pedagogical challenges and individual motivations for proper diagnosis and training.

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Introduction

The focus on developing competences within Education for Sustainable Development, hereafter ESD, is increasingly recognized and widely accepted (Rieckmann, 2018). Overall, a competence is defined as "(...) complex combination of knowledge, skills, understanding, values, attitudes and desires, which lead to effective embodied human action in the world, in a domain" (European Commission, 2013, p. 9). The sustainability competences approach is particularly relevant in the context of the Sustainable Development Goals (SDGs), specifically target 4.7 of SDG 4, which focuses on ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all (UNESCO, 2017). Developing sustainability competences is key to overcome the challenges involved in promoting SDG 4 and the other 16 SDGs.

Furthermore, according to UNESCO (2020), to implement a competence-based approach in ESD, educators need to develop competences that address real-world teaching and learning challenges. Moreover, ESD educators should master three types of competences built upon three dimensions of learning: (1) *Cognitive* that is related to knowledge, understanding and critical thinking; (2) *Socio-emotional* that relates to a sense of common humanity, values and responsibilities, empathy, solidarity, and respect; and (3)

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Behavioral that connects to skills development (European Commission, 2022, p. 9). However, the findings from a systematic review of educators' competence frameworks in ESD show a greater emphasis on cognitive and behavioral dimensions of learning in the detriment of socio-emotional competences (Corres et al., 2020). Furthermore, findings from a UNESCO study (2021) demonstrate that educators in ESD from around the world perceive themselves as less adept at addressing behavioural and socio-emotional teaching strategies compared to using cognitive related approaches. These findings are critical because they indicate that teachers may struggle with the socio-emotional aspects of ESD and related teaching challenges, such as *'eco-anxiety'*, that when teaching related to the ecological crisis can evoke feeling of helplessness, confusion, shock and trauma among students (Pihkala, 2020).

Other competences, that belong to the behavioral dimension, are close to develop holistic thinking, that are key in the field of ESD, related with an inter- and transdisciplinary knowledge base necessary to understand and address global and local issues such as climate change, social and geographical disparities, conflicts and economical reconfiguration, to name a few (Rieckmann, 2012). In consequence, given that ESD topics are not confined to a single discipline (Mulder, 2014), but, on the contrary, encompass inter- and transdisciplinary dimensions (European Commission, 2022), educators in ESD need to develop competences of this nature.

In addition to the question of which competences are being promoted or neglected, it is also essential to understand whether teachers' individual traits and aspects of their teaching contexts influence the development of specific competences in ESD. For instance, being a teacher in a formal context, such as a school or a university, requires following a pre-established curriculum. By contrast, in non-formal ESD settings educators have more flexibility to decide about contents and competences to work with students. These differences also imply different competences for educators, considering relational aspects, such as those between the educator with the environment or the educator with their students (Du Bois-Reymond, 2003). Furthermore, whether ESD educators and teachers develop their work in formal or non-formal contexts, both contexts could be complementary and focused towards the same transformational objectives. In other words: *"co-engaged arenas where participants focus their learning actions by tuning in to shared concerns in a school, institution or community setting and engaging in deliberative learning transactions to change practices in ways that are meaningful to everyone"* (O'Donoghue et al., 2018, p. 115)

Previous studies in higher education highlight the significance of teachers' motivations in this regard. Research indicates that teachers in higher education often exhibit a positive predisposition to teach sustainability issues. However, it is crucial to recognize that more than personal motivation is needed since the development of various competences is also necessary (Leal Filho et al., 2021).

Similarly, even if educators can be motivated to receive training in sustainability issues, they need to be aware of the availability of such training opportunities. As reported by Aznar Minguet et al. (2011), this is not always the case and may hinder the development of competences. This was different in a recent study in the German context focused on training for the development and assessment of ESD competences in higher education, where teachers reported a lack of motivation towards ESD (Scherak & Rieckmann, 2022).

Furthermore, Timm & Barth (2021) analyzed the links between the different competences that schools teachers in Germany perceive as necessary for teaching in ESD and their individual dispositions towards ESD. These authors highlight three central drivers or motivations for being involved in ESD: (1) acquiring specific knowledge about ESD, (2) addressing ecological and social challenges, and (3) seeking opportunities to enhance the school's reputation (Timm & Barth, 2021).

Regarding the contextual elements of educators' teaching that become relevant when developing their competences, a European study highlights three action fields to be considered in the teaching context: (1) instruction, which is related to classroom teaching or extramural activities, (2) participation in the design of one's own educational institution, and (3) engagement with society, both within the institution's immediate context and in the broader environment (Rauch & Steiner, 2013). These authors argue that it is within these action fields where educators not only develop their teaching skills but also encounter specific challenges and barriers in achieving ESD objectives. Consequently, this is where specific ESD educators' competences become particularly relevant.

When considering these challenges, it becomes evident that there are significant institutional and social obstacles in the development of educators' competences in ESD. At the European level, there is still a pressing need for cross-sectorial collaboration in ESD. Therefore, sustainability has not yet become a pervasive concern in educational policies (European Commission, 2022), which is a crucial step in highlighting the importance of training ESD educators' competences in the public arena. Regrettably, this lack of cross-sectorial collaboration has been a global issue faced by educators in ESD, as indicated by a recent international study (UNESCO, 2021). The results of this UNESCO report suggest that the most significant system-level barrier to ESD teaching is the insufficient coverage of ESD topics in the curriculum. Without this inclusion, the development of ESD competences in educators could be rendered ineffective. However, there is also a delicate balance to maintain, as an overcrowded curriculum can impede educators' ability to teach ESD effectively. Additionally, educators interviewed in this report expressed the need for a whole-institution approach and greater involvement from the wider community, among other demands. A whole-institution approach means that all stakeholders of the educational institution, both internal and external, actively reflect and work towards a particular objective, such as ESD-related projects (e.g. climate action), where many teachers play a leading role in their success (UNESCO, 2016), and where the ability to work in an inter and transdisciplinary way is key for educators and the wider the community (Millican, 2022; Vare et al., 2019).

However, according to a recent review on educators' competence frameworks and models in ESD (Corres et al., 2020), most of the reviewed frameworks (Albareda-Tiana et al., 2019; Álvarez-García et al., 2019; Bertschy et al., 2013; Cebrián & Junyent, 2015; De Kraker, 2017; García et al., 2017; Meyer et al., 2017; Pipere & Mičule, 2014; Sánchez-Carracedo et al., 2018; Vare et al., 2019; Varela-Losada et al., 2018; Winter et al., 2016) are based in formal education contexts, more specifically in the Higher Education Institutions (HEI). Additionally, these barely consider individual elements and teaching contextual factors, giving little attention to potential connections between them (Corres et al., 2020). To the best of our knowledge, there is neither research that analyses the association with the competences ESD educators have with their different challenges nor with their motivations. More importantly, there is a lack of studies that examine how these individual and contextual elements are linked to the competences of ESD educators. Thus, it is pertinent to explore in-depth how these particularities and interlinkages shape educators' competences in a specific ESD context.

Hence, the aim of our study is to comprehensively explore the interlinkages between the competences in ESD that educators perceive as relevant for their practice, their motivations, and the teaching challenges they encounter across different educational settings (e.g. formal and non-formal). To contribute to this overall objective, this study examines the competences deemed crucial for ESD by educators; their motivational drivers for becoming ESD educators, the teaching challenges they face; and analyzes the interlinkages between these competences, their motivational drivers, and their experienced challenges through a case study conducted in Barcelona.

Methodology

Sampling and data collection

As contextual factors are relevant to compare and better unravel the studied interlinkages, a study site with diverse ESD educators could offer a broader understanding of their needed competences. It is for this reason that the Barcelona case is examined, considering that in Spain ESD educators work in a variety of educational settings, such as public entities, private companies, community organizations, to name some (Soto, 2007). More specifically, in Catalonia, ESD educators not only work in different formal and non-formal settings but also perform a diverse set of activities, including: *“plan and perform ESD interventions, design educational resources, provide guided visits to natural spaces, design information campaigns, and teach in a classic classroom format”* (Generalitat de Catalunya, 2020, p. 19) for which they may need different competences while experiencing diverse challenges and motivations. Thus, we find Barcelona an interesting study case to explore how these settings relate to specific competences considering their specific pedagogic challenges, but also the role of individual elements.

Table 1. Interviewed ESD educators' socio-demographic information.

| Category | Subcategory | Formal setting ¹ | Non-formal setting ² |
|---------------------|------------------------------------|-----------------------------|---------------------------------|
| Gender | Female | 5 | 6 |
| | Male | 5 | 2 |
| Working institution | Secondary Education | 3 | 0 |
| | Higher education | 7 | 0 |
| | NGO/Private organization | 0 | 4 |
| | Public organization | 0 | 4 |
| Studies | Social and Economic Sciences | 3 | 3 |
| | Natural and Environmental Sciences | 8 | 4 |
| | Education Sciences | 3 | 5 |
| Teaching discipline | Social and Economic Sciences | 10 | 7 |
| | Natural and Environmental Sciences | 10 | 8 |
| | Engineering/Technology | 3 | 4 |
| | Education Sciences | 2 | 5 |

¹Institutionalized, recognized, and regulated by the national authorities to obtain an official certificate or degree.

²It could be institutionalized, but not necessarily provides an official certificate or degree; it could be seen as a complement to formal education in a person's lifelong learning.

Consequently, we developed a qualitative case study in the Barcelona Metropolitan Area, a 636 km² territory (48% urbanized) with a population of about four million people (Àrea Metropolitana de Barcelona, 2022). We decided to use qualitative methods, since these to provide in-depth information on the educators' views, perspectives and motivations (Newing, 2011). By doing this, the present study offers more profound insights into the analyzed topics and also a better understanding of the contextual and causal elements regarding educators' competences in ESD (Anderson, 2016).

To establish our sample, we employed a snowball technique (Corbin & Strauss, 2015; Newing, 2011). We contacted educators who had previously attended at conferences and local ESD events, adhering to the following selection criteria: 1) educators with substantial experience in formal and non-formal ESD within the Barcelona Metropolitan Area, and 2) educators working with young people aged 13 to 29 (covering secondary to higher education age groups). After conducting interviews with them, we asked them to provide contacts from other ESD experts. We repeated this process until reaching a saturation point, signifying that we had found similar elements in answers and decided to conclude our data collection (Corbin & Strauss, 2015; Newing, 2011). In total, we interviewed 18 key educators actively engaged in ESD, comprising 7 male and 11 female (see Table 1 for their socio-demographic characteristics).

We developed an interview guide, which we subsequently piloted with two local experts in ESD and qualitative research. Based on their valuable feedback, we made improvements and refinements to the questions. The final interview guide (see [supplementary material](#)) consisted of three categories of questions related to the main research topics: 1) educators' perceptions of the competences required for ESD teaching, 2) the motivations driving educators' interest in engaging with ESD, and 3) the challenges faced by educators in ESD. The ethical review board of the first and second authors' university granted approval for the ethical aspects of this research, and we obtained participants' informed consent (both orally and in writing) prior to conducting the interviews.

From January-March 2021, we conducted online interviews as a response to COVID-19 restrictions in Spain, utilizing the Google Hangouts tool. These interviews typically lasted approximately 50 minutes, with some shorter ones spanning half an hour and longer ones extending to an hour and ten minutes. All interviews were audio-recorded and subsequently transcribed.

Data analysis

Interviews were transcribed and analyzed using the Atlas.ti Software to systematically identify segments of the interviews corresponding to various analytic categories that in further we will refer as codes. The first author conducted data analysis following a coding protocol under the supervision of the other authors, which ensured the validity and reliability of the codification and further analysis.

Three groups of deductive codes were defined and employed (Corbin & Strauss, 2015) according to the research objectives. Throughout this analysis, we considered the learning setting (formal and non-formal) as a variable of analysis. Additionally, by exporting to MS Excel the number of times each category or code was found, we quantitatively assessed the relevance of specific codes during our analysis.

Table 2. The RSPII framework of competences for ESD educators.

| Competence name (used as code) | Definition |
|-----------------------------------|---|
| Systems | The educator helps learners to develop an understanding of the world as an interconnected whole and to look for connections across our social and natural environment and consider the consequences of actions. |
| Futures | The educator helps learners to explore alternative possibilities for the future and to use these to consider how behaviors might need to change. |
| Participation | The educator helps learners to contribute to changes that will support sustainable development. |
| Attentiveness | The educator helps learners to understand fundamentally unsustainable aspects of our society and the way it is developing and increases their awareness of the urgent need for change. |
| Empathy | The educator helps learners to respond to their feelings and emotions and those of others as well as developing an emotional connection to the natural world. |
| Values | The educator develops an awareness among learners of how beliefs and values underpin actions and how values need to be negotiated and reconciled. |
| Transdisciplinarity | The educator helps learners to act collaboratively both within and outside of their own discipline, role, perspectives and values. |
| Creativity | The educator encourages creative thinking and flexibility within their learners. |
| Action | The educator helps the learners to take action in a proactive and considered manner. |
| Criticality | The educator helps learners to evaluate critically the relevance and reliability of assertions, sources, models and theories. |
| Responsibility | The educator helps learners to reflect on their own actions, act transparently and to accept personal responsibility for their work. |
| Decisiveness | The educator helps the learners to act in a cautious and timely manner even in situations of uncertainty. |

Note: Adapted from "A Rounder Sense of Purpose: Competences for educators in search of transformation", Millican, R. In P. Vare, Lausset, N., Rieckmann, M. (Ed.), *Competences in education for sustainable development. Sustainable development goals series.* (35-43), 2022, Springer. (https://doi.org/10.1007/978-3-030-91055-6_5) Copyright by Springer.

To begin our data examination, we coded in Atlas.ti the competences that educators perceived as necessary for their teaching, using the 'A Rounder Sense of Purpose' (RSP) competences framework (Millican, 2022; Vare et al., 2019). This framework was selected based on the findings of the previously mentioned systematic review (Corres et al., 2020). The review's conclusions highlighted that the RSP framework was developed with a broader diversity of educators' profiles and educational settings in mind, including formal, non-formal, early childhood to higher education, and encompassing different EU countries.

The RSP framework, inspired by the 39 competences of the UNECE (2012) framework, delineates a total of 12 competences for ESD educators (see definitions for each competence in Table 2). Within this framework, each competence is associated with verifiable learning outcomes for students (*Learning Outcomes*) and includes information on the abilities required by educator to facilitate students in achieving these intended learning outcomes (*Underpinning Components of the Educator*) (Millican, 2022; Vare et al., 2019).

We conducted this coding process using Atlas.ti by considering each of the RSP educators' competences along with their respective *Learning Outcomes* and *Underpinning Components of the Educator*. Some coding was derived from sections of the interviews where direct questions were posed about the types of competences deemed necessary for their teaching roles. Additionally, other coding was extracted from segments of the interview that corresponded to questions indirectly addressing the competences perceived as essential for their roles when talking about their pedagogical practices, reflections, and related topics.

To identify quantitative patterns that could complement the qualitative analysis regarding the perceived relevance of competences in ESD, we exported to MS Excel the frequency of each competence's appearance in the interviews within each educational context (formal and non-formal), which was instrumental in creating Figures 1 and 2.

Second, to analyze the motivations behind the interest of educators in teaching ESD, using Atlas.ti we generated five codes inspired by Timm & Barth (2021) previous categorization of motivations and drivers towards ESD, in the following way:

- *Studies*: Individuals build their knowledge about environmental and sustainability issues during their studies (e.g. university, postgraduate studies).
- *Working Institution*: Individuals build their ESD knowledge while working at an educational institution already engaged in ESD.

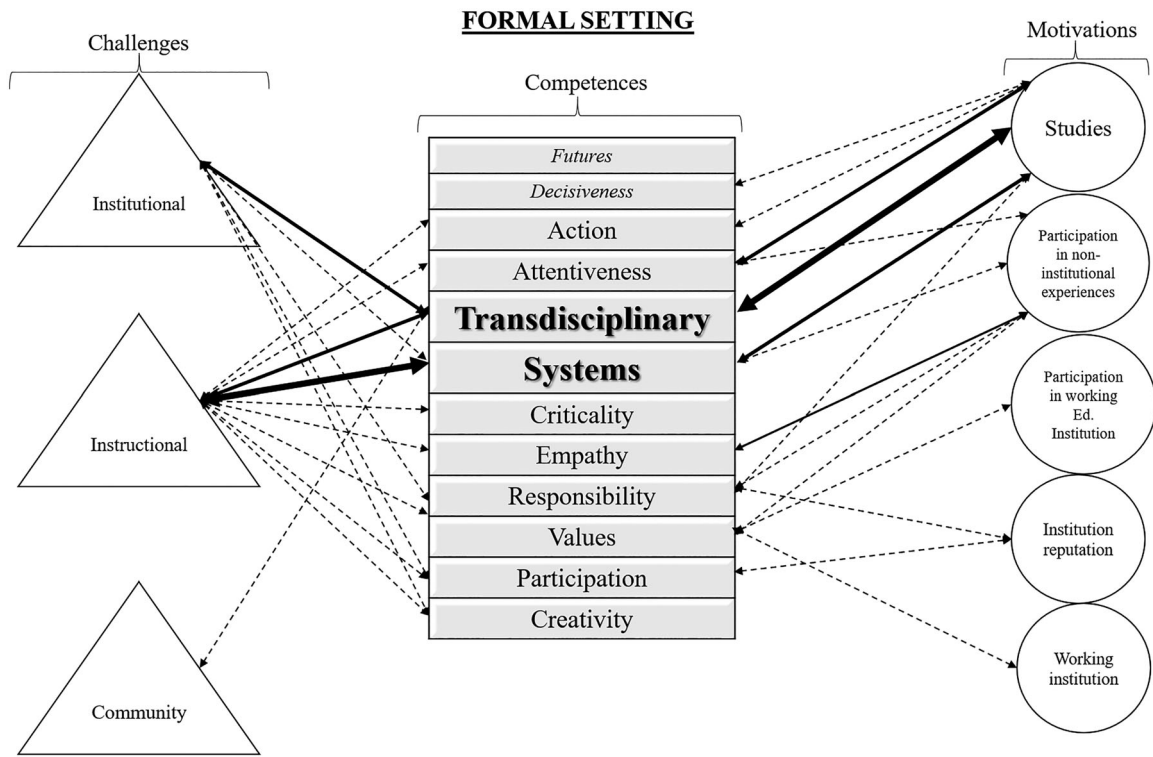


Figure 1. Formal context analysis.

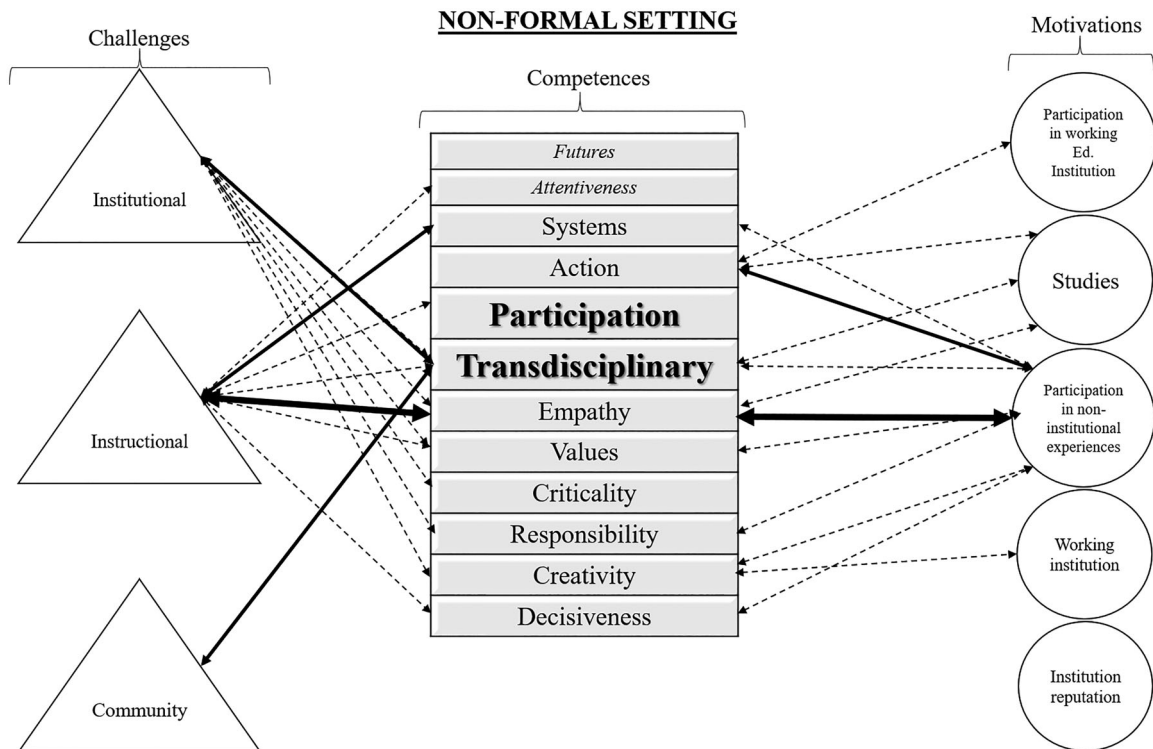


Figure 2. Non-formal context analysis.

- *Participation in working in educational institution*: Individuals observe these kinds of problems and begin to act due to empathetic involvement (e.g. use of plastics in the school diner).
- *Participation in non-institutional experiences*: Individuals reflect on their personal experiences connected to ESD issues (e.g. experiences abroad with people living in much poorer conditions and

highly dependent on local natural resources, strong personal relationships in the ESD community that make them feel comfortable).

- *Institution reputation*: Individuals learn about calls for sustainability-oriented educational institutions and see them as an opportunity to improve their institution's image.

Subsequently, to analyze the relationship between these motivations and drivers and the competences in ESD, we employed the RSP framework (Millican, 2022; Vare et al., 2019) to also code using Atlas.ti those responses from the interviewees that corresponded to questions about their motivations but that indirectly touched upon the competences they considered essential. For instance, within various segments of the interviews categorized under the motivation *Studies*, we scrutinized the quotations for elements related to each of the 12 RSP competences proposed in theory, such as *Systems*.

We sought to identify quantitative patterns that could enrich the analysis of the more relevant motivations among ESD educators and their relation to ESD competences. To achieve this, we again exported the data to MS Excel to tally the instances where each quotation was coded under a particular type of motivation and concurrently under a competence in each educational setting. This approach informed the analysis presented in Figures 1 and 2.

Third, again using the Atlas.ti tool and to code educators' answers regarding the challenges faced in ESD, we used and adapted the three action fields within the ESD educators' practice defined by the KOM-BiNE model (Rauch et al., 2008; Rauch & Steiner, 2013). The KOM-BiNE model (Competences for ESD in Teacher Education) was chosen since it was the only framework reviewed in *Phase I* that emphasized contextual elements regarding ESD educators' competences, which the authors named fields of action. We thus generated, adapted and defined three codes that corresponded to each action field found in Rauch & Steiner (2013), as follows:

- *Instructional*: Challenges located in the teaching (i.e. challenging didactic situations during class, being this onsite, online, outdoors, etc.).
- *Institutional*: Challenges located in the educational institution that harm ESD objectives (i.e. the school lacks institutional support for ESD initiatives)
- *Community*: Challenges located outside of the instruction and institution, to the detriment of the ESE objectives (i.e. families that are against ESD)

Subsequently, we analyzed the links between these challenges and the competences using the RSP framework (Millican, 2022; Vare et al., 2019) by coding in Atlas.ti the same interview extracts (or quotations). For instance, a quote describing a difficulty coded under 'Community challenge' could also be coded under a competence such as *Transdisciplinarity*.

Once more, we exported Atlas.ti data to MS Excel to identify quantitative patterns that could inform our analysis of the connections between these challenges and their competences. Accordingly, we counted how often each quotation was coded under a particular challenge type and simultaneously under a competence. To facilitate our analysis for Figures 1 and 2, we organized this data by educational setting.

Finally, we quantitatively analyzed the interlinkages between educators' competences and motivations, as well as their competences and challenges. Simultaneously, we relied on the qualitative data obtained in previous analyses to complement these results. For instance, even though educators from both settings placed greater quantitative emphasis on particular competence, there were qualitative differences in how they discussed that competence during the interviews. Similar distinctions were observed regarding their motivations and challenges. Consequently, we generated new evidence on the interlinkages between ESD educators' perceptions of their competences, motivations, and challenges across various educational settings in Barcelona.

Results

In this section, first we show the results on the competences that educators perceive as necessary for their teaching in ESD, and then we present the results on their motivations and challenges. Finally, findings on the interlinkages between the three components are described.

ESD competences perceived by educators as necessary for their teaching

As a result of tallying the frequency of each competence's appearance in the interviews in each educational context, it became evident that *Transdisciplinarity* emerged as one of the most significant competences for educators across both educational contexts, formal (F) and non-formal (NF), since it was the most mentioned competence in the interviews (20-F/21-NF)¹. However, when examining the educational contexts separately, educators in the formal setting particularly emphasized the relevance of *Systems* (25-F/15-NF). Conversely, educators in the non-formal context placed a strong emphasis on *Participation* (15-F/20-NF). Other competences were similarly emphasized across both educational contexts: *Values* (16-F/16-NF), *Action* (16-F/16-NF), *Empathy* (16-F/14-NF), *Creativity* (13-F/14-NF), *Criticality* (11-F/8-NF), and *Decisiveness* (6-F/7-NF). By contrast, the importance given to *Responsibility* was slightly higher in formal contexts than in non-formal (11-F/6-NF) as it happens in the case of *Attentiveness* (12-F-2NF) that was much less emphasized in the non-formal setting. Finally, the competence *Futures* (3-F/0-NF) was perceived as less relevant in both contexts.

Qualitative data helps to understand these quantitative results. *Transdisciplinarity* was especially highlighted in both educational contexts by interviewees who referred to the need to use pedagogies to promote cooperation. Interestingly, the understanding of who should be involved in such cooperation differed between educators in formal and non-formal contexts. Educators in the formal context primarily viewed collaboration as occurring solely among teachers and colleagues within the school or university, whereas those in the non-formal context sought collaborations with external institutions. As explained by the interviewees:

Talk with my colleagues, with the director of the program, etc., to find out a bit what they are doing in the other subjects to avoid overlaps because maybe your ideas are already being addressed in others and there will be redundancies (Transdisciplinarity/Formal: E12²).

(...) we work with collective organizations, we have a bag of the city needs, that we, later on, pass to the educational centers (Transdisciplinarity/Non-Formal: E2).

In both contexts, educators also emphasized how to explain and deal with complexity in their teaching, which is a key element of *Systems* competence. On the one hand, formal educators described that it is necessary for their teaching to be capable of providing more information and context when dealing with complex topics, because some ESD topics are particularly intricate and can generate more profound debates than expected. An example in the words of an educator: *"If a student asks me more information, I need to be there, to give the student a deeper vision and to those that want to go deeper"* (*Systems/Formal*: E11). On the other hand, educators highlighting the *Systems* competence in the non-formal context referred to the skills they need to cultivate in order to create an environment where students could grasp complex information or *"digest it"* rather than merely delivering new information.

Moreover, and as shown by the quantitative results, the *Participation* competence was also relevantly perceived, since educators reflected on techniques and pedagogies that foster learners' engagement. This can be seen across both contexts when educators mentioned using project-based pedagogies to deal with sustainability-related changes in and outside the classroom and the institution. Additionally, other pedagogies related to *Participation* that turn the student into the protagonist were emphasized, as revealed by some educators that encouraged their students to share and debate their learnings at school with their families. Nonetheless, in non-formal settings more than in the formal ones, educators emphasized components of this competence when, for instance, they explained how they relied on outdoor learning strategies that involved not only being surrounded by nature but collaborating with other ESD-related organizations. To illustrate this in the words of an interviewee: *"they [students] plant, harvest, prepare and eat those ailments within the school garden and with local farmers. They do so working service-learning activities and we accompany them for a long time"* (*Participation/Non-Formal*: E2). However, in the formal context, only one educator described using project-based pedagogies integrated in their teaching as an extensive practice because they were working in a school where ESD is transversally implemented, while the rest of formal context educators reported the use of participatory strategies occasionally in specific pedagogies developed.

Qualitative data also provides insights into why some competences received less attention during the interviews. For instance, the *Futures* competence was seldom mentioned in the formal setting and not all in the non-formal context. Only a few educators in formal ESD described their use of future studies techniques, such as futures simulation or scenarios with retrospective analysis through time, to help their students envision potential futures and evaluate their impacts. As stated by a participant when implementing retrospective scenarios to imagine possible futures: *“my exams always have two images with 70 or 60 years of difference. I want them to explain to me the changes in the landscape at the social, ecological and climate change levels”* (*Futures/Formal: E17*).

Regarding the *Attentiveness* competence, it was referred by some educators, particularly in the formal context. They explained how they applied engaging pedagogical methods to pique students' interest and raise awareness of the urgent need to address unsustainable aspects of society, thus fostering discussions with multiple perspectives. In a participant's words: *“you have to help them to anchor the concepts into the real world, the science we explain to them translated to their reality, to me that is indispensable”* (*Attentiveness/Formal: E17*). Consequently, the use of teaching techniques to promote reflection on the future and the imperative to urgently address unsustainable aspects of the human-nature relationship were not prominently emphasized by the non-formal educators who were interviewed.

Motivations and drivers towards engaging in ESD

Based on the frequency of quotations coded under specific types of motivation, within formal education settings, educators' motivations were more notably linked with experiences they had while studying, as indicated by the *Studies* code, which harked back to their childhood or university experiences (12 quotations-Formal). One of the interviewed teachers articulated this perspective: *“I had some practices with a teacher which was able to transmit this interest to me, and from that point to now, I keep exploring this. He (the teacher) was my great master; this needs to be acknowledged”* (*Studies/Formal: E7*).

A few educators mentioned being motivated by their involvement in activism or social movements outside of educational institutions, identified by the *Participation in non-institutional experiences* code (7-F). Meanwhile, only one formal educator reported being motivated towards ESD due to the institution's encouragement, coded as *“Institution reputation”*. In this case, their university actively sought sustainability innovations to enhance its reputation.

On the other hand, educators in non-formal educational settings were particularly motivated by their engagement in prior environmental and social advocacy, as indicated by the *Participation in non-institutional experiences* code (16-Non-Formal). As one educator expressed:

Then there was a point where we said: Let's do things for this! But we realized that we Europeans go and do things in other parts of the world, and we have a lot of work here, too. Sometimes you need to go to realize this. (*Participation in non-institutional experiences-Non-Formal: E18*).

Additionally, some educators mentioned that they were motivated by past educational experiences, such as reminiscing about how one of their high school teachers ignited their interest in biology and the environment (*Studies* code: 5-NF). Others cited previous jobs in educational institutions that were already oriented toward ESD, which fueled their interest in ESD (*Working institution* code: 2-NF). One educator mentioned feeling motivated by the desire to address sustainability challenges within their own' ESD institution, such as the lack of curriculum coverage on ESD topics, among other issues (*Participation in working in Educational Institution experiences* code: 1/NF).

Challenges experienced by ESD educators in their practice

By looking at the quantitative data, there was more emphasis towards *Instructional* (29) and *Institutional* (21) challenges within participants' ESD practice than *Community* (6) challenges.

In terms of *Instructional* challenges, educators referred to their self-perceived lack of expertise to implement creative and diverse pedagogies, as well as their lack of knowledge related to specific sustainability topics, such as teaching about marine species in the Mediterranean or biodiversity in the closer mountain in Barcelona (i.e. Collserola), to name some of the examples provided by educators.

Some formal educators also noted the difficulty of planning and teaching in heterogeneous classrooms. They faced the challenge of accommodating students from various disciplines and motivations, particularly at the higher education level.

Moreover, educators in this context found it challenging to incorporate into their teaching some relevant topics theoretically associated with ESD issues, such as gender topics. They explained that these topics were often outside their disciplinary backgrounds, despite their interest in learning more about them in order to effectively teach them.

On the other hand, descriptions from the non-formal context described environmental dilemmas. For instance, one educator explained that when considering the use plastic materials in their teaching, they weighed the potential benefits of facilitating a participatory-oriented project against the concern that it might send a contradictory message to their students.

Other Instructional challenges referred to addressing the lack of interest among their students in ESD-related topics. Educators in formal contexts frequently described struggling with their students' lack of motivation and complained about not being able to help them grasp ESD-related values and truly motivate them. University teachers, also in particular, felt that students often lacked basic literacy in ESD topics, which hindered their ability to generate interest, as explained during the interviews:

They [the students] don't have any background information about the topic, so it's difficult for them to have an opinion and propose things since they do not know them. And consequently, they don't know how to be critical or become interested (Instructional/Formal: E5).

In the non-formal context, some educators found it challenging to deal with students' emotions when, for instance, discussing topics related to the future without instilling a sense of catastrophe or hopelessness. As one interviewee expressed: *"to awake interest and motivation within my students, especially generate in them the will to act and do things without frustrate them, since sometimes there's almost panic when words like climatic emergency emerge"* (Instructional/Non-formal: E18).

In terms of Institutional challenges, interviewees from both contexts highlighted limitations and barriers to promoting collaboration with colleagues within their own schools or with individuals from other organizations involved in ESD. In formal settings, other challenges were related to the inflexibility of the curriculum and the pedagogical approaches promoted by their institutions. In contrast, educators in non-formal settings faced challenges more closely related to their precarious work conditions, which resulted in overwork and insufficient time to conduct their pedagogical interventions effectively. This lack of time also hindered their ability to build strong connections with students.

Finally, Community challenges mainly were associated with a need for increased cooperation with other organizations and community members in proximity. This was explained differently across both contexts. For example, an educator from the formal context emphasized the importance of having more opportunities to collaborate with institutions. Such collaboration could enable non-formal educators to provide complementary education to students alongside the mandatory curriculum (e.g. external ESD educators offering extracurricular activities like school gardening). It could also improve students' motivation towards environmental and sustainability issues. Also, in the formal context, educators pointed out that some families demotivate students in their pursuit of ESD by not supporting their children's environmental actions (e.g. discouraging them from using recyclable objects).

Similarly, educators from non-formal settings described how certain action-based projects developed by their students failed to engage the broader school community, which was essential for the project's success and for maintaining students' motivation. In the case of the non-formal context, this lack of cooperation was also perceived as happening among various ESD-oriented NGOs in the Barcelona Metropolitan Area. According to them, there is competition for government funding, leading to a lack of collaboration among these organizations.

Connections between competences, motivations, and challenges

Figures 1 and 2 show two graphical representations synthesizing the analyzed codes interlinked in both formal and non-formal contexts, respectively. At the center of both figures, there are rectangles corresponding to the twelve ESD educators' competences proposed in the RSP framework of educator

competences in ESD (Millican, 2022; Vare et al., 2019). The competences displayed in larger size and bolded received more quotations, indicating a greater quantitative emphasis. Those without bolding or italics received a similar number of quotations without special emphasis, while those in a smaller lettering and using italics received the least attention.

On the right side of both figures, there are circles corresponding to the five codes for educators' motivations or drivers toward ESD (Timm & Barth, 2021), while on the left side, there are triangles corresponding to the three codes of the action fields where educators perceived challenges in their practice (Rauch & Steiner, 2013). The thickness of the arrows pointing to the competences from both their motivations and their challenges represents the quantitative interlinkages between their Motivations and Competences (on the right) and among their Challenges and Competences (on the left). Thicker arrows indicate a greater emphasis based on the number of quotations.

In the formal context (Figure 1), our results show that *Transdisciplinary* and *Systems* competences were particularly emphasized as relevant by these educators (represented in larger, bolded lettering). Nevertheless, these competences also had strong associations with motivations (indicated by arrow thickness linking to circles) and challenges (indicated by arrow thickness linking to triangles). Notably, no challenges were associated with *Futures* and *Decisiveness* competences (indicated in smaller lettering and italics). Furthermore, neither *Futures*, *Creativity*, nor *Criticality* were associated with their motivations.

Within formal educators' discourses regarding their motivations, elements of the *Transdisciplinary* competence were identified when educators referred to how they chose to pursue a university degree with an interdisciplinary curriculum, believing it would provide them with the proper environment to explore various disciplines. However, some of them also reported having trouble working with multiple disciplines in their teaching (Instructional), which is an underpinning component of this competence. These educators also mentioned encountering Institutional barriers when working across disciplines, such as the rigidity of the curriculum or the lack of knowledge and interest in sustainability issues among some of their colleagues. In addition, as this competence also encompasses broader collaboration with other community members, challenges described by some educators regarding the lack of involvement of students' families in ESD projects were also linked to this competence. In summary, this competence was highly interlinked to all fields of action where educators might encounter challenges in this context.

Formal educators also justified their motivation for ESD because they started to become interested in understanding complex environmental problems (e.g. pollution) during their university studies. This aligns with elements of *Systems* competence. Even though this competence was associated to their motivations, at the same time educators referred to difficulties when it came to teaching complexity (Instructional), which is an underpinning component of *Systems* competence.

Although interviewed formal educators did not perceive *Empathy* competence as the most relevant, they did describe significant experiences outside of school that motivated them in ESD. For instance, they mentioned childhood experiences in natural environments that fostered their sense of belonging to those places and their commitment to caring for plants and animals, among other things. However, some educators also reported encountering difficulties in finding pedagogies and strategies to nurture a sense of empathy and connection with nature in their students, which are also underpinning components of *Empathy* competence.

Results regarding the non-formal context (Figure 2) show that *Transdisciplinary* and *Participation* competences were considered relevant for educators (indicated in larger, bolded lettering). However, unlike the formal context, only *Transdisciplinary* was strongly associated with both their motivations (as indicated by the thickness of the arrows connecting to circles) and their challenges (as indicated by the thickness of the arrows connecting to triangles). The competences *Attentiveness*, *Criticality*, *Futures*, and *Participation* were not associated with their motivations reported. Notably, neither *Action* nor *Futures* competences were linked with challenges in the non-formal context.

Non-formal educators derived their motivations to become interested in ESD from their experiences outside of school, often stemming from hands-on experiences and encounters with nature during their travels to other parts of the world or when watching a documentary that beautifully showed the Amazon jungle. These experiences are related to the underpinning components of *Empathy* competence, such as recognizing the needs of other beings beyond humankind. Non-formal educators also reported

several challenges interlinked with *Empathy* components, such as how to develop coping mechanisms and resilience resources to face overwhelming ESD topics. Interestingly, there were also Institutional barriers associated with developing this competence since some educators in the non-formal settings reported that lack of time, associated to their precarious work conditions, generated insufficient bonding with students, which is associated to *Empathy* competence elements.

Also, in their motivating experiences outside their formal education, educators narrated how the engagement in democratic processes in the context of sustainability triggered their interest in ESD, which is associated with elements of *Action* competence. Notably, they did not report challenges associated with this competence, except in the case of an educator who complained about the difficulties to truly and actively engage students in an action-oriented project.

Finally, it is noteworthy that *Transdisciplinary* competence was strongly linked to the challenges perceived by non-formal educators in their practice. However, unlike in the case of formal educators, these difficulties were primarily attributed to Institutional barriers that hindered their ability to collaborate with others.

Discussion

This study aims to comparatively explore the interlinkages among the ESD competences that educators consider vital for their practice, their motivations and teaching challenges across various educational settings in Barcelona to achieve transformational education. To facilitate a more in-depth discussion of our findings, we adopt the competences classification provided by the European Commission: Socio-emotional, Cognitive, and Behavioral (2022).

Therefore, among the findings we have presented, four key points have emerged as particularly noteworthy for discussion: i) the relevance of *Transdisciplinary* (behavioral) competence across their perceptions, their motivations and challenges differentiated by contexts, ii) the role of *Empathy* (socio-emotional) related challenges and motivations especially in the non-formal context, iii) the notable weight of *Systems* (cognitive) competence in the formal context, and iv) the differentiated emphasis on *Participation* (behavioral) competence across the different contexts. Finally, we will discuss the methodological limitations of the study.

First, *Transdisciplinarity* emerges as a key competence in ESD, as perceived by the interviewed educators. Their descriptions of challenges within the Institutional and Community fields of action highlight the notion that, while they consider *Transdisciplinarity* highly relevant, they often lack the conditions to fully develop this competence and its associated pedagogies. This perception regarding the challenges of developing *Transdisciplinarity* competence aligns with recent international studies on ESD educators, which have indicated that their institutions do not support inter- and transdisciplinary assessment nor feel trained to do so (UNESCO, 2021). To address these challenges, some studies have discussed the need to promote mutual learning among educators coming from diverse academic disciplines, primarily at the institutional level (Lozano et al., 2021). Additionally, another study has emphasized that, aside from the importance of training educators in ESD competences, there should also be institutional commitment to the proper integration of sustainability within educational institutions (Busquets et al., 2021).

Second, our results have shown that the *Empathy* competence is associated with challenges in the case of ESD educators from the non-formal setting. They perceive that lack of time to implement their educational activities, particularly when they are external educators in formal education institutions, hinders their ability to build stronger bonds with students. This suggests a need for disruptive pedagogical spaces, as proposed by the “wild pedagogies” (Jickling, 2018), even in non-formal settings. These pedagogies advocate for renegotiating the traditional concept of education, challenging norms, fostering critical reflection, establishing connections, and nurturing creativity, with nature serving as a co-teacher (Jickling, 2018).

Third, our results indicate that specific elements of the *Systems* competence (cognitive) were emphasized more in the formal context. Elements related to making complexity accessible to students were particularly prominent. This finding aligns with previous international research (UNESCO, 2021) that described how ESD educators often feel more confident in teaching cognitive skills, such as those associated with *Systems* components, compared to emotionally related competences, which are closer to the elements of *Empathy*. Within this UNESCO study, it is discussed that such disparities are partly attributed to the prioritization of cognitive competences in public policies (UNESCO, 2021). Indeed, cognitive-

oriented competences are still the most relevant in the Spanish curricula at different education levels, which can explain the dominance of *Systems* in the formal setting.

Fourth, the *Participation* competence (behavioral) was perceived as especially relevant for educators in the non-formal context. These results suggest that barriers related to this competence, as reported in the literature (Varela-Losada, 2018), may have been closer to being resolved in the case of non-formal educators. It could also be indicating that non-formal ESD has put more emphasis on participative and action-oriented pedagogies than formal ESD in the last decades (Cebrián et al., 2021), which might be having a positive impact on the development of related competences such as *Participation*. Regarding competences from the behavioral dimension of learning, this result also implies that the rigidity of formal educational settings (Jickling, 2017) may have limited the opportunities for formal educators to implement more participative pedagogies.

Limitations

The results from the analysis should be interpreted cautiously, as they were obtained in a particular geographical area through a case study conducted in Barcelona. These findings provide a deep understanding of the underlying relations within this context but may not be fully generalizable to other settings.

Finally, the interviews were conducted online due to pandemic circumstances, which may have had an impact on the participants' ability to discuss their perceptions with complete confidence. However, despite the remote format, all participants appeared to be comfortable, and their trust seemed to grow as the interviews progressed.

Conclusions

This study aims to illuminate the competences in ESD that educators perceive as necessary for fulfilling their roles successfully, as well as how the development of these competences is linked to their motivations and teaching challenges.

In general terms, our results highlight the significance of *Transdisciplinarity* competence (behavioral) in both formal and non-formal educational settings within the context ESD. This competence was consistently emphasized in the narratives of educators across both educational settings. Also, it is closely associated with their motivations and challenges, which are described differently in each educational setting. Non-formal educators reported facing inter-institutional barriers to achieving more collaborative and transdisciplinary projects, while formal educators described obstacles within their institutions when attempting to implement the whole-institution approach.

Another competence from the socio-emotional dimension of learning that emerges as especially relevant in our findings is *Empathy*. Although educators across both formal and non-formal settings in Barcelona do not perceive *Empathy* as a particularly crucial competence, it is still considerably interlinked with their motivations for engaging in ESD as well as their teaching challenges, especially in the case of non-formal educators.

Our findings also demonstrate that formal educators regard the *Systems* competence (cognitive) as especially relevant for their teaching role, and, at the same time, it is strongly associated to their Instructional challenges. In contrast, *Participation* (behavioral) was only emphasized in the descriptions of non-formal educators concerning its relevance for their teaching practice and their motivations toward sustainability activism.

In this regard, future training programs should be tailored to address the specific competences that are more closely related to the challenges educators face in their respective educational settings. For instance, in the case of Barcelona, where *Participation* and *Action* were not as strongly associated with challenges among non-formal educators, training efforts should prioritize competences that align more closely with the unique challenges of this context.

Furthermore, our results highlight the importance of developing *Transdisciplinarity* competence not only in the instructional field but also in the institutional and community fields of action. This can be achieved by involving educators from various disciplines, teachers, and institutional staff in sustainability-related projects, promoting interdisciplinary collaboration, and fostering a whole-institution approach to ESD.

In this sense, it is important to note that some of the challenges related to *Empathy* competence are especially relevant in the Instructional field. Therefore, when designing training programs for educators in ESD, it is crucial to address these challenges by providing educators with strategies for handling pedagogies that foster hope and avoid pessimism among students. Additionally, since elements of *Empathy* competence can be also associated with educators' motivations to engage in ESD, it is advisable to encourage educators to share their own experiences that have helped them build a meaningful connection with the natural world, even if these experiences fall outside of the formal curriculum. This approach would require training educators to create spaces for sharing personal experiences, promoting emotional openness, and facilitating meaningful understanding (Jickling, 2017); all in line with the principles of "wild pedagogies" that prioritize emotions and the dynamic reality of the learning process (Blenkinsop, 2018).

Finally, further research should explore innovative approaches to understanding and developing competences related to the socio-emotional dimensions of learning in the practical arena. This research can significantly contribute to the design of training programs that place a strong emphasis on socio-emotional competences, ultimately enhancing educators' emancipatory qualities with transformational potential (Wals & Jickling, 2002).

Notes

1. The total (N) is the number of times that interviewees referred to the competence in their responses. It is not based on the total number of participants.
2. The letter E use standing for Educator and an assigned number according to the chronological order the interviews took place.

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The authors report there are no competing interests to declare

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