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Physical education teacher educators' subjective theories about sustainability and education for sustainable development

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Abstract

Purpose – Physical education (PE) and PE teacher education have great potential to target goals that are important from an education for sustainable development (ESD) perspective. However, ESD has not been studied extensively in the PE context. The purpose of this paper is to explore subjective theories of PE teacher educators about the concepts of sustainability and ESD because they are important precursors of implementing ESD in PE teacher education.

Design/methodology/approach – This study was conducted using a qualitative cross-sectional design. Subjective theories about sustainability and ESD from $N = 9$ PE teacher educators from a university in Germany were assessed in a multistage process, including semistructured interviews and the structure-formation technique. Subsequently, subjective theories were analyzed using qualitative content analysis.

Findings – The results reveal a wide range of subjective theories about the concept of sustainability. PE teacher educators described the dimensions of the sustainability concept (ecological, economic, social and political) to different depths and placed different emphases in terms of the levels of action needed to reach sustainable development. The subjective theories regarding the concept of ESD mostly include instrumental and emancipatory aspects of ESD. These subjective theories differ in that they emphasize different forms of ESD.

Originality/value – To the best of the authors' knowledge, this study is the first of its kind to examine subjective theories regarding the concepts of sustainability and ESD in the context of PE teacher education. This study is one of only a few studies to provide detailed insights into the subjective theories of teacher educators in the area of sustainability and ESD.

Keywords Education for sustainable development, Higher education, Subjective theory, Qualitative content analysis, Physical education, Beliefs

Paper type Research paper

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Introduction

Nationally and internationally, there has been a call to embed the principles of education for sustainable development (ESD) into all levels of education (United Nations, 2015; UNESCO, 2021). The main goal of this call is to equip learners at all levels with:

> Competencies that empower individuals to reflect on their own actions, taking into account their current and future social, cultural, economic, and environmental impacts, from a local and a global perspective. (Cebrián *et al.*, 2020, p. 1)

Teacher educators are important multipliers in this regard because they convey their beliefs and teaching strategies regarding sustainability and ESD to generations of future teachers, who may convey their beliefs to pupils in their lessons (Maaß and Doorman, 2013). Therefore, teacher educators' subjective theories about the concepts of sustainability and ESD, as one aspect of their professional beliefs, are seen as important precursors of implementing ESD in teacher education and, subsequently, in schools (Goller and Markert, 2022; Krauss, 2020).

ESD is implemented in various ways depending on the subject (Christie *et al.*, 2015). The notion of sustainability plays a central role in life sciences and subjects such as geography and biology, whereas it is thought to be less central to other subjects, for example, physical education (PE). However, sports, games and movement offer a variety of opportunities for pedagogical reflections within the framework of ESD (Gieß-Stüber and Thiel, 2016), for example,. about norms and values in sports and society (Bondin *et al.*, 2020) or the ecological footprint of sports activities (Wicker, 2019). PE may also play an important role in the promotion of sustainable, active living (Nigg and Nigg, 2021) or mindfulness, which is associated with ecologically sound behavior (Geiger *et al.*, 2017).

Thus far, the empirical research and conceptual developments have mostly been concentrated on ESD-related learning outcomes at the pupil, student or teacher level (Cebrián *et al.*, 2020). Little is known about teacher educators' conceptions, beliefs or experiences as a prerequisite for successfully implementing ESD principles in the teaching–learning process in higher education (Christie *et al.*, 2015; Goller and Rieckmann, 2022) and even less is known regarding teacher educators in the subject of PE.

The goal of this study is to explore PE teacher educators' subjective theories about sustainability and ESD and, thus, make an empirical contribution to the research on teacher educators' subjective theories. In the following, we will introduce theoretical considerations regarding the concepts of sustainability and ESD, especially in the context of teacher education, as a background for the analysis of PE teacher educators' subjective theories of these concepts.

Theoretical considerations of sustainability and education for sustainable development

Defining the term "sustainability"

Defining "sustainability" is a difficult task. Thus, it could be challenging for educators to address the concept of sustainability in the classroom and make educational offers that lead to learners' key sustainability competences (Rieckmann, 2018), if it is not clear what sustainability means (Birdsall, 2014). The most cited definition of "sustainability," which focuses on intra- and intergenerational justice, stems from the Brundtland report by the World Commission on Environment and Development (WCED) (1987). Its authors made it clear that sustainability can only be reached by reconciling tensions between present and future generations, socioeconomic and environmental perspectives, Global North and South and scientific accuracy and political acceptability (Borowy, 2014). Following the principle of sustainability in decisions and actions means taking a *multidimensional* view of issues, that is, environmental, sociocultural and

economic perspectives and their interconnectedness; taking into account the *temporal scale*, that is, an estimation of the short- and long-term action consequences on the path to intergenerational justice, and considering the *spatial scale*, that is, an estimation of action consequences for the individual, local, regional, and global levels (Borowy, 2014; Sinakou *et al.*, 2019; UNESCO, 2005). Furthermore, the achievement of sustainability depends on taking action at various *levels of action* (Gupta and Nilsson, 2017). This means that actions are needed at both the individual and structural levels to achieve the Sustainable Development Goals (SDGs, United Nations, 2015).

Defining education for sustainable development

ESD is an important enabler of the societal transformation needed to achieve the SDGs (Rieckmann, 2018). Various forms of ESD are described in the literature: instrumental ESD, emancipatory ESD and transformative learning (Mezirow, 1990; Vare and Scott, 2007; Wals, 2011). These are partly overlapping and, therefore, can be considered clusters in the field of ESD. Educational processes may contain aspects of various ESD forms.

Instrumental ESD is aimed at fostering sustainable behavior (Wals, 2011). Within this perspective, ESD is "expert driven" (Wals, 2011, p. 177). The educator, as an expert, knows what is "right" and "wrong" in terms of sustainable development. There is a strong confidence in the current knowledge base and the kind of behavior needed to achieve the SDGs (Wals, 2011). From a didactical perspective, instrumental ESD centers on knowledge acquisition, the development of an awareness of sustainability problems and the application of what is learned in terms of sustainable behavior (Wals, 2011).

In contrast, emancipatory ESD is aimed at fostering key sustainability competences in learners (Rieckmann, 2018). Emancipatory ESD is "process driven" (Wals, 2011, p. 178). The educator, as a moderator, has a sense of empowering, involving, and engaging learners. There is less certainty regarding the current knowledge base and the kind of behavior that is needed to achieve sustainable development (Wals, 2011). Emancipatory ESD acknowledges the double complexity of sustainability issues, that is, factual and ethical complexity (Bögeholz and Barkmann, 2005). Coping with this double complexity is seen as the most important challenge in teaching ESD (Ohl, 2018). From a didactical perspective, emancipatory ESD should reflect a holistic, pluralistic and action-oriented approach to teaching (Sinakou *et al.*, 2019). Teaching principles include the creation of participative learning environments and an appreciative atmosphere; reference to knowledge from multiple disciplines; the inclusion of real-world problems and decision-making in learning tasks; fostering critical thinking; exposing learners to uncertainty, dilemmas, and conflicts of interests; integrating values into teaching; and inspiring creativity and innovation (Lohmann *et al.*, 2021).

Transformative learning aims at:

> Experiencing a deep, structural shift in the basic premises of thought, feelings and actions. It is a shift of consciousness that dramatically and permanently alters our way of being in the world. Such a shift involves our understanding of ourselves and our self-locations; our relationships with other humans and with the natural world; our understanding of relations of power in interlocking structures of class, race, and gender; our body-awarenesses, our visions of alternative approaches to living; and our sense of possibilities for social justice and peace and personal joy. (O'Sullivan *et al.*, 2016, p. xvii)

To achieve this shift, transformative learning is based on work with dilemmas. From a didactical perspective, it is important to decide which kind of dilemma can be a starting point for learning and how this dilemma will be presented. To achieve a permanent effect, initiating and supporting reflection seem to be crucial (Mezirow, 1990).

If ESD is to become viable in schools, competent teachers are needed (UNESCO, 2020; Vare *et al.*, 2019). Teachers require professional competence to implement quality ESD

(Lohmann *et al.*, 2021). This includes profound content knowledge regarding sustainability issues in a given context and an understanding of systems and their dynamics, knowledge about the complex and contested concept of sustainability and knowledge about values and emotions and how they shape behavior in the context of sustainability; pedagogical content knowledge, including knowledge of ESD-specific teaching principles and methods, assessment in the context of ESD, students' thinking related to SD and knowledge of curriculum and resources; institutional context knowledge, that is, a knowledge of fostering institutional change, cooperation and communication with colleagues, students and external partners; the socioecological impact of educational programs; and the sustainable use of resources in the educational setting. Furthermore, the beliefs and values of teachers, for example, subjective theories of SD and ESD, epistemological beliefs about knowledge and self-reflection; their motivational orientations; and their self-regulation skills are important aspects of their ESD-specific professional competence (Lohmann *et al.*, 2021). Teachers also require key sustainability competencies that are not specific to teaching, that is, systems thinking competence, anticipatory competence, normative competence, collaboration competence, strategic competence, critical thinking competence, self-awareness competence and integrated problem-solving competence (Rieckmann, 2018), to act as role models in the educational setting.

For the subject of PE, Lohmann *et al.* (2021) have specified these competences. Accordingly, sport- and physical activity-related sustainability content knowledge includes knowledge of challenges and problems of SD in the sport context, for example, about the environmental impact of individual and collective sports activities and about associations among sport-related mobility or consumption, climate effects and human rights, knowledge about inclusive sport and sport for peace and development; knowledge about problem-solving approaches, for example, sustainability strategies of sports clubs and federations or small- and large-scale sport events, nature- and climate-friendly sports activities and health benefits of physical activity, fair trade in the production of sport equipment; knowledge of goal conflicts, for example, conflicts between outdoor sports, nature conservation, citizens and tourist operators or conflicts between profit orientation and volunteerism; and knowledge of power relations in sport organizations, the sport economy and media.

The literature also points out that ESD only succeeds when it is structurally anchored in the learning institution. Thus, implementing ESD requires not only competent teachers but also a learning environment that is aligned with sustainable development principles (Kohl *et al.*, 2022; UNESCO, 2020). The goal of such a whole-institution approach to ESD is that the teaching of ESD in class is "reinforced by the way facilities are managed and how decisions are made within the institution" (UNESCO, 2020, p. 28).

Role of teacher educators' subjective theories in the education for sustainable development agenda

Whether and how prospective teachers acquire these competences depends on the design of the learning environment and teaching goals set by a given teacher educator, as well as prospective teachers' characteristics (Hapke *et al.*, 2021; Krauss *et al.*, 2020). Thus, teacher educators are multipliers whose subjective theories regarding sustainability and ESD are assumed to constitute a crucial factor in prospective teachers' acquisition of ESD-specific professional competence.

Groeben and Scheele (2000) describe subjective theories as "complex cognition aggregates of the research object, in which their cognitions relating to the self and the world become manifest and which show an at least implicit argumentational structure" (p. 2). In contrast to scientific ("objective") theories, subjective theories are comprised of the individual's worldview

and its internal structure regarding a specific concept, which impact how the person acts, for example, in teaching. The approach follows an epistemological idea of man (phenomenology), which, in contrast to the organismic (psychoanalysis) and mechanic (behaviorism) model, understands humans as capable of speech, reflection and conscious action (Straub and Weidemann, 2015). These capabilities result in the congruency of expressed intentions and observable actions, at least partially.

Subjective theories are assessed in cooperation with the individual as a research partner. Regarding sustainability and ESD, subjective theories are especially interesting, that is, learning what teacher educators think about the basic concept of sustainability and the learning goals, contents, methods and prerequisites of ESD.

Research about the subjective theories of PE teacher educators about sustainability and ESD is very much limited. It is mostly conducted in rather overarching target groups, such as educators in higher education in general. Reid and Petocz (2006) investigated conceptions of sustainability and ESD among university lecturers from a variety of subjects. The conceptions of teacher educators have been investigated far less often. Goller and Rieckmann (2022) conducted a systematic review concerning the understanding of ESD among lecturers involved in teacher training programs in various subjects. They concluded that there is no consistent understanding of sustainability and ESD among teacher educators. This review suggests that ESD, in general, is rated as relevant by teacher educators, but it also reports barriers to and drivers of the implementation of ESD in teacher education programs. Goller and Markert (2022) explored subjective theories of teacher educators in various subjects, but PE teacher educators were not included in their sample. Regarding PE teacher educators specifically, McEvoy *et al.* (2015) report, in a scoping review, that very few researchers address their beliefs, subjective theories or understandings beyond case studies (McEvoy *et al.*, 2015). For example, Hapke *et al.* (2021) investigated health-related beliefs and Mordal-Moen and Green (2014) conducted research about understandings of practical training versus reflexive discourse in PE teacher training. Research about PE teacher educators' subjective theories of the concepts of sustainability and ESD remains limited.

Purpose of this study

The purpose of this study is to explore the subjective theories of PE teacher educators about sustainability and ESD because these are seen as precursors to implementing ESD in PE teacher education. With this work, we make an empirical contribution to the research about teacher educators as key change agents in the field of ESD in the PE context.

We will investigate the following research questions:

Subjective theories about sustainability

RQ1a. Which subjective theories do PE teacher educators hold about the concept of sustainability?

RQ1b. How do these subjective theories correspond to the scientific definition of sustainability?

Subjective theories about ESD

RQ2a. Which subjective theories do PE teacher educators hold about the concept(s) of ESD?

RQ2b. To what extent do these subjective theories correspond to the scientifically discussed understandings of ESD (emancipatory, instrumental and transformative)?

Methods

Study design

The current study was conducted using a qualitative cross-sectional design to develop a complex and detailed understanding of PE teacher educators' subjective theories regarding the concepts of sustainability and ESD.

Sample

All colleagues at one PE teacher education institution in southern Germany were invited to take part in a project that aims to implement ESD in the PE teacher education programs at this institution. Data for this study were collected from $N = 9$ PE teacher educators (three male, six female) who have voluntarily chosen to participate in the anonymized project and are presented in this text using pseudonyms. The PE teacher educators were between 30 and 61 years and have 3 and 30 years of experience as PE teacher educators. They teach in a range of disciplines, including theoretical courses and lectures about sports pedagogy, training science and health, as well as practical courses such as football, volleyball, handball, basketball, swimming, dance or alpine skiing. Most PE teacher educators teach both theoretical and practical courses. None of them has explicit experience in ESD, however, some might have already covered topics related to sustainability issues without calling it ESD, for example, mindfulness-based practices and yoga philosophy or inclusive PE.

Procedure

Subjective theories about sustainability and ESD were created by means of the structure-formation technique (Scheele and Groeben, 1984; Groeben and Scheele, 2000). This technique is used to visualize the structure of a subjective theory through a concept map (see Figures 2 and 3). The concept map consists of concept cards that contain central aspects of the subjective theory, as well as a set of grammatical conjunctions that are used to bring the cards into a logical connection. For this study, we used the "flexible combination procedure" (Scheele *et al.*, 1992) which consists of conjunctions for definitions, explanations, evaluations and description of actions using everyday language. This type of structure-formation technique has been developed for use by subjects who are not familiar with this technique and was therefore suitable for our study.

We (authors JL and AG) assessed the subjective theories of sustainability and ESD in a multistage process that took place in two meetings per individual. In the first meeting, JL asked each teacher educator to describe his or her individual understanding (subjective theory) of sustainability and ESD in a semistructured interview (based on Goller and Markert, 2022). Based on these statements, AG reconstructed the teacher educator's subjective theories of sustainability and ESD with two separate concept maps (researcher maps). After the interview, the procedure of the concept mapping was explained to the teacher educator by JL. JL additionally offered informational material, for example, the set of conjunctions, with additional explanations and examples, for the teacher educator to use in preparing for the second meeting. In the second meeting, the teacher educator first reviewed the concept cards and drafted his or her own concept maps of for sustainability and ESD (educator maps). After he or she finished the concept maps, JL presented the researcher maps. Subsequently, the teacher educator and researcher (JL) conducted a communicative validation by comparing and discussing the differences and similarities between the researcher maps and educator maps. Finally, the teacher educator decided on a final map for each of the concepts based on his or her own self- and worldview. The teacher educator decides about the final maps of sustainability and ESD which can be a combination of researcher and educator maps.

Data analysis

The final maps for the term "sustainability" and the concept of ESD were then analyzed using qualitative content analysis (Kuckartz, 2018). This process involved:

(1) the definition of the main categories based on the theoretical background, as outlined in the Introduction;

(2) the coding of the material based on the main categories;

(3) an inductive definition of subcategories based on the material;

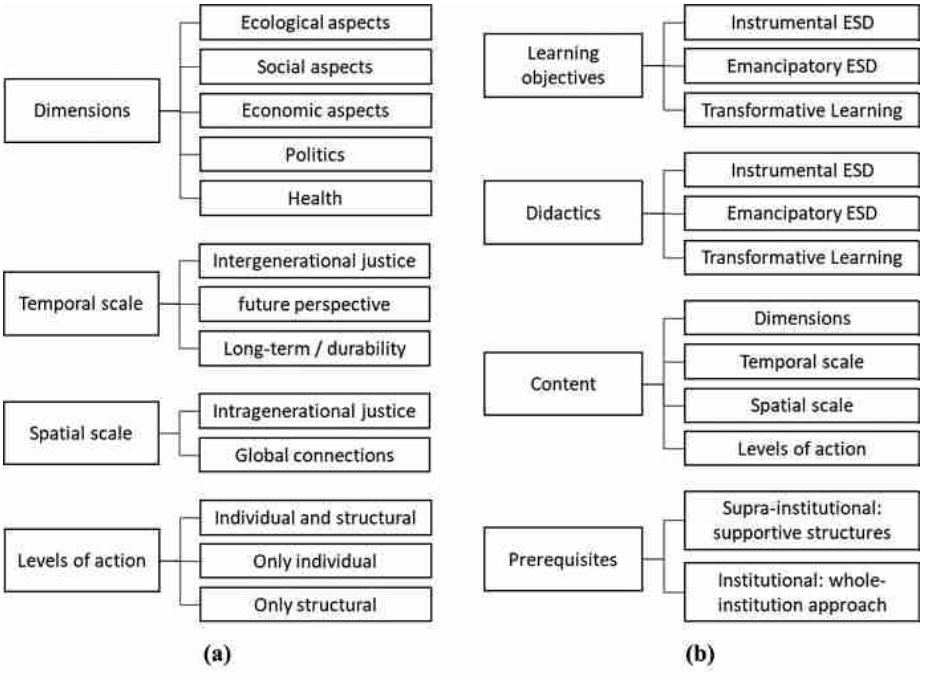
(4) the coding of all the material based on the refined category system (see Figure 1); and

(5) evaluation and interpretation (Kuckartz, 2018).

The evaluation and interpretation are comprised of two steps. First, the results are summarized according to the main categories. Second, exemplary cases are presented to demonstrate the range of subjective theories.

Because sustainability and ESD are different concepts with different theoretical frameworks, this process was performed separately, with two different category systems for the subjective theories on sustainability and ESD (see Figure 1). Steps (1)–(3) were conducted by both researchers together. Steps (4) and (5) were conducted by JL for the concept of sustainability and by AG for the concept of ESD. Codings were discussed continuously, and disagreements were resolved by consensus.

The subjective theories about sustainability were analyzed based on the main categories, dimensions, temporal scale, spatial scale and levels of action, as outlined in the Introduction.



Notes: (a) Sustainability; (b) education for sustainable development

Figure 1.
Category systems for the analysis of subjective theories on sustainability and education for sustainable development

Regarding the main category dimensions, we used social, ecological and economic dimensions as deductive subcategories and additionally developed health and politics as inductive subcategories. Regarding the subjective theories about ESD, we analyzed learning objectives, didactics, content and prerequisites as the main categories. The subcategories for learning objectives and didactics were based on the various forms of ESD, as outlined in the Introduction. However, some statements about the didactics of ESD cannot be clearly identified as either emancipatory, instrumental or transformative, because they are context dependent. The same objective might be reached in instrumental, emancipatory or transformative ways. Content refers to specific sustainability topics that seem to be suitable for ESD. Therefore, the subcategories for content are based on the main categories that were used to analyze the subjective theories about the concept of sustainability. The prerequisites for ESD are subdivided into suprainstitutional and institutional subcategories. These subcategories were developed inductively based on the material in an iterative process by JL and AG.

Results

The results are presented in two sections, one for the subjective theories on sustainability (*RQ1*) and another for the subjective theories on ESD (*RQ2*). Within each section, we first present the results of the subjective theories according to the main categories. Subsequently, selected cases are described as examples (see also Figure 2). These cases demonstrate the spectrum of subjective theories on sustainability and ESD, respectively, in our sample.

Subjective theories of sustainability

Regarding the *dimensions of sustainability*, three PE teacher educators (Markus, Jana and Sara) explicitly describe sustainability as a multidimensional concept. They include at least social and ecological and, sometimes, additionally economic, health and political perspectives as important. In contrast, four educators explicate rather unidimensional subjective theories, with a focus on resource conservation and environmental factors. Miriam and Petra lie between these two clusters: both show a strong focus on environmental factors, but they additionally made connections to the economic (Miriam), health (Petra) and political (both) spheres. The political sphere was also present in Robert's subjective theory of sustainability. He did not explicitly refer to any of the "classical" sustainability dimensions (social, ecologic or economic).

The *temporal scale* of sustainability was present in most subjective theories. The explicit theme of intergenerational justice was the main aspect of Robert's subjective theory of sustainability and an important part of Miriam's. Future thinking was also present in Markus's and Sara's subjective theories; however, it was less explicitly linked to justice and future generations. The temporal scale was also central to Petra's and Max' definitions, but in the sense of the need for measures or products to be long lasting and durable. Petra's definition of sustainability was focused on the long-term implementation of measures, whereas Max emphasized the importance of producing durable and recyclable products.

The *spatial scale* did play a minor role in all subjective theories and was only mentioned by Sara in terms of a "global perspective." The term "intragenerational justice" was not mentioned by any of the educators.

Considering the *levels of action* at which sustainability can be achieved, four teacher educators (Jana, Sara, Sonja and Robert) stressed the importance of a multilevel approach, that is, sustainability can only be achieved through individual and political action or structural changes. Two educators viewed structural changes as the most important (Miriam and Petra). In contrast, Sina's subjective theory on sustainability involves only individual behaviors. Markus and Max did not specify any level of action.

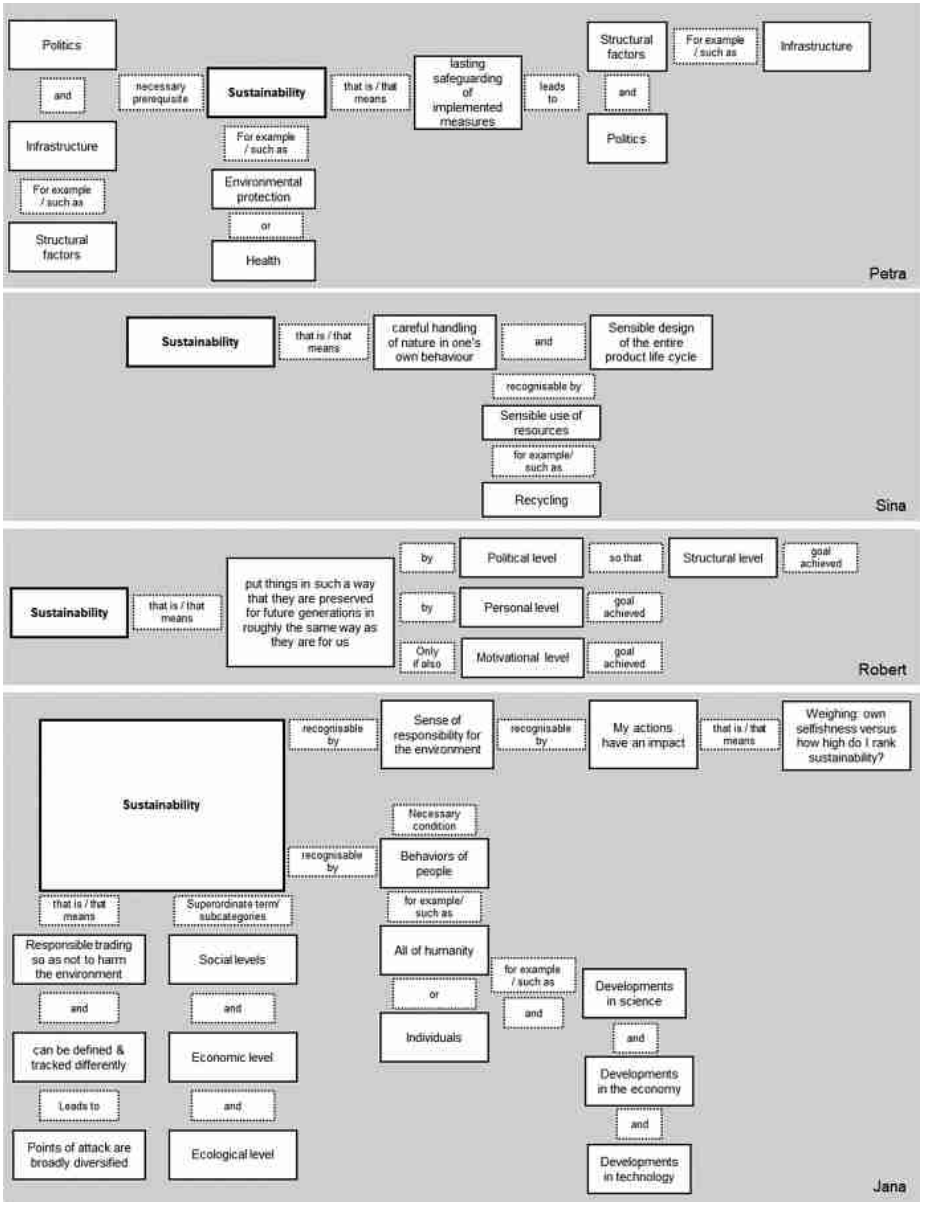


Figure 2.
Subjective theories of sustainability – selected cases

Case Petra: sustainability as long-term implementation. Petra's subjective theory on sustainability focuses on the long-term implementation of measures. According to her, political decisions and institutional structures are both prerequisites and outcomes of the long-term implementation of health and environmental measures. She refers primarily to the meaning of

"sustainable" as "permanent" and less to the sociopolitical interpretation of the term "sustainability."

Case Sina: environmental sustainability. Sina's focus is on the careful use of resources on an individual level. She stresses the relevance of individual behavior and sustainable lifestyle choices in several fields of action (e.g. mobility, consumerism and nutrition) and thereby mostly refers to environmental issues.

Case Robert: sustainability as intergenerational justice. Robert's subjective theory on sustainability is focused on intergenerational justice. He also emphasizes the importance of a multilevel approach to sustainability, including political decisions leading to structural changes, as well as individual efforts. He points out that motivational factors must be taken into account to advance sustainability goals in society.

Case Jana: sustainability as multidimensional concept and future-oriented process. Jana defines sustainability as a multidimensional process that must be pursued at the social, economic and environmental levels by individuals and humanity as a whole. At the individual level, she requires a sense of responsibility for the environment and knowledge about the consequences of action. At the societal level, sustainability means changing economics, technology or science in a more general way.

Subjective theories of education for sustainable development

Regarding the concepts of ESD, the PE teacher educators talked about learning objectives, methods, content and prerequisites for ESD. A large number of the mentioned *learning objectives* can be attributed to instrumental ESD. We find an expert-driven view, with strong confidence in the current knowledge base, in statements that learners should come to "know ecological, economic, and social aspects" (Robert). For most teacher educators, it was important to "raise awareness for problems" (Petra). Specifically, teacher educators speak about creating "sensitivity for dealing with planet, limited resources" (Sina) and an "awareness of injustices that we take for granted" (Sara). Fostering sustainable behavior is also an objective of instrumental ESD. Learners should "understand why it makes sense to behave sustainably" (Max). We also find learning objectives that can be attributed to emancipatory ESD. These learning objectives are rather process related and less content specific. Sonja, for example, describes learning objectives such as "learners develop attitudes" and "act accordingly." Sina wants learners to "be able to evaluate processes." Learning objectives such as "reflection" and "pupils become politically active" (Jana) are related to both emancipatory ESD and transformative learning. Furthermore, we found learning objectives such as "love/relationship with nature" (Sara) and "appreciation" (Sonja) that complement the forms of ESD described and the associated learning objectives.

Teacher educators mentioned many *methods* and didactic principles regarding ESD.

The didactics of instrumental ESD focus on knowledge acquisition, the development of an awareness of sustainability problems and the application of what is learned in terms of sustainable behavior. In this sense, PE teacher educators reported "knowledge transfer" (Sina), "communicat[ing] facts about resource use" (Sonja), "education about positive and negative effects of own behavior" (Miriam) and "sensitization" (Sara) as didactical elements of ESD. The objective of sustainable behavior may be reached by "bringing change to everyday life step by step" (Jana). Emancipatory ESD reflects a holistic, pluralistic and action-oriented approach to teaching. Most teacher educators named methods of action-oriented learning, for example, project-based learning (Sonja, Sara, Petra and Robert); "experimental learning" (Markus); or "cooperative planning" (Sina). For Petra, "empowerment" and "participation" play an important role in ESD as well. One specific method, the "expert interview" (Jana) may be linked to an expert-driven perspective (instrumental ESD). However, depending on the way it is implemented in a

learning situation, it may also be a reference to inquiry-based learning (emancipatory ESD). Reflection is a crucial element of both emancipatory ESD and transformative learning that was mentioned by two teacher educators (Miriam and Sara). Using stimuli can be a starting point for emancipatory ESD or transformative learning, depending on the context and further didactical steps. Also, "create[ing] personal involvement" (Jana) can be an element of all three forms of ESD.

Regarding the *contents of ESD*, six of the nine teacher educators name ecological issues, five name social issues and two name economic or health contents. Mobility was the most frequently mentioned example of ecological content (Sara, Sonja and Petra). For some teacher educators, content should be reflected in temporal and spatial scales. Markus, for example, refers to the temporal and spatial scale as content for ESD in his statement "preserve the planet for a long time." Sara also adopts a global and future perspective when listing questions such as "What's the world like?" and "How do I want the world to be?" as ESD content. Considering the levels of action, teacher educators most often addressed individual responsibility, for example, analyzing one's own ecological footprint (Markus and Sonja) or consumption (Sina, Jana and Sara).

Teacher educators describe *prerequisites* on two levels. On the suprainstitutional level, Miriam and Sina name structural political support as a prerequisite for the implementation of ESD. Petra emphasizes that "getting people on board in structures" and "working structurally from the start" are important prerequisites for ESD. Additionally, teacher educators state that ESD should be a "cross-sectional task for all educational institutions" (Sina), for example, daycare facilities for children (Sina), schools (Markus and Sina), universities (Sina), adult education (Sina) and sports clubs (Sonja). Schools are seen as playing a particularly important role in ESD because they "reach everyone" (Sonja). Organizational stringency along educational paths and long-term institutional anchoring must be ensured (Markus).

At the institutional level, several aspects of a whole-institution approach were mentioned as important prerequisites for ESD. For schools, anchoring ESD in the curricula (Sara and Max) or even creating a corresponding school subject (Markus, Jana and Sara) is proposed. The principles of sustainability should apply to the entire facility (charter and mission statement). In the best-case scenario, these are developed in a participatory manner (Sina). The teacher educators disagreed regarding whether these principles should be formulated as voluntary (Sina) or mandatory (Sara). Jana mentions a variety of examples showing how sustainability might be considered at the institutional level, such as festivals with sustainability themes, energy-saving lamps, school meals or the organization of mobility around the school. However, she also sees a problem in the lack of supporting framework conditions. Robert states that the infrastructure and organizational structure must make it easy for people to behave sustainably. In this way, the learning institution can do justice to its role model function (Sonja, Sara and Jana). In this context, "Principals [should] set ESD as a goal" for the entire institution (Max). Every other teacher is a "role model" as well (Jana). They should be "trained and make ESD their own goal" (Max).

Case Sina – education for sustainable development as a cross-sectional issue. Sina defines ESD as education that is carried out as a cross-sectional issue in all educational institutions and levels. In her view, ESD means "creat[ing] sensitivity for dealing with the planet [and] limited resources." This applies to consumption, health and food production. She states that reflection leads to the development of competences, for example, for the evaluation of processes according to sustainability criteria, which then results in an understanding of connections and behavioral changes. In teaching, she focuses on a combination of knowledge transfer and action-oriented learning. She sees a risk of resistance from pupils, which she answers by being undogmatic and presenting content that is "well dosed" and "nicely packaged." Sina sees "political support" and a charter developed voluntarily and participatively as crucial prerequisites for ESD.

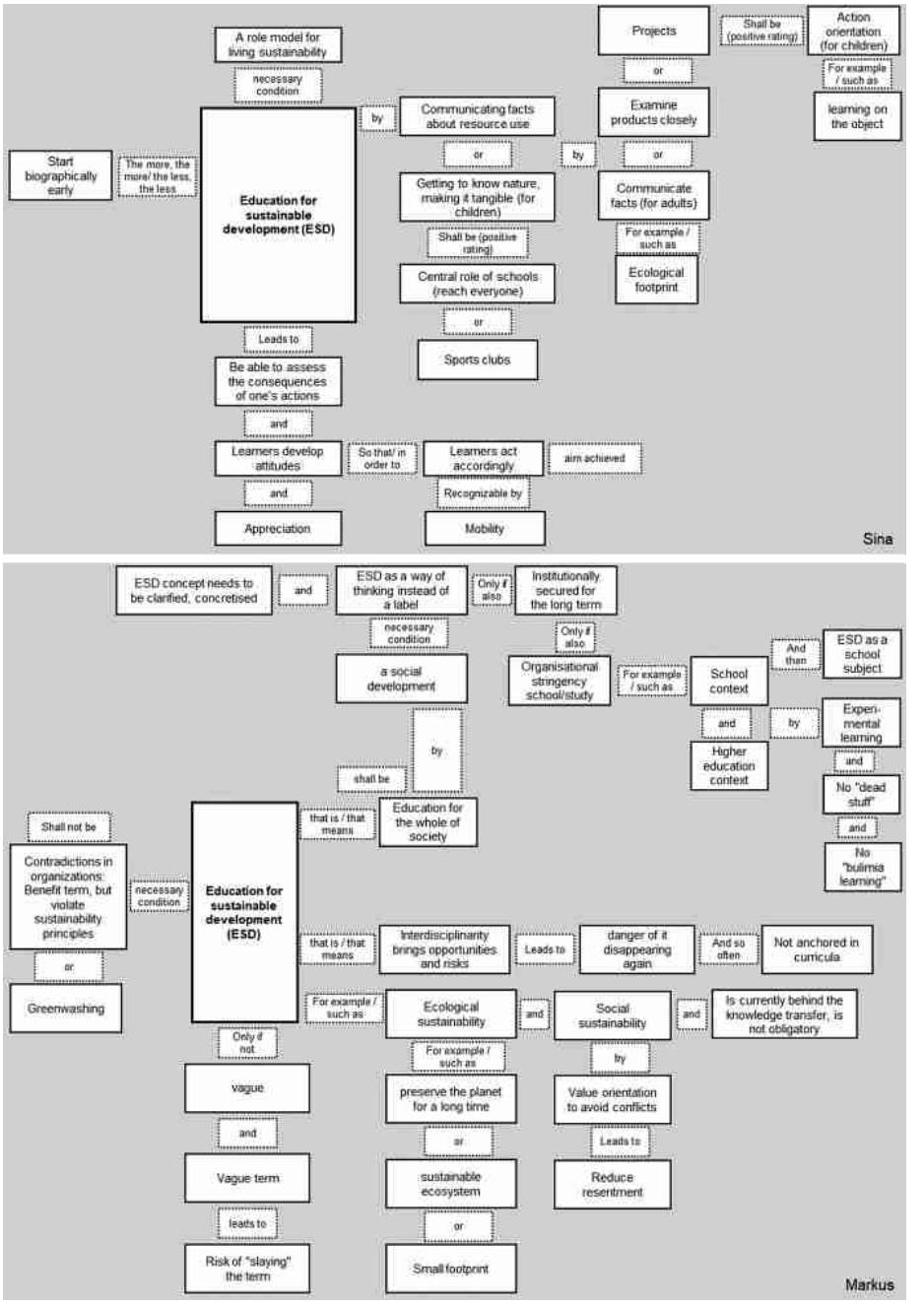


Figure 3.
Subjective theories about education for sustainable development – selected cases

Case Markus – critical and aware of risks. Markus focuses on the problems and risks associated with ESD and ESD implementation. He sees ESD as "education for the whole of society" and names school and higher education as relevant settings. He sees ecological and social sustainability as typical examples of content. At an organizational level, he claims that problems such as "contradictions in organizations: [they] use [the] term but violate sustainability principles" and "greenwashing" must be solved before ESD can be successfully implemented. The term itself, in his eyes, is vague and overwhelming. It should be substantiated and institutionalized, for example, as a school subject. He names experiential learning as a method and calls for avoiding "bulimia learning" and "dead content." In the interdisciplinary character of ESD, Markus sees a risk, apparently because of responsibility issues.

Discussion

The purpose of this study was to explore the subjective theories of PE teacher educators about the concepts of sustainability (*RQ1*) and ESD (*RQ2*). In the following sections, we will discuss how these subjective theories correspond to "objective" theories, that is, the scientific definition of sustainability and the instrumental and emancipatory approaches to ESD or transformative learning, as outlined in the Introduction.

Subjective and "objective" theories about sustainability

The results reveal a wide range of subjective theories about the concept of sustainability. PE teacher educators described the dimensions of the sustainability concept (ecological, economic, social, health and political) at different depths and emphasized different levels of action that will be needed to reach sustainable development. We also analyzed how these teacher educators' subjective theories correspond with the scientific definition of sustainability, as outlined in the Introduction. The results show that PE teachers may be close to the scientific definition of sustainability in one dimension but further away in other dimensions.

Petra explained sustainability mostly in terms of durability, without mentioning the normative notion of sustainability as a multidimensional construct that aims at intra- and intergenerational justice. Sina (and also Sonja, Miriam and Max) refer to the normative concept of sustainability but focus on resource conservation and the environmental component of the construct. In a similar study with student teachers in primary education, Birdsall (2014) reported that 45% of student teachers had an understanding of sustainability that centered around resource conservation and caring for the environment. This understanding reflects the so-called strong sustainability conception (Heidiger, 2006). This conception implies that natural resources and the properties of the physical environment must be sustained, even if this is associated with changes in the social and economic dimensions (Heidiger, 2006). In contrast, the weak sustainability conception assumes that social, economic and ecological dimensions are equally important and that regression in one dimension may be offset by progress in another. Roberts' subjective theory of sustainability is relatively close to the Brundtland definition (WCED, 1987), with a focus on intergenerational justice. The most comprehensive subjective theories are those of Jana, Sara and Markus. They are the closest to the "objective" theory that we outlined in the Introduction: sustainability as a multidimensional construct with a temporal scale (future thinking, intergenerational justice) and spatial (intragenerational justice) scale (Borowy, 2014).

Regarding the levels of action reported in the subjective theories about sustainability, most PE teacher educators believe that sustainability can be reached through decisions made at a structural level. In line with United Nations Educational, Scientific and Cultural Organization (UNESCO, 2020), they emphasize the important role of political decision-

making and implementing whole-institution approaches in sustainable development. When the individual level is mentioned, the PE teacher educators see consumption and mobility as important for sustainable development on an individual level.

Subjective and "objective" theories of education for sustainable development

The subjective theories of the interviewed PE teacher educators usually include instrumental and emancipatory aspects of ESD. The subjective theories differ in that they emphasize different approaches to ESD. Additionally, some subjective theories seem to be inconsistent. Some name instrumental goals, such as specific sustainable behaviors, in conjunction with process-oriented and emancipatory teaching methods. This finding is in line with the conception of instrumental and emancipatory ESD, as put forth by Vare and Scott (2007) and Wals (2011). Vare and Scott (2007) describe the different forms of ESD within a heuristic of "the ancient Chinese concept of Yin and Yang," rather than as "absolute opposites held apart along a continuum, or as competing sets of skills" (p. 195). In line with educational approaches that focus on the development of competences (Glaesser, 2019) and the requirement to develop sustainability competences in learners (Rieckmann, 2018), some teacher educators emphasized that teaching and learning in ESD should include knowledge and action. The aspect of reflection, which plays an important role in the concepts of emancipatory ESD and transformative learning, seems to be less central to the subjective theories of the teacher educators (Mezirow, 1990).

We also found that some teacher educators mixed the concepts of sustainability and ESD, especially when they labeled elements of sustainability as ESD. Markus describes ecological and social sustainability as examples of ESD. We interpret this as an indicator of uncertainty regarding the differences between these two concepts. The high degree of complexity or an impression of vagueness (Markus) in this area can be experienced as a barrier to taking action.

Another theme that seemed to be important to the teacher educators in our sample was that schools – and learning institutions more generally – should be role models in terms of sustainable management and teaching staff and principals should be role models in terms of sustainable behavior. The teacher educators thus emphasize the relevance of organizational framework conditions that are important for the honest and holistic implementation of ESD. This finding empirically supports UNESCO's (2020) call to pursue a whole-institution approach when implementing ESD.

The teacher educators in our sample are teachers in a higher education institution. However, in their subjective theories about ESD, they mostly refer to the context of schools, instead of universities. This implies that they see ESD as an important task for schools but that they also likely see it less as their own responsibility to implement ESD in higher education. In their subjective theories, they reflect the necessity that ESD should be implemented at various educational levels. However, it seems to be necessary to further sensitize and train teachers at all levels of education for their tasks as ESD multipliers.

Implications for the implementation of education for sustainable development in physical education teacher education

There are as many different types of ESD as there are ESD multipliers. If ESD is to be implemented coherently in an institution, a common understanding of it must first be developed. Transdisciplinary and transformative projects (Defila and Di Giulio, 2018) could be a feasible way to develop a common understanding of central concepts and bring about structural changes in learning institutions in the sense of a whole-institution approach (Kohl *et al.*, 2022).

If ESD is to become viable in PE teacher education, it seems to be important to create good-practice teaching and learning concepts for ESD in the specific context of PE and PE

teacher education. Our research provides evidence that PE teacher educators find it important to implement ESD and work toward sustainable institutions. However, the participants of our study lack concrete ideas about how ESD can be implemented in the specific context of sports, play and movement and how they can foster ESD-specific professional competence in prospective PE teachers, as suggested by Lohmann *et al.* (2021).

Limitations and future directions for research

Subjective theories about the concepts of sustainability and ESD in our sample show a certain range in terms of content and focus. However, the sample consists of PE teacher educators who voluntarily chose to participate in a project aimed at implementing ESD in PE teacher education. Thus, they have all shown interest in sustainability topics and expressed that ESD implementation is relevant. The subjective theories of additional PE teachers from other institutions or PE teachers who did not participate in the aforementioned project should be analyzed to investigate inter- and intrainstitutional differences in individual and common subjective theories regarding sustainability and ESD. A larger sample would allow the application of cluster analysis to determine the differences and commonalities between groups of people.

The multistage process of the structure-formation technique (Scheele and Groeben, 1984; Groeben and Scheele, 2000) reveals subjective theories in great detail and includes a validation step. However, this method also requires that the persons interviewed invest time for two in-depth sessions and prepare for the second session in which the concept maps are created. Some PE teacher educators did not prepare the structure-formation session and, in the session, did not deal very intensively with individual concepts and relationships.

We explored the subjective theories of PE teacher educators regarding the concepts of sustainability and ESD. However, we did not conduct an explanative validation. This means that we did not explore whether and how the teacher educators implemented ESD in their own teaching. Therefore, we cannot predict how subjective theories and actual teaching practice are associated.

Conclusions

The goal of the present research was to explore the subjective theories of PE teacher educators about sustainability and ESD because these are seen as precursors for implementing ESD in PE teacher education. The subjective theories of the PE teacher educators approach the "objective" theories outlined in the Introduction in different ways. These theories differ in content, as well as their focus on specific factors. Regarding the term "sustainability," some focus on ecological aspects and resource conservation, whereas others understand sustainability as a multidimensional concept with spatial and temporal aspects. Regarding the term "ESD," PE teacher educators usually include emancipatory and instrumental aspects. Furthermore, they emphasize the importance of supporting structures for implementing ESD as a cross-sectional task for all educational institutions. To implement ESD holistically in terms of a whole-institution approach, it would be beneficial to develop a common understanding of the basic concepts of sustainability and ESD. This might best be reached through participative processes.

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