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Primary School Student Teachers' Perceptions of Their Sustainability Competencies

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Abstract

Teacher education holds the potential for a cultural, holistic sustainability change of the society. The sustainability reform in higher education is commonly pursued through sustainability competency frameworks. Sustainability competencies are often assessed with quantitative approaches in research literature. This research, as a part of a design-based research project, is crucial in filling the gap in the qualitative understanding of primary school student teachers' sustainability competencies. The data, consisting of primary school student teachers' open-ended self-assessments of five key sustainability competencies, were analyzed using a combination of inductive and deductive qualitative content analysis. The research suggests that in systems thinking, students' ability to see the "bigger picture" varied or was unapparent. For strategic thinking, students identified impactful actions, but also felt inadequate in their actions. In collaboration competency, students struggled with emotions and knowledge-based justification during communication. Futures thinking competency revealed pessimistic, realistic, or positive outlooks, often marked by mistrust toward other people. In values thinking competency, students struggled to communicate their values to others. This study is significant as it provides a deeper understanding of primary school student teachers' perceptions of their sustainability competencies, which can inform the development of an effective pedagogy that promotes sustainability competencies.

Keywords: Key competencies in sustainability, primary school student teachers, qualitative content analysis, sustainability transition, teacher education.

Introduction

A sustainability transition can be described as a change that will enable the needs of humankind to be met without compromising the possibilities of future generations meeting their needs (National Research Council, 1999; Watz, 2020). To develop strategies and make decisions to promote sustainability transition, both individuals and organizations need skills and knowledge about sustainability (Watz, 2020). Also, the need for fairness in the sustainability transition needs to be addressed through critical reflection (European Commission, 2022). A broad definition of sustainable development is that the economy and the environment would reach long-term stability (Emas, 2015). Therefore, the education and working sectors play a central role in promoting or hindering the sustainable development and sustainability transition.

Higher education has the potential to impact the systemic and cultural sustainability transition of our society (Corcoran & Wals, 2004; Linnér & Wibeck, 2019). Consequently, a worldwide interest in developing programs that promote sustainability transition in higher education has been remarkably high over the past decades (Brundiars et al., 2021; Lozano et al., 2019; Weiss & Barth, 2019). Additionally, in Finland, the Rectors' Council of Finnish universities has committed all the national universities to promoting sustainability in educational programs and their operational culture (Finnish Universities Rector's Council, 2020).

Still, there is no internationally and transdisciplinary agreed, conceptual integrity on the learning objectives in higher education programs that promote sustainability (O'Byrne et al., 2015; Redman & Wiek, 2021). Despite conceptual ambiguities, as noted in a meta-analysis conducted by Redman and Wiek (2021), the conceptualization of the five key sustainability competencies remains prevalent (Wiek et al., 2011, 2016). Sustainability competencies illustrate sets of skills, attitudes, and knowledge that "empower students to become effective in positively contributing to sustainability problem-solving in their lives, professions, and communities" (Brundiars, 2021, p.11). The five key competencies according to Wiek et al. (2011, 2016) are the following:

1. Systems thinking competency that refers to the ability to understand and analyze complex ecological, economic, and social systems that impact sustainability. This competency helps in identifying interactions, causal relationships, and impact chains among different factors.
2. Collaboration competency that relates to the ability to engage in effective communication and collaboration with various stakeholders, such as businesses, communities, government agencies, and nongovernmental organizations. This competency is crucial for achieving common sustainability goals.
3. Values thinking competency encompasses knowledge and understanding of legal, ethical, and moral norms and principles related to sustainability. This competency helps organizations and societies to act responsibly and ethically during the sustainability transition.
4. Futures thinking competency means the ability to anticipate future trends and challenges related to sustainable development. It involves scenario planning and long-term planning to prepare for future changes and challenges.

5. Strategic thinking competency includes the ability to plan and implement long-term strategies and actions to promote sustainability. This competency requires strategic thinking, resource management, and adaptability to achieve sustainable development goals.

Furthermore, while Bianchi (2020) and Brundiens et al. (2021) offer an extended definition of sustainability competency, this broader framework was not adopted in this study due to its wide scope. Instead, the use of the five key competencies aligns with previous research (Karvonen et al. 2023; Ratinen & Linnanen 2022). The framework of the five key competencies is widely applied in the sustainability education literature (Brundiens et al., 2021; Redman & Wiek, 2021) to outline the goals of education for sustainability.

One of the higher education fields that could contribute to the sustainability transition is teacher education (Mula & Tilbury, 2023). Teachers can affect the sustainability-related skills, knowledge, and attitudes of the students they teach (Evans, 2020). Also, in Finland, the National Core Curriculum requires teachers to promote students' sustainability knowledge, skills, and attitudes in basic education (The Finnish National Board of Education, 2014). Moreover, according to Mula & Tilbury (2023), teachers' professional learning has been recognized as one of the most substantial catalysts for bringing innovative sustainability into educational systems and preparing learners to contribute to a sustainability transition.

Primary school student teachers are defined as students participating in teacher education programs and, after graduating, teaching pupils aged 7 to 12 in primary schools. To promote sustainability competencies in teacher education programs, several studies have proposed pedagogical approaches to increase primary school student teachers' sustainability competencies (Albareda-Tiana et al., 2018; Bürgener & Barth, 2018; Evans & Ferreira, 2019; Imara & Altinay, 2021; Scharenberg et al., 2021). However, the understanding of the quality of primary school student teachers' perceived sustainability competencies remains incomplete. Interestingly, sustainability competencies have been studied mostly using a quantitative analysis, including scale-based questionnaires (Cebrián et al., 2019; Ratinen & Linnanen, 2022; Karvonen et al., 2023). A comprehensive understanding of primary school student teachers' perceptions of sustainability competencies necessitates qualitative assessment, which is crucial in supporting the development of pedagogy that promotes sustainability competencies in teacher education. Also, participating students and higher education teachers in educational development work are essential for reforming higher education towards sustainability. The quality of the experience of the students needs to be studied and understood to achieve truly sustainable higher education.

Aims

Higher education study programs that promote sustainability transition are currently under development and consideration (Brundiens et al., 2021; Redman & Wiek, 2021). In addition, teacher education is recognized to be a catalyst for a sustainability transition (Mula & Tilbury, 2023). Also, primary school student teachers' sustainability competencies

have not been researched qualitatively before, which makes the understanding incomplete and unsustainable. Through the present study, the perceived sustainability competencies of Finnish primary school student teachers is qualitatively researched. As a result, the following research question has been formulated:

- How do Finnish primary school student teachers perceive and express their sustainability competencies in open-ended self-assessments of five key sustainability competencies?

Materials and Methods

Materials

This sub-study is part of a four-year design-based research (DBR) project started in 2022. The University of Lapland has a special teacher education program focused on sustainability and outdoor education (SOE). In contrast to other teacher education programs, which confer both Master's degrees and vocational qualifications for teaching children aged 7–12 in primary schools, the SOE program includes a more extensive curriculum on the environment, nature, and sustainability. The participants ($n = 34$) taking part in the present research are all students of this specific teacher education program. The data was gathered in 2022–2023 during contact teaching in the mandatory course of second-year SOE students similarly for two consecutive years. The participants cover roughly 20% of the population of all the teacher students at the University of Lapland.

The research data collected during the course consisted of students' open-ended self-assessments of their sustainability competencies before the course. The self-assessments were based on the five sustainability competencies (Wiek et al., 2011, 2016). Students were asked to reflect on their skills, knowledge and attitudes related to each competency. The data were made anonymous to protect the participants' privacy. The participants signed informed consent forms before taking part in the study. Also, the participants could drop out of the research project at any time. The data is stored according to the national ethical guidelines for research and data collection (Finnish National Board on Research Integrity, 2024).

Methods

This study is a part of a four-year long design-based research (DBR) project. Although, the present research also fills the requirements of the action research regarding, for example, the teachers' double roles as teachers and researchers (Nijhawan, 2017). DBR and action research have much in common, as both methodologies aim to produce practical, context-bound applications and practices while involving participants in the process (Nijhawan, 2017; Anderson & Shattuck, 2012). Still, the two methodologies emphasize different aspects, such as the role of the theory developed during the research (Nijhawan, 2017). DBR research aims at building understanding that describes and improves practice and theory (Anderson & Shattuck, 2012), whereas action research is

often faced with the critique of the lack of theory (Nijhawan, 2017). The DBR method was chosen in this study over action research mainly because it involves theory building. As teachers and researchers, we see theory building as essential during real-world, context-bound practical interventions, since it can promote transdisciplinary and international scalability and comparability of the results.

The present research focuses on qualitatively describing the sustainability competency perceptions of Finnish SOE primary school student teachers. We pursued to stay strictly close to the data to provide authentic descriptions using the same expressions participants used in their answers. Therefore, the problem-driven qualitative content analysis (QCA) was applicable in this study. The combination of inductive and deductive analysis would provide an accurate description of the students' sustainability competencies strictly based on the data through systematic reading (Krippendorff, 2019). In this study, the researchers' pre-understanding of the sustainability competencies described in the introduction impacted the choices made when selecting which parts of the data were meaningful to answer the research question. Therefore, it is possible that different teachers and researchers would have ended up with different interpretations.

The QCA procedure in our research is explained next. QCA was selected because of its ability to offer a descriptive outlook on the data (Krippendorff, 2019). Also, QCA focuses on the consistency of data and codes (Schrier, 2012), which we considered necessary in our aims of describing the phenomenon accurately and coherently. The analysis of the self-assessments progressed through the following phases: *selecting, structuring, generating, defining, and revising the code frame* (Schreier, 2012). First, the data were segmented according to formal criteria (the framework of five key competencies by Wiek et al., 2011, 2016) to examine each competency separately. To make sure all relevant data were involved in the coding, all possibly meaningful words and sentences were included in coding categories (Schreier, 2012). Second, the structuring and generating phases included combining the data-driven and concept-driven ways of coding (Schreier, 2012) since we could not rule out the effect of the key sustainability competency framework definition in our analysis. Still, we also pursued staying as close as possible to the data. In addition, the residual categories needed to be formed to include the random or marginal findings (Schreier, 2012). Third, the main and subcategories were named and described to differentiate them from each other (Schreier, 2012). Lastly, the generated coding frame was revised by both researchers to ensure inter-coder reliability (O'Connor & Joffe, 2020). In addition, the coding frame was tested on the data to indicate how well it covered the answers. As a result, after some minor modifications, the coding frame was applied to the data to conduct the analysis.

Results

Each figure presented below contains the number of answers/codes included in each category. It is important to note that the numbers in categories do not necessarily match the number of respondents, since the same respondent could be presented in many categories concurrently. Also, the answers that included only a brief mention of the category without further explanation were coded in the main category but not in the

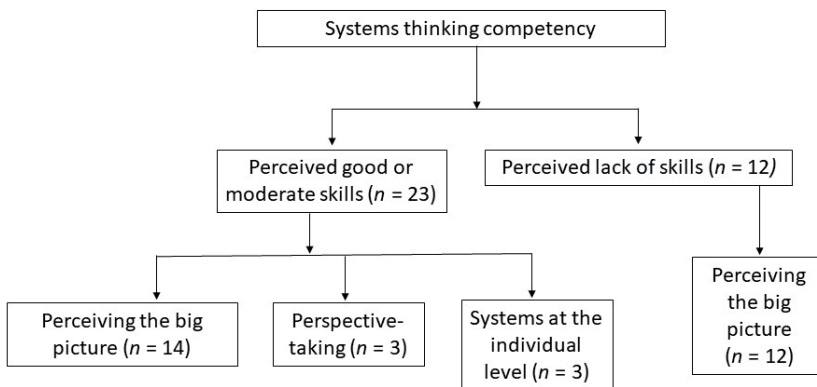
subcategories due to the lack of information. Also, residual categories containing single or random expressions are not included in the figures for clarity.

Systems Thinking Competency

Figure 1 depicts the perceived systems thinking competency of the Finnish SOE primary school student teachers. Namely, most of the participants expressed their systems thinking skills being at a good or moderate level ($n = 23$) using expressions such as “I feel like I am good at seeing sustainability issues as a whole.” Moreover, to describe their good levels of systems thinking skills, many of them highlighted their skills to see the big picture in sustainability issues ($n = 14$). Furthermore, a few participants expressed their ability to take perspectives ($n = 3$) as part of their systems thinking skills. Also, three of the participants emphasized their ability to operate on an individual level and comprehend the systems from an individual point of view, using expressions such as “I often look at environmental issues from the individual’s perspective.” On the contrary, some students expressed some lack in their systems thinking skills ($n = 12$) using expressions such as “This area in my sustainability competency requires much more information.” Interestingly, all of these expressions ($n = 12$) regarding a lack of systems thinking competency concerned the participants’ abilities to see the bigger picture when considering sustainability issues.

Figure 1

The Perceived Systems Thinking Competency of SOE Primary School Student Teachers



Strategic Thinking Competency

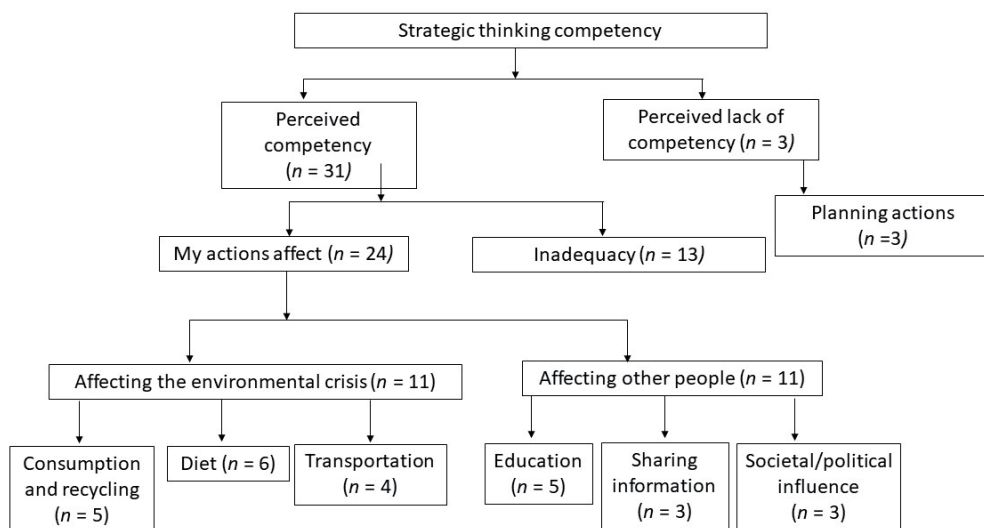
Figure 2 illustrates the perceived strategic thinking competency of the Finnish SOE primary school student teachers. First, 31 participants expressed their perceived

competency in strategic thinking through expressions like “I can plan sustainability actions” or “I recycle my waste.” Although the majority of the participants expressed strategic thinking competency ($n = 31$), thirteen respondents also perceived some inadequacy in their possibilities to affect sustainability issues positively. They described their perceptions with sentences such as “My actions are not enough to save the World.” It is noteworthy that a participant could be categorized in both categories if they perceived their possibilities to have an effect, but also felt inadequate.

Twenty-four participants experienced that their actions could directly affect either the environmental crisis ($n = 11$) or other people ($n = 11$). First, the participants expressed their perceived direct impact on the environmental crisis through consumption habits and recycling ($n = 5$), diet ($n = 6$), and transport ($n = 4$). Second, the participants highlighted their possibilities in affecting other people through education, upbringing, or the teachers’ profession ($n = 5$), sharing information in social media ($n = 3$), and through societal or political influence through, for example, voting ($n = 3$). On the contrary, three of the respondents experienced a lack of strategic competency. Furthermore, this perceived lack of competency was related to their perceived lack of skills in planning sustainability actions ($n = 3$).

Figure 2

The Perceived Strategic Thinking Competency of SOE Primary School Student Teachers



Collaboration Competency

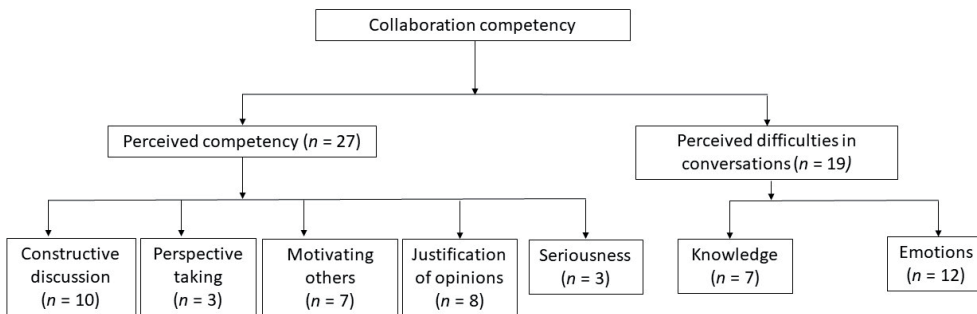
Figure 3 depicts the perceived collaboration competency of Finnish SOE primary school student teachers. In the participants’ answers, collaboration competency was reduced to concern mainly conversations with others. Other forms of collaboration were

only briefly mentioned in residual categories. First, the participants experienced either perceived competency ($n = 27$) or perceived difficulties ($n = 19$) during sustainability and environment-related conversations. On the one hand, the participants who felt competent in environmental discussions described their skills through abilities in constructive discussion ($n = 10$), perspective-taking in conversations ($n = 3$), abilities in motivating others to perform environmental actions ($n = 7$), justifying their opinions in conversations ($n = 8$), and comprehending the seriousness of the environmental topics during conversations ($n = 3$).

On the other hand, a considerable number of the participants expressed perceived difficulties in environmental or sustainability-related conversations ($n = 19$). Interestingly, the difficulties participants experienced could be divided into two different categories. First, the difficulties experienced in conversations considering knowledge ($n = 7$) were related to the participant's perception of having insufficient scientific knowledge to discuss environmental or sustainability topics with others. Second, the difficulties related to emotions ($n = 12$) were described as difficulties in, for example, remaining calm during the conversations or feeling unheard or respected by the listener.

Figure 3

The Perceived Collaboration Competency of SOE Primary School Student Teachers



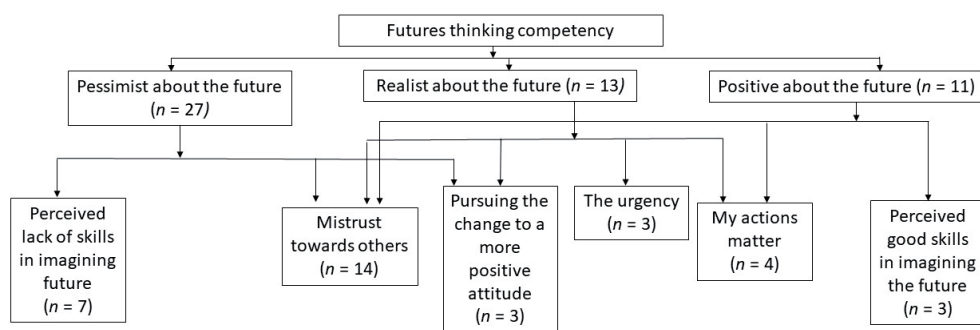
Futures Thinking Competency

Figure 4 depicts the perceived futures thinking competency of Finnish SOE primary school student teachers. Three main categories that included three different ways to relate one's outlook toward the future were formed. In addition, some features were shared between the main categories. First, 27 participants expressed their pessimistist outlook toward the future using expressions like "fear" or "anxiety." Seven of them expressed a lack of skills in imagining the future. Second, 13 participants experienced their outlook as realistic. Also, three of them highlighted the urgency of applying worldwide sustainability actions. Third, 11 participants experienced positive future outlooks, and some of them highlighted their good perceived skills in imagining the future ($n = 3$).

As mentioned, the different outlooks also shared a few subcategories. Both pessimist and realist categories shared answers about pursuing or gaining a more positive attitude toward the future ($n = 3$). Also, both categories contained mentions about the environmental impact of one's actions in and for the future ($n = 4$). Interestingly, all three outlooks (positive, realistic, and pessimistic) shared one subcategory: mistrust toward others ($n = 14$). This subcategory contained expressions that described participants' mistrust of other individuals, governments, countries, or industries that might engage in environmental actions.

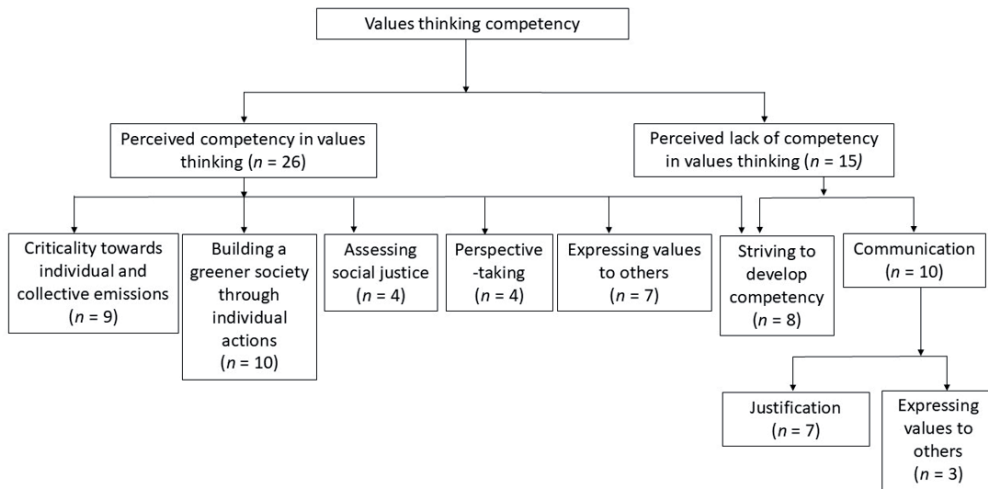
Figure 4

The Perceived Futures Thinking Competency of SOE Primary School Student Teachers



Values Thinking Competency

Figure 5 depicts the perceived values thinking competency of Finnish SOE primary school student teachers. Twenty-six respondents described the perceived competency in values thinking, and 15 respondents reflected the perceived lack of it. First, the respondents describing the competency in values thinking highlighted their skills in being critical toward individual and collective emissions ($n = 9$), building a greener society through their own actions ($n = 10$), assessing social justice ($n = 4$), taking perspectives in value reflections ($n = 4$), and expressing their values to other people ($n = 7$). Second, the participants expressing a lack of values thinking competency described difficulties in communicating their values to other people ($n = 10$). Moreover, these difficulties were depicted to be related either to the justification of one's values ($n = 7$) or expressing values to others successfully ($n = 3$). The main categories "Perceived competency in values thinking" and "Perceived lack of competency in values thinking" had one subcategory in common, "Striving to develop values thinking competency" ($n = 8$), which was highlighted in the answers included in both main categories.

Figure 5*The Perceived Values Thinking Competency of SOE Primary School Student Teachers*

Discussion

The Perceived Sustainability Competency of Finnish SOE Primary School Student Teachers

The instrumental approach in sustainability (Johnsen, 2021) must be avoided when reforming higher education towards sustainability. This requires more holistic, qualitative approaches to complete the quantitative understanding of the sustainability competencies. Consequently, the present research design allowed us to increase the previous understanding of primary school student teachers' sustainability competencies (Karvonen et al., 2023; Cebrián et al., 2017) by qualitatively identifying ways in which Finnish SOE primary school student teachers perceive their sustainability competencies. First, within systems thinking competency, students who experienced good or moderate skills in systems thinking competency emphasized their ability to see the bigger picture. However, the students who experienced a lack of this competency also expressed a lack of skills in seeing the bigger picture. As a result, this finding suggests that the ability to see the bigger picture defines students' ideas about their own systems thinking competency. Still, the systems thinking also includes various other dimensions, as described in the introduction (Wiek et al. 2011, 2016). Therefore, these findings suggest that students have a very narrow understanding of systems thinking competency if compared to the definition of systems thinking competency (Wiek et al. 2011, 2016). Moreover, the findings are similar compared to previous research about sustainability competency beliefs of Finns (Ratinen & Linnanen, 2022). Unfortunately, the narrow understanding of system thinking competency can lead to unsustainable behaviour and thinking since

the connections between cause and effect are missed. For example, systems thinking competency has an important role in facilitating co-operation and implementing sustainable development goals (Reynolds et al., 2017).

Second, in strategic thinking competency, the individual's possibilities to have an impact appeared the most underlining discussion in their answers. Moreover, students mentioned two different ways to act for sustainability: 1) to affect the environment or 2) other people. Even though the majority of the participants expressed the possibility of affecting either the environment or other people, still, many of them also experienced feelings of inadequacy about their actions. To conclude, these results suggest that the students have identified ways to act for sustainability but are also experiencing complicated feelings of inadequacy, which may affect their sustainability actions. As a result, when aiming at developing holistic pedagogy that supports sustainability competencies, primary school student teachers' experiences of inadequacy should be considered to foster their pro-environmental behaviors.

Third, in the perceived collaboration competency, students considered mainly the concept of conversations, which is a very narrow part of collaboration competency (Wiek et al. 2011, 2016). Still, the role of conversations in collaboration is evident, and students experienced and emphasized both competency and difficulties regarding this part of the collaboration competency. Interestingly, students experienced and emphasized two dimensions of the conversation as particularly complex: 1) the knowledge base and 2) the emotions during conversations. As a result, the results suggest that students have a very narrow understanding of collaboration competency. Also, their content knowledge and emotional skills may discourage them from having environmental or sustainability discussions with others. Therefore, supporting primary school student teachers' emotional regulation and strengthening their scientific rationale could promote their collaboration competency. This should be further explored.

Fourth, in the futures thinking competency, three future outlooks were identified: positive, pessimistic, and realistic. Primary school student teachers were fascinatingly more focused on expressing their future outlooks and emotion-loaded future visions than their perceived skills in envisioning the future. Moreover, this evidence might reflect students' inability to perceive their own competencies. In addition, the unifying factor for all outlooks was a perceived mistrust toward others: people, governments, countries, and industries. This mistrust was mostly based on others' lack of pursuit of environmental action. As a result, this finding suggests that even though the students' future outlook is positive, their future visions could still be delimited by their mistrust of others. Also, the experience of mistrust is suggested to be quite common among primary school student teachers. This finding affected significantly how the course was arranged in the following years. The teachers included more content about hope and co-operation in the course while supporting the student engagement and futures thinking competency self-reflection. Interestingly, people's mistrust towards, for example, environmental policies has been examined before (Fairbrother, 2017) and, some tools to communicate sustainability with different audiences (Voci & Karmasin, 2024) have been proposed. Moreover, further research would be needed to explore sustainability communication challenges, especially in the primary school teachers' profession, to promote educational

programs to match the needs of work life.

Finally, in values thinking competency, students reported diverse experiences of feeling competent in value reflection, such as social justice considerations and expressing values to others. Interestingly, difficulties in communicating values were evident, similar to the collaboration competency, as evidenced by trouble justifying or expressing values to others. To clarify, students expressed inadequacy and a lack of competency when communicating their values to others. Interestingly, sharing values was also a dividing factor, defining students' experience as either competent or incompetent in values thinking. In addition, this finding suggests that students experience not only difficulties in conversations about knowledge base and emotions, but also similar difficulties in expressing their values to others and justifying their views. As a result, these two findings fortify each other's message – students feel intimidated by sustainability-related and value-loaded conversations, especially when their own values, emotions, and knowledge base are threatened. Therefore, it might be useful to consider whether supporting primary school student teachers' conversation skills and confidence would support students' sustainability competencies. Also, it could be considered what kind of pedagogies would support the conversation skills in which students experience a lack of competency, namely, emotions, knowledge base, and communication of values. As a result, that could help students experience competency in environmental and sustainability conversations. For example, social pedagogy (Petrie, 2011) could be researched in this context as a possibility to promote students' communication skills.

Lastly, it would be interesting to research whether enhancing collaboration competency would also produce changes in perceived strategic thinking competency and, especially, in affecting other people. Also, due to experiences of being unheard in environmental conversations, the difficulties encountered in discussions and communicating values might be connected to futures thinking competency and, especially, to experiences of mistrust toward others. This would be worth researching further.

Discussion of the Research Methodology and Design

Due to the small sample of the study, a critical authorship is required. It is essential to remember that the identified sustainability competency perceptions cannot be evaluated as better or worse or ranked on a scale. Instead, these descriptions should be treated as observations about students' ways of comprehending their competency in relation to these learning objectives. Moreover, these perceptions could be treated as "starting points" for learning or individual conceptualizations students made when comparing themselves to the learning objectives before potential competency learning. Also, the findings would benefit from additional interviews to strengthen them, as a truly sustainable and holistic viewpoint of learning would require.

Still, the results indicate that there are some shared perceptions Finnish SOE primary school student teachers have about sustainability competency. Lastly, it is necessary to emphasize that other forms of data could have provided different types of expressions and interpretations since writing is not necessarily a shared ability or preferred expression channel for everyone. Therefore, the results should be confirmed with other forms of

data, such as interviews or observations.

In QCA, texts need to be interpreted in relation to their context and purpose (Krippendorf, 2019). In our research, it is necessary to remember that the data produced were part of a very specific, mandatory course of the participants' educational program. Also, the students' experience with the texts was to produce an approved assignment to complete the course. Therefore, the context and purpose of the texts set some limitations on how the results can be interpreted and utilized. Moreover, the power position of a "course-completing" student compared to an "evaluator" teacher might have affected the data. Lastly, regarding the context, all of the participants in this study were primary school student teachers studying in a Sustainability and Outdoor Education focused teacher education program, which might have distorted the results compared to primary school student teachers studying at other programs. Still, the course was introductory in nature suggesting that participants had comparable knowledge prior to the course compared to their peers from other educational programs.

In addition, the reliability and validity of the methodology of the present research need to be discussed. Although two teaching researchers discussed and agreed on the formed code frame to ensure the stability of the codes (O'Connor & Joffe, 2020), the possibility of two researchers agreeing is not a justification for the reliability of the frame (Krippendorf, 2019). Still, the replicability of the results increased the reliability of this research, indicating intracoder reliability (O'Connor & Joffe, 2020) since the code comparison between self-assessments from two different years indicated code consistency (Krippendorf, 2019). Therefore, the code frame indicates reliability across time (Schreier, 2012). Still, the replicability of the results should be confirmed in further research.

Moreover, the validity of the coding frame of the self-assessments is increased due to the previous research (Brundiens et al., 2021; Karvonen et al., 2023; Lozano et al., 2019; Ratinen & Linnanen 2022; Weiss & Barth, 2019; Wiek et al., 2011, 2016) since the previously developed scales to measure sustainability competencies offer theoretical directions to coding. Also, the generated coding frame can be compared to the previous research, and the justifications for the chosen concepts can be presented in relation to earlier research. Lastly, the content validity of the coding frame was assessed during the revision phase of code frame construction to ensure that the subcategories covered all research dimensions and participants' answers (Schrier, 2012). Also, residual categories covered only a few haphazard and random codes.

Conclusion

Our research has identified common ways in which primary school student teachers qualitatively express their perceived sustainability competency across five key sustainability competency-based self-assessments. The findings complement the previous understanding, which is based solely on quantitative measurements (Cebrián et al., 2017; Karvonen et al., 2023) and, as a result, the qualitative understanding of the primary school student teachers' perceived sustainability competency has been expanded. To summarize, the most interesting findings of the present research concerned the difficulties primary

school student teachers experienced in sustainability or environmental debates, feelings of inadequacy when considering their sustainability actions, and a narrow understanding of the content of the sustainability competencies. Still, the present findings regarding the perceived sustainability competency of Finnish SOE primary school student teachers should be treated as observations and typical conceptualizations of their perceptions, not normative prototypes that would not advocate holistic, sustainable research. Lastly, the findings should be confirmed in future research.

Nevertheless, identifying these perceptions is only the first step. At the practical level, the results of this study significantly impacted the contents and pedagogies applied during the course the participants attended and in the following years. Moreover, the concerns expressed by the students through self-assessments did guide the teachers' work in the course planning to offer students support and meaningful learning experiences. For example, teachers aimed at mitigating concerns related to environmental discussions through teaching scientific reasoning about global warming and supporting students' emotional know-how in conversations through emotional education (see, e.g., Cohen, 2006).

Next, it would be beneficial to continue researching whether the identified perceptions are universally and transdisciplinary shared or not. Furthermore, the possibility of constructing a pedagogy model that supports sustainability competency to promote every aspect of perceived sustainability competency could be discussed. As a result, the findings of this study should be further researched to develop pedagogy to enhance primary school student teachers' sustainability competencies and to achieve truly sustainable and non-instrumental teacher education. This is especially important if the learning goals of the five key competencies (Wiek et al., 2011, 2016) become a shared framework for sustainability in teacher education.

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