Interdisciplinary Journal of Environmental and Science Education
2022, 18(3), e2278
ISSN 2633-6537 (Online)
https://www.ijese.com

Research Article

Education, Sustainability and Responsibility–Pedagogic Antinomies for Prospective Teachers?

Jochen Laub [1*]

[1] University Koblenz-Landau, Landau, GERMANY
***Corresponding Author:** laub@uni-landau.de

Citation: Laub, J. (2022). Education, Sustainability and Responsibility–Pedagogic Antinomies for Prospective Teachers? *Interdisciplinary Journal of Environmental and Science Education, 18*(3), e2278. https://doi.org/10.21601/ijese/12015

ARTICLE INFO

Received: 15 Feb. 2022

Accepted: 8 Apr. 2022

ABSTRACT

Current approaches of education for sustainable development (ESD) focus on the importance of dealing with sustainability values and ethical judgements in sustainability issues. Vare and Scott (2007) distinguish between different understandings of education for sustainable behavior (ESD I) or education for a reflective awareness of the value of sustainability (ESD II) (Singer-Brodowski, 2016; Sippl et al., 2020; Vare & Scott, 2007). It has not been examined in detail yet, how teachers recognize or reflect on the pedagogical and content-related antinomies (Helsper, 2004) of ESD. However, it is important to reflect on the content related pedagogical antinomies of ESD mentally, if this is to be implemented (Laub, 2021a). The present article therefore considers how prospective teachers integrate the concepts of education, sustainability, and responsibility into an idea of ESD argumentative and which antinomies they reflect on. By a qualitative approach, texts of prospective teachers are analyzed and types of argumentation are build (Kuckartz, 2018). The results show basically two different types of argumentation, that show different degrees of reflection of antinomies and different integrations of their concept of responsibility in ESD.

Keywords: ESD, pedagogic antinomies, responsibility, professionalization, geography didactics

INTRODUCTION

The concept of sustainability is currently in a prominent position both in public and in (educational) scientific discourses. Yet, *Fridays for Future*-demonstrations show that this also affects the lives of schoolchildren. Against the background of the drastically changing world, the increasing consumption of resources, the growing amount of waste, and the worsening climatic situation on earth, sustainable action is one of the central educational goals of school in our days. The enormous importance of the sustainable development goals is formulated as education for sustainable development (ESD) by UNESCO (2017). ESD represents one of the central conceptual foundations of the normative orientation of teaching, for example in the subject of geography (Hemmer, 2016; Keil, 2019). The ESD concept sounds plausible and promising, the goals already seem noble and desirable without closer examination. Almost 50 years after the Club of Rome's conclusions about the "limits of growth" (Meadows et al., 1972), the demands for sustainability today are probably a broad consensus and actually undisputed in public. Sustainability is recognized as a social value and even serves as a 'slogan' for a wide variety of products today. In the classroom, however, teachers are faced with various challenges that are associated with the concept of sustainability. In teaching sustainability-topics, teachers need the ability to reflect on these subject-related and pedagogical challenges. Especially the normativity of the approach is a challenge, that is increasingly emphasized in critical approaches (Lambert, 1999; Laub 2021a; Pettig, 2021) and the critique of standardization of education (Dickel, 2011). This normativity (on a pedagogical as well as on a content level) collides with the idea of education, which presupposes the freedom and self-determination of the learners, especially with regard values and ethical judgements. This article considers the resulting tensions as antinomies and assumes that ESD, amongst other things, poses a challenge of combining the freedom of the learner with the normativity of the educational concept. Antinomies are contradictions between thesis and antithesis, that cannot be solved easily (Helsper, 2001). How teachers deal with these pedagogic and content-related antinomies mentally is of utmost importance and central. In order to recognize this more precisely, the present article asks, if teachers know about these antinomies and are able to reflect on pedagogic antinomies associated with the tension between the freedom implicit in the educational idea and the normative goals of the ESD approach. These are also evident on the level of content. Tensions that arise between education and sustainability are in the

foreground. Teachers have to reflect on and integrate them mentally. The perspective of this contribution also integrates the pedagogical concept of responsibility, that is able to relate antinomic terms given in ESD. For this, the contribution relates to the pedagogic thoughts of Petzelt (2018), which give a possibility to resolve the tension between education and sustainability in his understanding of responsibility. The contribution asks how teachers understand and explain antinomic tensions between the terms education (Bildung) and sustainability and if they use the concept of responsibility to solve visible contradictions. In contrast to previous considerations, the article starts from the antinomies that are associated with the pedagogical approaches of ESD and tries to get insight into how teachers reflect on the role of these antinomies. As the main antinomies are related to the pedagogical challenges of moral education, the ethical complexity of ESD is a main topic in the research, as Vare and Scott (2007) show with ESD II. To get a more evidence-based view, the empirical access analyses texts of 42 prospective teachers, that show their view of the relation of concepts and their logic solution of the antinomic structure of education and sustainability. Using a qualitative content-analytical approach (Mayring, 2015), this article considers how prospective teachers integrate the concepts of education, sustainability and if they use responsibility as an integrative pedagogical concept.

The contribution starts with outlines of the theoretical frame of a pedagogical perspective on sustainability. This includes a discussion of pedagogic antinomies and their meaning for educational approaches for sustainable development. In a second step, the meaning of responsibility is introduced. Since the understanding of Petzelt (2018) can play a significant role in mediating between education and sustainability, his approach is highlighted here. Then follows a look at empirical indications on how teachers deal with similar problems. This view refers to various aspects of the professional knowledge of teachers (Baumert & Kunter, 2006; Laub et al., 2021; Shulman, 1987) on ethical complexity because this field is closely linked to ESD II. The fourth step lies on the empirical exploration, the methodological framework, and the research process. The presentation of the connections in the theoretical part also serves to form types of the interpretative procedure in the empirical-analytical part. The last step shows results and gives insight into how teachers reflect on the challenges of antinomic tensions within approaches of ESD.

PEDAGOGOCAL ANTINOMIES AND EDUCATION FOR SUSTAINABLE DEVELOPMENT

Pedagogical Antinomies on Different Levels

Teaching requires a capability of integrating different forms of knowledge from different scientific backgrounds (Baumer & Kunter, 2006). Especially ESD shows a high complexity on different levels. Therefore, there is both a need and an opportunity to look at how teachers deal with tensions between these levels mentally and in practice. Pedagogical theory formation was fundamentally aware of the challenges of contradictions that result from contradictions within the pedagogical context - long before the concepts of antinomy or paradox were discussed (Hug, 2011). Kant's (1974) understanding of this is a conflict between laws that can be ascribed to pure reason. It is also Kant (1974) who points out the basic antinomy of the pedagogical (Helsper, 2001, p. 84) when he formulates the question of the possibility of cultivating freedom in coercion. In the pedagogical context, Theodor Litt was the first to include the term in the educational vocabulary (Kron, 1969, p. 95).

As Gerhard Vollmer (1990, p. 49) points out, antinomies can be understood as a certain class of contradictions "in which both sides (thesis and antithesis) can apparently be justified equally well". According to Vollmer (1990, p. 50), conflicting values and norms are mostly to be regarded as antinomies. Today, antinomies are discussed especially within system-theoretical approaches of the educational. Professionalization research focuses particularly on the antinomies and paradoxes of teachers' professional actions (Binder, 2016).

In his organization-theoretical approach, Helsper (2001) points out that various antinomies can be ascribed to teachers' actions. He assigns these to four levels:

1. Constitutive antinomies to be taken into account reflexively (antinomies of justification, antinomies of practice, antinomies of subsumption, antinomies of uncertainty, antinomies of trust, antinomies of autonomy, antinomies of organization, antinomies of differentiation, antinomies of things and antinomies of proximity)
2. Antinomies as a result of the social organization of the educational system
3. Antinomies on the level of individual action and on the structural level and
4. Antinomies on the meta-level, which must be located against the background of the pluralization and differentiation of society (Helsper, 2001, p. 87)

The contribution focuses on the ability of teachers to reflect on the antinomies related to ESD. It is particularly important whether teachers recognize this as a problem and how they reflect on it. In Helsper's (2001, p. 87) understanding, the antinomies considered more in detail are primarily constitutive antinomies. The article will also take the norm problem highlighted by Ruhloff (1979) into account, which is associated with the transfer of the concept of sustainability into pedagogical contexts. Basically, it can be seen that educational science finds it difficult to justify pedagogical standards, criteria and norms (Ruhloff, 1979, p. 15). The problem of norms raises the question of what answers the different (philosophical-oriented) approaches give to the question of pedagogical standards. Ruhloff (1979, p. 17) does not focus the question on "concrete norms and standards, but considers above all the possibilities of justifying norms contained in the theoretical approaches" (Ruhloff, 1979, p. 18). Fundamental antinomies arise from the tension between the terms education and sustainability. The relationship between the two terms requires clarification of their hierarchy and reference structure. It proves to be problematic to subordinate

education to a term that is taken over from structural or ecological approaches. This means a transfer of sustainability from a functionalistic-naturalizing context to educational contexts, and therefore the content contains various contradictions. Yet, education refers to an evolving subject, sustainability to a system context. So even on a conceptual-theoretical level, antinomies are indicated in concepts of sustainable education (Laub, 2021a). Even for Kant (1974), the antinomies do not represent the argumentation-logical end point of a train of thought, but rather refer (also) to the starting point of further efforts at knowledge (Kron, 1969).

Antinomies and Education for Sustainable Development

In the understanding of the World Commission Report on "our common future", sustainability is a way of shaping human society that meets current needs without jeopardizing the basis for meeting the needs of future generations (Hauff, 1987, p. 46). As de Haan (2007, p. 7) points out, thinking and acting in this context refers primarily to future developments. From a pedagogical point of view, this opens up the question of the paradoxes associated with the approach at various systems-theoretical levels. This is the theoretical background for differentiation of the categories for the evaluation of the texts in the empirical approach. The following explanations differentiate, on the one hand, between the normativity associated with the approach and on the other hand further areas of tension that the concept of sustainability entails, on a pedagogical and on a content level. In the system, however, access remains systemic or even structurally functional or ecological.

Central, however, is the antinomy of freedom, as it is called in relation to Kant (2000). Freedom in itself is not an antinomy. Rather, the normativity of the ESD concept creates a contradiction to the educational goal (resp. requirement) of freedom. Kant's (2000) question as to how it is possible to cultivate freedom under constraint is very clear for ESD. The question arises as to whether it is possible to cultivate free people under the compulsion of a normative guideline, which already presupposes the guideline of sustainability.

At its core, according to the thesis, the conception of ESD as an ecological or system-theoretical approach has several fundamental problems that Helsper (2001) describes as constitutive. One of the central problems is the integrated relationship between subject and system or between system and lifeworld ("Lebenswelt"). This shows the challenge of integrating different levels (micro versus macro) (Giddens, 1984). The consideration of a pedagogical subject concept that is not structurally functionalistically shortened proves to be difficult. This represents a fundamental challenge for functionalist or system-theoretical approaches, as Habermas (1982, p. 462), for example, points out with his concept of the "*Lebenswelt*". Tensions between the individual and society can be attributed to the antinomy that exists between autonomous individuals and society. Helsper (2001) discusses this with the autonomy antinomy. The logic of the consideration within the approaches to ESD is described by various authors as system-theoretical (Bräutigam, 2014; Ohlmeier & Brunhold, 2015). System-thinking is a central part of the skills that students should acquire based on the concept. Ohlmeier and Brunhold (2015, p. 115 & 133) also claim that systemic learning is particularly relevant under global conditions. However, it is by no means unproblematic to grasp the lifeworld and other contexts through such a systemic, functionalizing reason (Adorno, 1959). In this view, there is an antinomic tension between systemic thinking and pupils' lifeworld. Bräutigam (2014) shows the connection between ESD and systemic thinking as part of the SYSDENA project and points out that the systemic approach characterizes scientific approaches of sustainability in general. The system components ecology, economy, culture/society are integrated (Schrüfer & Schockemöhle, 2012). Under the premise of sustainable development, the world is thus viewed in terms of the theory of difference through the various systems of ecology, economy and culture/social affairs. These are mutually related. The basic values of these different systems (conservation, diversity, efficiency, profit, variety, tolerance, beauty, etc.) are antinomial to each other. The enormous complexity of such consideration represents a further paradox, which results not only from the unmanageable situation of facts, but also from other uncertainties resulting from the global context (antinomy of uncertainty).

In approaches of *global learning* and ESD, students and their actions are integrated into global contexts, and responsibility for global developments is even ascribed to them through their actions. This shows the antinomy described by Helsper (2001) as a tension between closeness and distance. Even if, in Helsper's (2001, p. 88) understanding, students have to choose their learning tasks with the greatest possible self-determination. These always start with the living environment of the students. School as a safe space is also closed, especially with regard to the attribution of responsibility for sustainable action maintain (Reinhardt, 2014, 2017). In particular, the lifeworld orientation of the lessons leads to an enormous attribution of responsibility for learners' actions. It is also important to prevent simplistic causal relationships that lead to a pronunciation of privatization of responsibility, that is deduced from systematic connections between student consumption.

ESD approaches and concepts are becoming increasingly differentiated and multifaceted. The following consideration can therefore only refer to antinomies and paradoxes in individual concepts as examples. This consideration of the contributions is understood in the sense of a positive-constructive reflection and aims at a dialog about possibilities of dealing with antinomies in concepts for the pedagogical-reflective implementation of education for sustainable development or transformative education. The proximity to approaches of transformational learning is already evident. In particular, learners should acquire the knowledge and skills necessary in order to bring about both personal and social change. On the other hand, Vare and Scott (2007) see ESD II as sustainable learning, in which learners reflect on the importance of sustainability for themselves.

ESD II shows an opening for ethical questions and value judgements, which also critically reflect on the normativity of the concept itself. In so doing, content-related antinomies could be didactically integrated and become a possible starting point for further questions from students. They refer to Festinger's theory of cognitive dissonance and aim primarily at changing behavior and ways of thinking (Vare & Scott, 2007,

p. 197). The antinomian tensions on a meta-level, between the freedom of the person and the commitment to social norms and values, can be considered a central challenge for the concept of ESD II.

One way of accessing the normative dimension of sustainability is the constructive use of constitutive antinomies and paradoxes for pedagogical discussions. The contradictions and unresolvable tensions in particular may enable a critical-reflexive approach to normative questions and ethical judgement-making processes (Dickel, 2016; Felzmann & Laub, 2019; Oser & Althoff, 1992; Pöppel, 1990; Rekus, 1993). Also in this regard, the need of the ability to reflect on antinomies of sustainability is visible. The antinomies outlined in this article could therefore be viewed as challenges for teachers. At the same time as didactic starting points for pedagogical processes they open up questions about the meaning of sustainability, put the term itself up for discussion and thus call for the examination of validity claims (Mikhail, 2016).

EDUCATION, SUSTAINABILITY AND RESPONSIBILITY

Responsibility as Relational Pedagogical Concept

Currently, there is a strong emphasis on responsibility within educational policy and pedagogical thoughts. Responsibility gains importance for ESD as well as for theories of education, and might be a conceptual possibility to solve the antinomy between sustainability and education, especially the antinomy of freedom (Kant, 2000). Therefore, it gives a perspective on a more differentiated view on argumentative types concerning ESD. Especially type ESD II as Vare and Scott (2007) describe, it might be differentiated or extended.

Petzelt's (2018) definition of responsibility gains attendance for its ability to integrate the antinomies between freedom and normativity on a conceptual level. His definition enables to link the terms education, sustainability and, responsibility.

On the one hand, responsibility is considered to be linked to taking oneself, i.e., it is transferred to the subjective level. On the other hand, it is about an obligation that freely acting people feel, and in addition, the definition says that it is about responsibility for the consequences of actions. Nida Rümelin (2011, p. 12) assumes that responsibility can be understood as a fundamental characteristic of the *conditio humana*. Responsibility is a relational concept: someone (or a group of people) bears responsibility for something (possibly an action) towards an authority (e.g., their own conscience). This is also shown by the definition already considered. A normative system, which is used to assess the consequences of actions, plays a role in the assessment of responsibility. In a legal sense, that would be criminal law, for example. However, every human being is responsible for his or her own conscience. Weischedel (1932, p. 26) emphasizes this self-responsible monolog of the ego with itself. One's own actions and their consequences are evaluated against the background of a system of values and norms (Benzhaf, 2002; Weischedel, 1932). Responsibility is thus to be understood as an ethical and moral examination of the consequences of one's own actions. Fundamentally, as bearers of responsibility, humans are connected to an object for which they are responsible, and to a system of moral norms that represents the background to their evaluation (Lenk, 1991).

Responsibility, which is due to us as human beings, is fundamentally linked to a moment of freedom. This freedom to make decisions or the ability to reason can be regarded as a necessary condition for the possibility of responsibility (Weischedel, 1932, p. 19). If I am unable to influence, control or decide something, then ultimately, I do not have any responsibility for it either. However, my self-determination as an autonomous rational being means, as it were, an attribution of moral responsibility. In contrast to this, more recent approaches such as those of Martin Buber, Judith Butler, or Emmanuel Lévinas see the origin of our responsibility in our being dependent on other people. This is where the concept can be related to the pedagogic antinomy of freedom. The fact that we are receptive to being addressed by others makes us responsible (Butler, 2014, p. 120). Ecological ethics often relate to the concept of responsibility of Jonas (1979). He points out that in the age of man's technical availability over nature, and this thought also represents one of the foundations of the Anthropocene concept, man's responsibility is expanding (Jonas, 1979, p. 31). Jonas (1979) formulates an ethical imperative that he adapts to the changed range of action in human practice and integrates future generations into our responsibility.

In the recent past, especially since the middle of the 20th century, not only have the perspectives on all three elements that characterize responsibility as a relational concept changed. On side of the bearer of responsibility, there is currently talk over collective responsibility or systemic co-responsibility (Benzhaf, 2002, p. 86). The ethical background that is used for evaluation also changes in the course of social changes (postmodern pluralism). At the same time, the binding nature of norms and values also changes, so that individuals increasingly have to decide for themselves which ethical orientations are important to them. Ethical standards, or the moral criteria with which responsibility is judged, are not easy to grasp.

Responsibility as a pedagogical concept has to clarify the connection between the learner and the world, i.e., to other people and the world around them. In the tradition of transcendental-critical pedagogy, Petzelt (2018) develops a concept of responsibility that is integrated into and based on his pedagogical system. He looks at responsibility in the literal sense. He describes the creation of the relationship between knowledge and attitude as *re-sponsi-bility* (Petzelt, 2018). The relationship between knowledge and attitude is central. This relationship is actively established by each knowing self. In the relationship of the learner, to the world, but also of the subject to the knowledge acquired, an attitude is required. Knowledge is demanding attitude (Petzelt, 2018, p. 266). It has the task of creating a relationship between knowledge and attitude in which it binds them together and is therefore responsible (Petzelt, 2018, p. 264 & 280). At the same time, there is an orienting and ordering dimension in this moment, in which the ego arranges and determines itself in relation to what is recognized. Establishing a relationship between knowledge

and attitude is incumbent on each ego. In the pedagogical sense understood here, freedom and self-reliance are to be regarded as essential prerequisites for responsibility too (Petzelt, 2018, p. 47). Petzelt's (2018) understanding forms the basis of this article as the central understanding and shows a relation to the pedagogic antinomy of freedom.

Responsibility and the Pedagogic Antinomies of Sustainability

The relationship between the concept of responsibility and the antinomies of sustainability are highly relevant for the didactic implementation. That is because the focus of pedagogical action has to focus on the antinomy of freedom as starting point for teaching and, at the same time, as condition for its success. It seems to be important to integrate a reflected pedagogical concept of responsibility into the concept of transformative education, which makes it possible to counter the danger of functionalist reduction (Potthast, 2016; Vielhaber, 2006).

This results in the requirement to enable students to consciously reflect and take on responsibility. An assessment of action references and consequences then puts the students in a position to make ethical judgements about contexts that affect them. That is being done to recognize oneself as responsible and to evaluate the possibilities of responsible action against the background of one's own criteria. This offers the possibility to prevent indoctrinating abbreviations or moralistic instructions (Sippl & Scheuch, 2019, p. 111).

Looking at the ethical dimension of responsibility, teachers may ask their students ethical questions, more precisely, to ask questions about their own responsibility and to make ethical judgements. This ethical judgement/judging means to fundamentally differentiate ethical questions (Ulrich-Riedhammer, 2017, p. 103). Such a rational discussion also means an analytical consideration of one's own responsibility. On the one hand, this raises questions about the scope of their own responsibility: Which people, which ecological systems, which living beings are affected by my actions? What responsibility towards these do I recognize myself in? On the other hand, these questions refer to the possibilities and backgrounds of one's own value judgements: What judgements/values cause me to act? What normative ideas underlie my sense of responsibility? What normative principles should I reflect more on? What values do I ascribe to systems, environments and living beings? A didactically reflected and pedagogically justified concept of responsibility opens up the possibility of a reflective opening of sustainability topics, as Vare and Scott (2007) formulate them for ESD 2 (education for sustainable development type 2). The irritation of existing normative orientations is also understood as a task of transformative educational processes (Singer-Brodowski, 2016). The concept of responsibility enables the questions of learners and their systems of relevance and to open them up for reflective processes. Yet, it makes it possible to recognize regulations that enable an ethical orientation. The argumentation can show, that responsibility in Petzelt's (2018) understanding can be considered as a central concept to deal with antinomies between education and sustainability mentally. It meets pedagogical requirements and at the same time keeps the subject in a position to be independent and to make responsible judgements. In this reading, responsibility can take up the antinomian connection between freedom and coercion, which is inherent in ESD, and helps to mentally connect both concepts. It stands as a concept that can relate the other two terms.

REFLECTIONS OF TEACHERS IN DEALING WITH SUSTAINABILITY AND RESPONSIBILITY

Implementing ESD, the professional knowledge of teachers is central. The theoretical background provided serves to make the challenges tangible on the content level and thus, to clarify the requirements for teachers. The present focus concerns two areas that are to be distinguished in professionalization research, on the one hand, imbedding the area of ESD, on the other hand, imbedding the area of ethical complexity. At first, it may be surprising to integrate the area of ethical complexity here, however this represents the content area of ethical debates with the normative challenges of ESD. As the explanations show, the aim here is to enable pupils to reflect on ethical aspects. Both areas are closely linked (Bögeholz & Barkmann, 2005; Mehren et al., 2015), as ESD II focuses a reflection of values of sustainability and sustainability itself, ethical aspects of sustainability topics are in the center of the discussion. Vare and Scott (2007) describe an appropriate implementation of sustainability topics in the classroom with ESD II, precisely because the area of ethical judgement is also didactically opened up here. Empirical findings from teacher professional research on subject teaching indicate that teachers have difficulties with ethical aspects of given class topics.

Opening up the ethical complexity in sustainability issues, is closely linked to the antinomies, the contribution focuses, because both relate to the way ESD deals with normativity. The ability of teachers to reflect on ethical issues (Laub et al., 2021) is central to ESD II. When looking at the studies on ethical judgement, it becomes clear that teachers see this as a particular challenge. This requires teachers to have professional knowledge of ethical aspects associated with teaching topics. Laub et al. (2021) refer to the knowledge required for this as subject-related ethical professional knowledge and see it as not represented in previous conceptions of teachers' professional knowledge.

Studies on the handling of ethical questions within socio-scientific issues (SSI) concern a central area of ESD and show similar results. SSI contexts often only function as a motivating framework for learning or applying subject knowledge (Ekborg et al., 2013; Forbes & Davis, 2008; Lee et al., 2006; Sadler et al., 2006; Tidemand & Nielsen, 2017). This also applies to teachers or student teachers who have previously attended a training course or course on SSI (Ekborg et al., 2013; Evagorou & Puig Mauriz, 2017; Kilinc et al., 2017). Social sciences and language teachers were found to be more familiar with teaching methods on controversial issues than their science counterparts (Levinson et al., 2001).

In order to integrate ESD appropriately, however, it is necessary to open the ethical dimension within SSI for pupils.

Interviewed teachers of natural science subjects hardly ever show such an explication (Sadler et al., 2006), which is also comparable for teachers in the language area (here: Swedish) when addressing an SSI (Christenson et al., 2017). This could also be shown predominantly for German political teachers teaching the topic of climate change (Hartmann-Mrochen, 2013) and for English teachers in all subjects except religion and psychology teachers (Levinson et al., 2001). For geography teachers in Germany, various works show that teachers' attitudes to teach ethically open topics and to initiate political judgement is very positive. However, the implementation in the classroom does not take place to the same extent (Applis, 2016; Budke et al., 2016). Many teachers feel overwhelmed by ethical openness. Geography teachers sometimes assess their own political knowledge, which is not part of their training, as low (Budke et al., 2016). Laub et al. (2021) describe knowledge that would be necessary for ESD II as "subject-related ethical professional knowledge" of teachers and regard it as knowledge that is linked to specialist knowledge. Studies of the subject-specific and subject-didactic knowledge of politics and religion teachers (Pirner, 2013; Weisseno et al., 2015; Weschenfelder, 2014) do not explicitly indicate teachers' ethical knowledge. The results mentioned point to the special importance of reflecting the question of the pedagogical and didactic handling of the ethical dimension of sustainability issues. Similarly, the ability of students to identify a moral problem within a situation is considered important (Alfs, 2012; Heusinger von Waldegge, 2016), however, teachers are very unsure how to enable students to do this (Alfs, 2012; Steffen & Hößle, 2017). These competences of pupils and teachers could be understood as the content level of the pedagogical perspective on sustainability education presented here. It reflects the basic challenges in handling that were carried out. Risch et al. (2017) emphasize the weak integration of ESD in university education. It is therefore of utmost importance to differentiate teacher skills on both levels: the factual level of sustainability issues and the question of the possibility of value issues and moral education. It remains all the more questionable how teachers view these challenges and how they theoretically and conceptually solve these associated antinomies.

METHODS

Methodological Framework

The qualitative empirical approach of the study can be described as category-based method for the systematic analysis of qualitative data (Flick, 2002), as certain aspects of the material are brought out and analyzed with categories, that are derived from theoretical framework described above. The procedure of a structuring content analysis is shown (Mayring, 2015, p. 473).

The units of analysis (Kuckartz, 2018, p. 30) are 42 texts of different prospective teachers at the Universities of Koblenz-Landau and Stuttgart. The texts were produced in university courses of geography didactics and pedagogy in 2021 and 2022. Participating students are in their education beyond the bachelor's level and in the education for the secondary schools in the master-program. The selection of the people was completely random. All seminar participants were asked to take part in the study. All people enrolled were admitted to the seminars, no selection was made. The combination of disciplines of the students is very divers, two thirds of the participants studied geography. The high focus on geography increases prior knowledge of sustainability issues, since geography is a key-discipline for ESD (Hemmer, 2016; Schrüfer & Schockemöhle, 2012), but ESD is addressed in the curricula of all subjects in Germany. In the present study, the number of subjects compared to the number of possible subject combinations is clearly too small to be able to draw meaningful conclusions of the influence of different subjects. This is mainly due to the high variance of different subject combinations. The produced texts vary between a length of three and up to six pages (length of lines 80 characters). Grammatical and spelling errors were not taken into account. Coders were scientific employees from the University of Koblenz-Landau and Stuttgart, who developed categories and coding discursively in consultation. The procedure could be described as category-oriented (Kuckartz, 2018, p. 50). The focus is on the ability to reflect the antinomies within the concept of sustainability. The need to integrate responsibility as third concept means a high requirement for the surveyed, that makes it impossible to give any standard answers.

The students were asked in a very open form and in accordance with the specifications for expert interviews in order to express the knowledge and skills of the respective person in the best possible way. In order to keep the influences during the survey as small as possible and to give the respondents as much time as possible to answer, the survey was carried out in a written form, with open questions and a longer time period. The task was not part of the assessed seminar performance. The wording of the task is as follows: "Bildung" (education), responsibility (of the student) and sustainability are terms with didactic relevance. Please explain how you understand these terms and how they relate to each other from your perspective with regard to teaching. The access and the conclusions refer to arguments of the present texts. This does not allow direct conclusions to be drawn about the thoughts of the individual person.

Categories and Types

The way in which categories are formed depends heavily on the theoretical foundation and the research question of the project. In the present case, there is a strong theoretical reference to an already existing foundation, which suggests a deductive category formation (Kuckartz, 2018, p. 63). Like an analytical foil they are used to structure the interpretive coding of the texts and make them comprehensible (Mayring, 2015). It is important to be open to other types in order to expand the existing system with new types, if necessary. The coding frame is hierarchic (Kuckartz, 2018, p. 38), but refers to different levels (text-structure, content/argumentative structure). The main categories were deduced from the theoretical frame and relate to the concepts of education, sustainability and responsibility, that build the base of the contribution. The fourth category (relation of concepts) and the fifth category (antinomies) correspond to the main research question and refer to the relationships between the terms the argumentative structures of the texts show. The

Table 1. Categories and Types

Categories	Types
Concept of education	Functionalistic Output/competence oriented Pedagogic …
Concept of sustainability	Sustainability as concept of *Ecology* *Culture* … Sustainability as educational concept *Sustainability as ESD I* *Sustainability as ESD II* …
Concept of responsibility	Responsibility as closed concept (given rules) Responsibility as open relational concept Scope of responsibility Bearer of responsibility …
Relation of concepts (formal structure)	Strongly simplified integration Complex integration No relation
Antinomies	*Freedom* *Individual/structure (=macro/micro)* …
Related content (lesson topics)	*Climate change* *Renewable energies* *Deforestation* *Waste* *Future of the oceans* *Global economy* *Global justice* *Species extinction* *Consumption* …

sixth category (*related content*) opens the perspective to topics or content associated with sustainability and responsibility. It was added during the text analysis. The types that differentiate within the categories are either indicated by the theoretical frame (e.g., concept of sustainability: ESD I / ESD II) or result from the empirical findings in the text (e.g., related content: waste). The types were formed as logically distinct as possible (Kuckartz, 2018, p. 43). The individual categories are further differentiated with different codes. The categories are not fully distinct, the codes within the categories are (Kuckartz, 2028, p. 38). The deeper differentiation of the codes within the categories should above all show whether the text argues in the direction of the complex pedagogical integration of the terms or not. For the category of educational concept, a distinction is therefore made as to whether the concept of education is pedagogically theoretical, competence-oriented (*output/competence oriented*), cognitive or reduced. The focus of the analysis is the connection between the terms. According to the theoretical explanations, the combination of terms and the formulation of complex understandings of terms represent possible approaches to integrating antinomies without discussing them one-sidedly. **Table 1** shows categories and types.

The category *related content (lesson topics)* was chosen as an additional category in order to be able to analyze the specific teaching relevance of some concepts. The types were derived inductively from the texts within the theoretically founded categories. The antinomies, however, were coded in the texts as they were differentiated above in the contribution. They were coded even if they were only logical contradictions and did not contain the terms antinomy, paradox, contradiction or the like.

RESULTS

Text-Structure (Formal Coding)

On the level of text structure, the texts show very similar structuring. First, the terms of education, sustainability and responsibility are discussed in isolation from the others, then follows an integration of all three terms. The level of text structure clearly indicates whether the texts are fundamentally integrative (continuous references between the terms) or additive (sequence of isolated passages to individual terms). The encoding refers to a formal dimension. Observations on the level of text structure may be of particular interest. Structuring the texts into meaning-related parts shows a very small proportion of discursive integrative discussion of the relationship between the three terms. In most passages of the texts, the terms stay unconnected one after another. The passages that relate the three terms are short and placed at the end of the text. There are occasional links to other passages.

Argumentative Structure (Relation of Concepts)

The texts show different types of argumentative connections of the three terms. In principle, two different ways of arguing for the connection of the terms can be distinguished. In addition, there are few texts that outline a completely different contextual connection. Most of the texts offer a *concept of education*, that could be called output orientated or functionalistic. Only a few show a profound pedagogical understanding, that differs from that. The analysis of *concepts of sustainability* show a very high degree of uniformity. Overall, they are strongly aimed at ecological sustainability and focus on climate change as a main topic (*related content*). Besides, global justice plays a role as a topic too. The category *concept of responsibility* shows that the texts refer largely to the extension of the relations of our responsibility. With regard to sustainability, they emphasize the responsibility towards future generations, but also the responsibility of consumers for global production and supply chains. Responsibility often comes with the character of a catchphrase. Ultimately, pedagogic definitions of terms are almost non-existent. However, the need to educate students to be responsible people is emphasized.

The results show different ways of reflecting pedagogical antinomies of sustainability. The argumentative structures of the texts can by differentiated into two argumentative types. Type A: *Naive integration of concepts*; and type B: *Elaborated pedagogic integration of concepts*. Only some texts, that can be associated with type B show an explicit discussion of pedagogic antinomies. **Figure 1** shows Naive integration of concepts focusing on knowledge.

The text hyphens that education hast to *ensure* sustainability (WS20S-13, item 120-122). The antinomy of freedom is neglected and education focuses on a single goal, sustainability. A very narrow understanding of education is

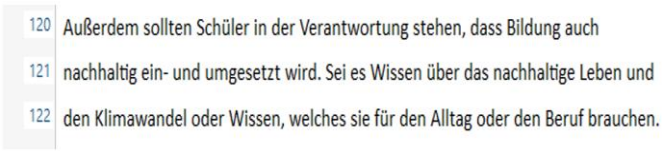

Figure 1. Naive integration of concepts: Focus on knowledge (WS20S-13, item 120-122)[1]

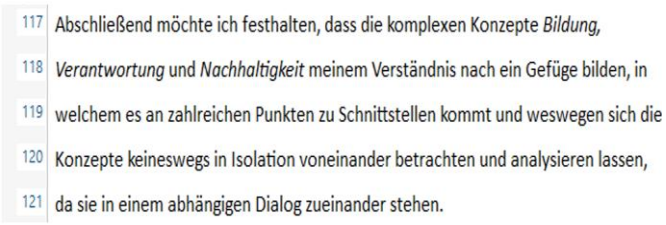

Figure 2. Naive integration of concepts: Focus on integration (WS20S-28, item 117-121)[2]

given. The argumentation within this type A is very similar to what Vare and Scott (2007) call ESD I. No reflection on ethical dimensions and no critical reflection on the concept of sustainability is integrated. In most of the texts of his type, we can see a very undifferentiated concept of education, sometimes even functionalized. **Figure 2** shows naive integration of concepts focusing on integration.

The text shows argumentative type A. A relation between sustainability, education, and responsibility is considered, but no further explanation is given. The relation is emphasized, but rests is on a naive level, where contradictions find no consideration. No further details are declared. Ethical complexity and a critical view on sustainability are missing. If one looks at this type of argumentation in its forms in the texts, it is striking that sustainability, as ESD I also shows, is seen as a fact, as a goal of teaching. The concept of responsibility finds integration and is also linked to sustainability. Attempts to open up the ethical complexity (what are we responsible for, before whom, by what standards?) are rarely recognizable. A strong thematic focus on ecological aspects of sustainability appears. The antinomic problems that arose between the freedom of the concept of education and the normativity of ESD found no consideration in argumentative type A.

The argumentative type B is characterized by the depth and complexity of the discussion. This applies particularly to the degree of abstraction of pedagogical terms and the level of discussion with them. Type B is therefore referred to as "*elaborated pedagogic integration of concepts*". The reflecting on the importance of sustainability and the naming of antinomies are particularly important. The elaborate integration may or may not be hierarchical. **Figure 3** shows the elaborated integration of antinomies.

Central to the quoted passage is the statement that "people are not obliged to act in spite of, but precisely because of their freedom to act" (WS20S-33, item 53-54). The syntactic structure emphasizes the antinomic structure (see above). This represents a central argumentative context, as produced by Kant (1999) in the "Grundlegung der Metaphysik der Sitten" (Foundations of the Metaphysics of Morals). The passage shows an argumentation, that links the antinomy of freedom to ESD and human rights. The ethical dimension is opened by the concept of responsibility (item 54-59).

The second type of argument shows fundamentally more complex and elaborate understandings of terms. Especially in the B type of integration, this means that the antinomian structure of Education for Sustainable Development has to be reflected. This is also organized via the concept of responsibility (**Figure 4**).

Concerning the category *concept of education*, it would be too simplistic to speak of a strict allocation of certain educational concepts to the types of argumentation. Although it is evident that type A argumentations focus more strongly on competence orientation or the functionality of education. Type B shows more education-oriented concepts that initially emphasize the value of education itself.

However, all texts very rarely recognize antinomies in the integration of terms. Thinking in terms of tension is rather neglected in favor of a harmoniously integrated line of argumentation. Overall, a picture emerges that corresponds very precisely with the differentiation made by Vare and Scott (2007). The notion of responsibility is used heavily within the type B texts as a concept that opens up an ethical dimension and relates it with the learner's perspective. The connection to the other two terms works well. The antinomies are addressed only very fundamentally. When they appear, they are only integrated via argumentative type B.

DISCUSSION

The article shows the results of a research project to record how teachers reflect the challenges of ESD with regard to ethical complexity and pedagogical antinomies. Even if it is not possible to generalize the results of the qualitative approach numerically, the study does provide indications that could be interpreted against the background of existing knowledge. With regard to the reflection of related antinomies and the implicated ethical dimension, it could be argued that representations remain underdeveloped. The regarded preservice teachers show little differentiated reflecting on pedagogic antinomies and ethical judgement in ESD-contexts. Vare and Scott's (2007) distinction between ESD 1 and ESD 2 is evident in the argumentative types that could be analyzed in the texts.

[1] Translation of the excerpt in **Figure 1**: *"In addition, students should be responsible for ensuring that education is used and implemented in a sustainable manner. Be it knowledge about sustainable living and climate change or knowledge you need for everyday life or work."*

[2] Translation of the excerpt in **Figure 2**: *"In conclusion, I would like to state that, as I understand it, the complex concepts of education, responsibility and sustainability form a structure in which there are numerous points of intersection and which is why the concepts can by no means be viewed and analysed in isolation from one another, as they are part of a dependent dialog to one another."*

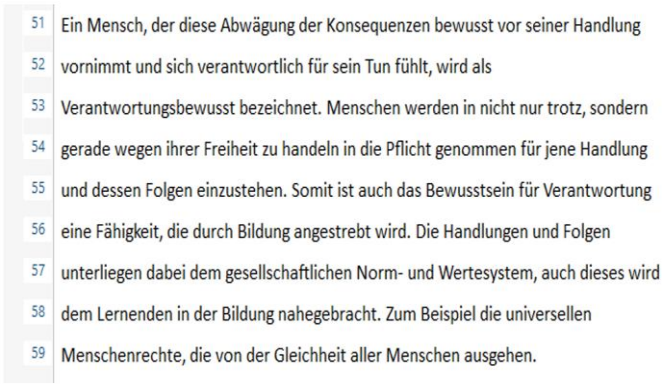

Figure 3. Elaborated integration of antinomies (WS20S-33, item 51-59)[3]

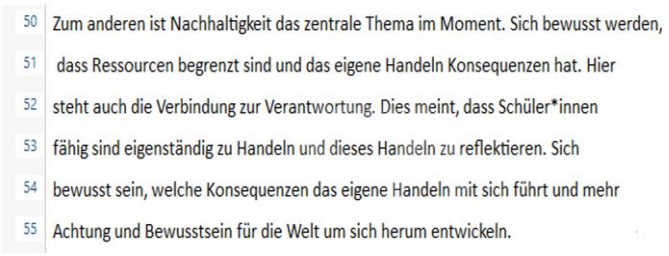

Figure 4. Responsibility (WS20S-31, item 50-55)[4]

Reflecting antinomies is not a common approach in subject teaching. It gains importance rather in the pedagogical discussion. Tensions are only shown in a very small part of texts, but even these show no openness and no step towards recognizing or reflecting antinomies. Further research should be done on the importance of the ability to reflecting and dealing with contradictions and tensions, which are likely to have a significant impact on the quality of implementation on the teaching level both on the content and on the pedagogical level. The texts, which show awareness of ethical challenges of ESD, also show a pedagogically elaborate understanding of education, that explores the tension between individual freedom and the importance of the values of sustainability, which can be considered fundamental for teachers. The texts offer a broad integration of the term responsibility. Obviously, responsibility has a meaning for preservice teachers in contexts of sustainability. A pedagogical and differentiated understanding is nearly non-existing.

CONCLUSIONS

The theoretical framework shows that the consideration of pedagogical antinomies, especially constitutive antinomies (Helsper, 2001) can also be related to ESD and that antinomies appear on different levels that are relevant for approaches of sustainable education (Laub, 2021b). This article outlines these antinomies theoretically and shows that prospective teachers have difficulties in integrating the terms education, sustainability and responsibility. A lack of knowledge concerning the named antinomies can be seen here. Furthermore, the article shows that the antinomies of education for sustainable development could be compensated by an elaborate pedagogical concept of responsibility in the sense of Petzelt (2018), which on the one hand, presupposes a commitment to normative regulatives, and, on the other hand, presupposes the freedom and the potential rational talent of students as a condition of its possibility. The study is not intended to make general statements about all teachers, but to gain initial insight into the way in which prospective teachers reflect on antinomies of ESD and the way in which they conceptually integrate the term responsibility. In this regard, the present analysis of texts gives first insight in how little reflection on basic pedagogical antinomies they are able to formulate.

The present analysis of the texts by prospective teachers clearly shows that it is a challenge for the authors of the analyzed texts to recognize the antinomies between the terms education and sustainability in such a way that they can be placed in a logical relationship. It is the antinomy of freedom that appears between the concepts of education and sustainability that is problematic. The concept of responsibility is found in the texts in a mediating position, however, it turns out that the term is of little importance in didactic and pedagogical training. For the most part, it remains superficial. A theoretically correct and reflected concept of responsibility would be desirable. All the more so as the term is given great importance in pedagogy, ethics, educational plans and conceptions of ESD.

The results show a particular urgency in the process of professionalizing teachers with regard to education for sustainable development. The education of teachers therefore needs to focus more specifically on the recognition of ethical questions, pedagogical paradoxes and antinomies of the central concepts presented.

An interesting question arises regarding teachers' skills to link the areas of pedagogical and didactic knowledge involved. The study does not aim to answer this question, but it suggests that prospective teachers use facets of knowledge alternatively as frames for interpretation but do not integrate them. In the classroom or in a teaching situation, however, challenges are present as complex overall situations.

[3] Translation of the excerpt in **Figure 3**: *"A person who consciously weighs up the consequences before taking action and feels responsible for his or her actions is referred to as responsible. People are not only obliged to act in spite of, but precisely because of their freedom to act and to take responsibility for that action and its consequences. Thus, the awareness of responsibility is also a skill that education strives for. The actions and consequences are subject to the social system of norms and values, and this is also brought to the learner's attention in education. For example, the universal human rights that start from the equality of all people."*

[4] Translation of the excerpt in **Figure 4**: *"On the other hand, sustainability is the central topic at the moment. Become aware that resources are limited and that your actions have consequences. Here is also the connection to responsibility. This means that students are able to act independently and to reflect on this action. Become aware of the consequences of your actions and develop more respect and awareness of the world around you."*

Funding: No external funding is received for this article.

Declaration of interest: The author declares no competing interests.

Ethics approval and consent to participate: Not applicable.

Availability of data and materials: All data generated or analyzed during this study are available for sharing when appropriate request is directed to the author.

REFERENCES

Adorno, T. (1959). Theorie der Halbbildung [Semi-education theory]. In *Soziologische Schriften I* [*Sociological writings I*] (pp. 93-121). Suhrkamp.

Alfs, N. (2012). *Ethisches Bewerten fördern. Eine qualitative Untersuchung zum fachdidaktischen Wissen von Biologielehrkräften zum Kompetenzbereich "Bewertung"* [*Promote ethical evaluation. A qualitative study of the didactic knowledge of biology teachers in the competence area "assessment"*]. Kovač.

Applis, S. (2016). Der Habitus steht der Didaktik im Weg. Die Förderung soziomoralischer Kompetenzen als Herausforderung für den Habitus von Lehrkräften im Fachunterricht [Habitus stands in the way of didactics. The promotion of socio-moral competencies as a challenge for the habitus of teachers in subject teaching]. In D. Julia, C. Brand, & J. Rohbeck (Eds.), *Empirische Forschung in der Philosophie-und Ethikdidaktik* [*Empirical research in philosophy and ethics didactics*] (pp. 119-143). Thelem.

Baumert, J., & Kunter, M. (2006). Stichwort: Professionelle Kompetenz von Lehrkräften [Keyword: Professional competence of teachers]. *Zeitschrift für Erziehungswissenschaft* [*Journal of Educational Science*], *9*(4), 469-520. https://doi.org/10.1007/s11618-006-0165-2

Benzhaf, G. (2002). *Philosophie der Verantwortung. Entwürfe, Entwicklungen, Perspektiven* [*Philosophy of responsibility. Drafts, developments, perspectives*]. Winter.

Binder, U. (2016). Die Analyse erziehungswissenschaftlicher Wissenserzeugung als Paradoxiemanagement. Einführung in den Thementeil [The analysis of educational knowledge generation as paradox management. Introduction to the topic]. *Zeitschrift für Pädagogik* [*Journal of Pedagogy*], *62*(4), 447-451.

Bögeholz, S., & Barkmann, J. (2005). Rational choice and beyond: Handlungsorientierende Kompetenzen für den Umgang mit faktischer und ethischer Komplexität [Rational choice and beyond: Action-oriented skills for dealing with factual and ethical complexity]. In R. Klee, A. Sandmann, & H. Vogt (Eds.), *Lehr-und Lernforschung in der Biologiedidaktik. Forschungen zur Fachdidaktik* [*Teaching and learning research in biology didactics. Research on subject didactics*] (pp. 211-224). Studienverlag.

Bräutigam, J. (2014). *Systemisches Denken im Kontext einer Bildung für nachhaltige Entwicklung. Konstruktion und Validierung eines Messinstruments zur Evaluation einer Unterrichtseinheit* [*Systemic thinking in the context of education for sustainable development. Construction and validation of a measuring instrument for the evaluation of a teaching unit*] [PhD dissertation, Pädagogische Hochschule].

Budke, A., Kuckuck, M., & Wienecke, M. (2016). Realisierungen der Politischen Bildung im Geographieunterricht. Ergebnisse einer Interviewstudie mit Geographielehrkräften [Realizations of political education in geography lessons. Results of an interview study with geography teachers]. In A. Budke, & M. Kuckuck (Eds.), *Politische Bildung im Geographieunterricht* [*Political education in geography lessons*] (pp. 155-166). Steiner.

Butler, J. (2014). *Kritik der ethischen Gewalt* [*Critique of ethical violence*]. Erw. Ausg. Suhrkamp.

Christenson, N., Gericke, N., & Chang Rundgren, S.-N. (2017). Science and language teachers' assessment of upper secondary students' socioscientific argumentation. *International Journal of Science and Mathematics Education, 15*(8), 1403-1422. https://doi.org/10.1007/s10763-016-9746-6

de Haan, G. (2007). Bildung für eine nachhaltige Entwicklung als Handlungsfeld [Education for sustainable development as a field of action]. *Praxis Geographie* [*Practice Geography*], *37*(9), 4-9.

Dickel, M. (2011). Geographieunterricht unter dem Diktat der Standardisierung. Kritik der Bildungsreform aus hermeneutisch-phänomenologischer Sicht [Geography lessons under the dictate of standardization. Criticism of educational reform from a hermeneutic-phenomenological point of view]. *GW-Unterricht123/2011*. http://www.gw-unterricht.at/index.php/onlineausgaben/15-2011/37-123-3-2011.html

Dickel, M. (2016). Der Sprung ins Denken. Geographie als politische Bildung [The leap into thinking. Geography as political education]. In A. Budke, & M. Kuckuck (Eds.), *Politische Bildung im Geographieunterricht* [*Political education in geography lessons*] (pp. 47-55). Steiner.

Ekborg, M., Ottander, C., Silfver, E., & Simon, S. (2013). Teachers' experience of working with socio-scientific issues. A large scale and depth study. *Research in Science Education, 43*(2), 599-617. https://doi.org/10.1007/s11165-011-9279-5

Evagorou, M., & Puig Mauriz, B. (2017). Engaging elementary school pre-service teachers in modeling a socioscientific issue as a way to help them appreciate the social aspects of science. *International Journal of Education in Mathematics, Science and Technology, 5*(2), 113-123. https://doi.org/10.18404/ijemst.99074

Felzmann, D., & Laub, J. (2019). Ethisches Urteilen im Geographieunterricht fördern [Promote ethical judgment in geography lessons]. *Praxis Geographie* [*Practice Geography*], *10*(2019), 4-11.

Flick, U. (2002). *Qualitative Sozialforschung. Eine Einführung* [*Qualitative social research. An introduction*]. Rowohlt.

Forbes, C. T., & Davis, E. A. (2008). Exploring preservice elementary teachers' critique and adaptation of science curriculum materials in respect to socioscientific issues. *Science & Education, 17*(8-9), 829-854. https://doi.org/10.1007/s11191-007-9080-z

Giddens, A. (1984). *Die Konstitution der Gesellschaft. Grundzüge einer Theorie der Strukturierung* [*The constitution of society. Fundamentals of a theory of structuring*]. Suhrkamp.

Habermas, J. (1982). *Theorie kommunikativen Handelns* [*Theory of communicative action*]. Suhrkamp.

Hartmann-Mrochen, M. (2013). *Zwischen Notengebung und Urteilsfähigkeit. Einstellungen und Vorstellungen von Lehrkräften verschiedener Fachkulturen zum Kompetenzbereich Bewertung der Nationalen Bildungsstandards* [*Between grading and judgment. Attitudes and ideas of teachers of different subject cultures to the competence area assessment of the national educational standards*] [PhD dissertation, Staats-und Universitätsbibliothek Hamburg].

Hauff, V. (1987). *Unsere gemeinsame Zukunft: Der Brundtland-Bericht der Weltkommission für Umwelt und Entwicklung* [*Our common future: The brundtland report of the world commission on environment and development*]. Eggenkamp.

Helsper, W. (2001). Antinomien des Lehrerhandelns-Anfragen an die Bildungsgangdidaktik [Antinomies of teacher action-requests to educational didactics]. In U. Hericks, J. Keuffer, H. Kräft, & I. Kunze (Eds.), *Bildungsgangdidaktik – Perspektiven für Fachunterricht und Lehrerbildung* [*Educational didactics-Perspectives for subject teaching and teacher training*] (pp. 83-105). Springer. https://doi.org/10.1007/978-3-663-05749-9_6

Helsper, W. (2004). *Antinomien, Widersprüche, Paradoxien: Lehrerarbeit-ein unmögliches Geschäft? Grundlagenforschung und mikrodidaktische Reformansätze zur Lehrerbildung* [*Antinomies, contradictions, paradoxes: teaching work-an impossible business? Basic research and microdidactic reform approaches to teacher training*]. Klinkhardt.

Hemmer, I. (2016). Bildung für nachhaltige Entwicklung. Der Beitrag der Fachdidaktiken [Education for sustainable development. The contribution of subject didactics]. In J. Menthe, D. Höttecke, T. Zabka, M. Hammann, & M. Rothgangel (Eds.), *Befähigung zu gesellschaftlicher Teilhabe. Beiträge der fachdidaktischen Forschung* [*Ability to participate in society. Contributions to didactic research*] (pp. 25-40). Waxmann.

Hug, T. (2011). Die Paradoxie der Erziehung [The paradox of education]. In B. Pörksen (Ed.), *Schlüsselwerke des Konstruktivismus* [*Key works of constructivism*] (pp. 463-483). Springer. https://doi.org/10.1007/978-3-531-93069-5_27

Jonas, H. (1979). *Das Prinzip Verantwortung. Versuch einer Ethik für die technologische Zivilisation* [*The principle of responsibility. An attempt at an ethics for technological civilization*]. Suhrkamp.

Kant, I. (1974). *Kritik der reinen Vernunft* [*Critique of pure reason*]. Suhrkamp.

Kant, I. (1999). *Grundlegung zur Metaphysik der Sitten* [*Basis on the metaphysics of ethics*]. Meiner.

Kant, I. (2000). Über Pädagogik [About pedagogy]. In I. Kant (Ed.), *Werkausgabe Band 12: Schriften zur Anthropologie, Geschichtsphilosophie, Politik und Pädagogik* [*Volume 12: Writings on anthropology, philosophy of history, politics and education*]. Suhrkamp.

Keil, A. (2019). Agenda 2030 und BNE–Hintergründe, aktuelle Entwicklungen und Perspektiven für das Fach Geographie [*Agenda 2030 and ESD backgrounds, current developments and perspectives for the subject of geography*]. *Praxis Geographie* [*Practice Geography*], *6*(2019), 4-9.

Kilinc, A., Demiral, U., & Kartal, T. (2017). Resistance to dialogic discourse in SSITeaching: The effects of an argumentation-based workshop, teaching practicum, and induction on a preservice science teacher. *Journal for Research in Science Teaching, 54*(6), 764-789. https://doi.org/10.1002/tea.21385

Kron, F. (1969). Die pädagogische Bedeutung der Antinomien bei Kant, Hegel und Schleiermacher [The pedagogical meaning of the antinomies in Kant, Hegel and Schleiermacher]. *Paedagogica Historica* [*Historical Pedagogy*], *9*(1-2), 91-119. https://doi.org/10.1080/00309230690090105

Kuckartz, U. (2018). *Qualitative Inhaltsanalyse. Methoden, Praxis, Computerunterstützung* [*Qualitative content analysis. Methods, practice, computer support*]. Beltz-Juventa.

Lambert, D. (1999). Geography and moral education in a super complex world: The significance of values education and some remaining dilemmas. *Philosophy and Geography, 2*(1), 5-18. https://doi.org/10.1080/13668799908573652

Laub, J. (2021a). Erziehung zur Nachhaltigkeit?–Paradoxien und Antinomien beim Umgang mit dem Normproblem einer Bildung für nachhaltige Entwicklung [Education for sustainability?–Paradoxes and antinomies when dealing with the norm problem of education for sustainable development]. *Binder, Krönig, 180*. https://doi.org/10.18452/23079

Laub, J. (2021b). Verantwortung zur Nachhaltigkeit–Zur Bedeutung des Verantwortungsbegriffs im Kontext des Anthropozän-Konzeptes bzw. einer transformativen Bildung [Responsibility for sustainability–On the meaning of the concept of responsibility in the context of the Anthropocene concept and transformative education]. In C. Sippl, & E. Rauscher (Eds.), *Kulturelle Nachhaltigkeit lernen und lehren* [*Learning and teaching cultural sustainability*] (pp. 387-398). Studienverlag.

Laub, J., Horn, M., & Felzmann, D. (2021). Fachbezogenes ethisches Professionswissen von Geographielehrkräften als eine Voraussetzung für die Förderung ethischen Urteilens im Geographieunterricht [Subject-related ethical professional knowledge of geography teachers as a prerequisite for the promotion of ethical judgments in geography lessons]. *Zeitschrift für Geographiedidaktik* [*Journal of Geography Didactics*], *49*(1), 1-13. https://doi.org/10.18452/23079

Lee, H., Abd-El-Khalick, F., & Choi, K. (2006). Korean science teachers' perceptions of the introduction of socio-scientific issues into the science curriculum. *Canadian Journal of Science, Mathematics and Technology Education, 6*(2), 97-117. https://doi.org/10.1080/14926150609556691

Lenk, H. (1991). *Wissenschaft und Ethik* [*Science and ethics*]. Suhrkamp.

Levinson, R., Turner, S., Koulouris, P., Desli, D., Douglas, A., Evans, J., & Kirton, A. (2001). The teaching of social and ethical issues in the school curriculum arising from developments in biomedical research: A research study of teachers. *Institute of Education, University of London*. https://doi.org/10.13140/RG.2.2.30402.38088

Mayring, P. (2015). *Qualitative Inhaltsanalyse. Grundlagen und Techniken* [*Qualitative content analysis. Basics and Techniques*]. Beltz-Juventa.

Meadows, D., Zahn, E., & Milling, P. (1972). *Die Grenzen des Wachstums. Bericht des Club of Rome zur Lage der Menschheit* [*The limits of growth. Report of the Club of Rome on the state of mankind*]. Deutsche Verlagsgesellschaft [German Publishing Company].

Mehren, M., Mehren, R., Ohl, U., & Resenberger, C. (2015). Die doppelte Komplexität geographischer Themen. Eine lohnenswerte Herausforderung für Schüler und Lehrer [The double complexity of geographic issues. A worthwhile challenge for students and teachers]. *Geographie aktuell & Schule* [*Geography Current & School*]*, 37*(216), 4-11.

Mikhail, T. (2016). *Pädagogisch handeln. Theorie für die Praxis* [*Act pedagogically. Theory for practice*]. Schöningh. https://doi.org/10.30965/9783657782963

Nida Rümelin, J. (2011). *Verantwortung* [*Responsibility*]. Reclam.

Ohlmeier, B., & Brunhold, A. (2015). *Politische Bildung für nachhaltige Entwicklung. Eine Evaluationsstudie* [*Political education for sustainable development. An evaluation study*]. Springer. https://doi.org/10.1007/978-3-658-02854-1

Oser, F., & Althoff, W. (1992). *Moralische Selbstbestimmung. Modelle der Erziehung und Entwicklung im Wertebereich. Ein Lehrbuch* [*Moral self-determination. Models of education and development in the realm of values. A textbook*]. Springer.

Pettig, F. (2021). Transformative Lernangebote kritisch-reflexiv gestalten. Fachdidaktische Orientierungen einer emanzipatorischen BNE [Designing transformative learning opportunities in a critical and reflective manner. Didactic orientations of an emancipatory ESD]. *GW-Unterricht* [*GW Lessons*]*, 34*, 5-17. https://doi.org/10.1553/gw-unterricht162s5

Petzelt, A. (2018). *Grundzüge systematischer Pädagogik* [*Principles of systematic pedagogy*]. Lambertus.

Pöppel, K. G. (1990). Moralische Erziehung im Fachunterricht [Moral education in the classroom]. In A. Regenbrecht, & K. G. Pöppel (Eds.)*, Moralische Erziehung im Fachunterricht. Münstersche Gespräche zu Themen der wissenschaftlichen Pädagogik* [*Moral education in the classroom. Münstersche discussions on topics of scientific pedagogy*] (pp. 27-48). Münster.

Potthast, T. (2019). Berufsethos für Lehrerinnen und Lehrer, Ethik in den Wissenschaften und die Frage der Werteorientierung–kritische Überlegungen [Professional ethics for teachers, ethics in the sciences and the question of value orientation–critical considerations]. In C. Cramer, & F. Oser (Eds.), *Ethos: Interdisziplinäre Perspektiven auf den Lehrerinnen-und Lehrerberuf* [*Ethos: Interdisciplinary perspectives on the teaching profession*] (pp. 143-151). Waxmann.

Reinhardt, S. (2014). Moralisches Lernen [Moral learning]. In W. Sander (Ed.)*, Handbuch politische Bildung* [*Political education handbook*] (pp. 329-340). Schwalbach.

Reinhardt, S. (2017). Unterricht mit rechts orientierten Jugendlichen und Schülern und Empörten-Probleme und Ideen [Lessons with right-wing young people and schoolchildren and the indignant-problems and ideas]. *Gesellschaft–Wirtschaft–Politik* [*Society–Economy–Politics*]*, 2*, 281-291. https://doi.org/10.3224/gwp.v66i2.10

Rekus, J. (1993). *Bildung und Moral. Zur Einheit von Rationalität und Moralität in Schule und Unterricht* [*Education and morals. On the unity of rationality and morality in school and instruction*]. Juventa.

Ruhloff, J. (1979). *Das ungelöste Normproblem der Pädagogik* [*The unsolved problem of norms in pedagogy*]. Quelle & Meyer.

Sadler, T., Amirshokoohi, A., Kazempour, M. &, Allspwa, K. (2006). Socioscience and ethics in science classrooms: Teacher perspectives and strategies. *Journal of Research in Science Teaching, 43*(4), 353-376. https://doi.org/10.1002/tea.20142

Schrüfer, G., & Schockemöhle (2012). Nachhaltige Entwicklung im Geographieunterricht [Sustainable development in geography teaching]. In J.-B. Haversath (Ed.), *Geographiedidaktik. Theorie, Themen, Forschung* [*Didactics of geography. Theory, topics, research*] (pp. 107-132). Westermann.

Shulman, L. S. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review*, 57(1), 1-22. https://doi.org/10.17763/haer.57.1.j463w79r56455411

Singer-Brodowski, M. (2016). Transformative Bildung durch transformatives Lernen. Zur Notwendigkeit der erziehungswissenschaftlichen Fundierung einer neuen Idee [Transformative education through transformative learning. On the need for a new idea to be based on educational science]. *Zeitschrift für internationale Bildungsforschung und Entwicklungspädagogik* [*Journal for International Educational Research and Developmental Pedagogy*], 39(1), 13-17. https://doi.org/10.25656/01:15443

Sippl, C., & Scheuch, M. (2019). Das Anthropozän als Denkrahmen für Bildungsprozesse. Eine Projektskizze [The anthropocene as a conceptual framework for educational processes. A project outline]. *Zeitschrift für agrar-und umweltpädagogische Forschung* [*Journal for Agricultural and Environmental Research*]*,* 1, 107-119.

Sippl, C., Rauscher, E., & Scheuch, M. (Eds.) (2020). *Das Anthropozän lernen und lehren* [*Learning and teaching the anthropocene*]. Studienverlag.

Ulrich-Riedhammer, E.-M. (2017). *Ethisches Urteilen im Geographieunterricht. Theoretische Reflexion und empirisch-rekonstruktive Unterrichtsbetrachtung zum Thema "Globales Lernen"* [*Ethical judgment in geography lessons. Theoretical reflection and empirical-reconstructive teaching analysis on the topic of "global learning"*]. Münsterscher Verlag für Wissenschaft [Münsterscher Publishing House for Science].

UNESCO. (2017). *Education for sustainable developement goals. Learning objectives.* https://unesdoc.unesco.org/ark:/48223/pf0000247444

Vare, P., & Scott, W. (2007). Learning for a change. *Journal of Education for Sustainable Development, 1*(2007), 191-198. https://doi.org/10.1177/097340820700100209

Vielhaber, C. (2006). Wieviel Nachhaltigkeit verträgt das Schulfach Geographie und Wirtschaftskunde? [How much sustainability can the school subject geography and economics tolerate?] *GW-Unterricht* [*GW Lessons*]*, 103*, 17-24.

Vollmer, G. (1990). Paradoxien und Antinomien. Stolpersteine auf dem Weg zur Wahrheit [paradoxes and antinomies. Stumbling blocks on the way to truth]. *Naturwissenschaften* [*Natural Sciences*]*, 77*, 49-66. https://doi.org/10.1007/BF01131775

Weischedel, W. (1932). *Versuch über das Wesen der Verantwortung* [*Essay on the nature of responsibility*]. Otto.

Weisseno, G., Weschenfelder, E., & Oberle, M. (2015). Überzeugungen, Fachinteresse und professionelles Wissen von Studierenden des Lehramts Politik [Convictions, professional interest and professional knowledge of students in the teaching profession politics]. In G. Weißeno, & C. Schelle (Eds.), *Empirische Forschung in gesellschaftswissenschaftlichen Fachdidaktiken. Ergebnisse und Perspektiven* [*Empirical research in social science didactics. results and prospects*] (pp. 139-154). Springer. https://doi.org/10.1007/978-3-658-06191-3_10

Weschenfelder, E. (2014). *Professionelle Kompetenz von Politiklehrkräften* [*Professional competence of politics teachers*]. Springer. https://doi.org/10.1007/978-3-658-04193-9