‘LEARNING BY DOING’ IN HIGHER EDUCATION: EMPIRICAL INSIGHTS INTO EDUCATION FOR SUSTAINABLE DEVELOPMENT

‘APRENDER FAZENDO’ NO ENSINO SUPERIOR: INSIGHTS EMPÍRICOS SOBRE EDUCAÇÃO PARA O DESENVOLVIMENTO SUSTENTÁVEL

‘APRENDER HACIENDO' EN LA EDUCACIÓN SUPERIOR: PERSPECTIVAS EMPÍRICAS SOBRE LA EDUCACIÓN PARA EL DESARROLLO SOSTENIBLE

Bettina HOLLSTEIN[1]
e-mail: bettina.hollstein@uni-erfurt.de

João TZIMINADIS[2]
e-mail: joao.tziminadis@uni-erfurt.de

Pia SCHRAGE[3]
e-mail: piaschrage1234@gmail.com

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[1] University of Erfurt, Erfurt – Thuringia – Germany. Managing Director in the Max Weber Center for Advanced Cultural and Social Studies.
[2] University of Erfurt, Erfurt – Thuringia – Germany. Doctoral Fellow in the Max Weber Center for Advanced Cultural and Social Studies.
[3] University of Erfurt, Erfurt – Thuringia – Germany. Research Assistant in the Max Weber Center for Advanced Cultural and Social Studies.

ABSTRACT: Education for sustainable development (ESD) is a key enabler for Sustainable Development Goals (SDGs). Therefore, it is crucial that ESD be provided with firm theoretical foundations. In this contribution, we use pragmatism, especially that of John Dewey, to combine education, problem solving, and democracy. Our goal in this paper is to assess the experience of students in two different ESD settings at the University of Erfurt, in both of which students conduct real-world projects with extramural partners. Using a whole institution approach, our research surveys the perspective of different stakeholders (students, teachers, and extramural partners) with the aim of understanding which conditions favor successful ESD in higher education. In the empirical part, we describe the collection and analysis of data from students' experiences. Drawing on it and referring to theoretical concepts, we identify some conditions for successful ESD in higher education contexts.

KEYWORDS: Sustainable development goals. Pragmatism. John Dewey. Competences. Service-learning, Project-based learning.

RESUMO: *A educação para o desenvolvimento sustentável (EDS) é um facilitador fundamental dos Objetivos de Desenvolvimento Sustentável (ODS). Portanto, é crucial que a EDS tenha bases teóricas sólidas. Nesta contribuição, usamos o pragmatismo, especialmente o de John Dewey, para vincular educação, solução de problemas e democracia. Nosso objetivo neste artigo é avaliar a experiência de alunos em dois contextos distintos de EDS na Universidade de Erfurt, em ambos os quais alunos desenvolvem projetos reais com parceiros externos. Usando uma abordagem whole-institution, nossa pesquisa analisa a perspectiva de diferentes partes interessadas (alunos, professores e parceiros externos) com o objetivo de entender quais condições favorecem uma EDS exitosa no ensino superior. Na parte empírica, descrevemos a coleta e a análise de dados das experiências de alunos. Com base nesses dados e em conceitos teóricos, identificamos algumas condições para o êxito da EDS em contextos de ensino superior.*

PALAVRAS-CHAVE: *Objetivos de Desenvolvimento Sustentável. Pragmatismo. John Dewey. Competências. Service-learning. Aprendizagem baseada em projetos.*

RESUMEN: *La Educación para el Desarrollo Sostenible (EDS) es un factor clave de los Objetivos de Desarrollo Sostenible (ODS). Por consiguiente, es crucial que la EDS cuente con sólidos fundamentos teóricos. En esta contribución, utilizamos el pragmatismo, especialmente el de John Dewey, para vincular la educación, la resolución de problemas y la democracia. Nuestro objetivo en este artículo es evaluar la experiencia de los estudiantes en dos contextos diferentes de EDS en la Universidad de Erfurt, en ambos de los cuales los estudiantes desarrollan proyectos reales con agentes externos. Utilizando un enfoque whole-institution, nuestra investigación analiza la perspectiva de las distintas partes interesadas (estudiantes, profesores y agentes externos) con el objetivo de comprender qué condiciones favorecen el éxito de la EDS en la enseñanza superior. En la sección empírica, describimos la recogida y el análisis de datos sobre la experiencia de los estudiantes. Basándonos en estos datos y en conceptos teóricos, identificamos algunas condiciones para el éxito de la EDS en contextos de educación superior.*

PALABRAS CLAVE: *Objetivos de Desarrollo Sostenible. Pragmatismo. John Dewey. Competencias. Service-learning. Aprendizaje basado en proyectos.*

Introduction

Education is essential in achieving the sustainable development goals (SDGs) the representatives of most nations in the world have embraced to fight the climate crisis and to promote a good life[4] for all people in the world as well as for future generations. In this article, our goal is to assess the experience of students in two different ESD settings at the University of Erfurt, in both of which students conduct real-world projects with extramural partners. We first explain what concepts are key in education for sustainable development (ESD) and what theoretical foundations can we use to establish a firm grounding for ESD. We use pragmatism, especially that of John Dewey, to combine education, problem solving, and democracy. In the empirical part of this article, we describe the research on ESD we conducted at the University of Erfurt with students in the above-mentioned educational settings. One setting was an interdisciplinary course for Bachelor of Arts (BA) students.

Another was a course for Master of Arts (MA) students in the public policy program. In both settings, the students had to work as a team to carry out a project using their theoretical knowledge in a real-world context with external cooperating partner organizations. Using a whole institution approach, the research project aimed to survey the different stakeholders (students, teachers, and cooperating partner organizations from outside the university) to understand their different experiences. In this contribution we concentrate on the students' experience. Drawing on our theoretical concepts, we identify some conditions for successful ESD with respect to the students' perspective in university contexts.

Education for sustainable development

In view of the global environmental and social challenges threatening the well-being and survival of humankind on earth, the concept of sustainable development, which was first articulated in the so-called Brundtland Report "Our Common Future" (World Commission On Environment And Development, 1987), was operationalized in more detail in the form of Sustainable Development Goals (SDGs). These goals were adopted by the United Nations General Assembly in 2015 (UN, 2015). Sustainable development is not restricted to environmental issues but includes all aspects of a good life: both intragenerational (global) and

[4] The term "good life" is understood here in a pluralistic sense and refers to people's respective ideas about what a successful life is, taking into account intra- and intergenerational justice as well as planetary boundaries as developed, for example, by Hartmut Rosa and Christoph Henning (2018).

intergenerational justice for future generations. Not all of the 17 goals listed can be easily addressed consistently as a group. While we find struggles concerning the importance of different competing goals in different situations, the fourth goal, "Quality Education," is more or less noncontroversial. Within this goal, target 4.7 states more specifically:

> By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development (UN, 2015, p. 17).

Education for sustainable development (ESD) is a key enabler for all the other SDGs (UNESCO, 2020, p. 67). Therefore, it is more than a goal, it is also a means by which sustainability can be achieved. For this reason, the years 2005-2014 became the UN Decade of Education for Sustainable Development, aiming at a transformative change in direction of sustainable development.

> Education for sustainable development will contribute to enabling citizens to face the challenges of the present and future and leaders to make relevant decisions for a viable world. These actors will have acquired various skills (critical and creative thinking, communication, conflict management and problem solving strategies, project assessment) to take an active part in and contribute to the life of society, be respectful of the Earth and life in all its diversity, and be committed to promoting democracy in a society without exclusion and where peace prevails (UNESCO, 2005, p. 4).

This definition of ESD does not only pertain to information or knowledge people might acquire in learning processes to resolve environmental problems, but also addresses the well-known fact that information alone is not sufficient to change how we act in relation to our social and natural environment. Such transformative action also needs motivation and a commitment to common values within society as well as institutions channeling our habits and routines toward more sustainability[5]. Changes in the human way of life, in dominant patterns of production and consumption, and in decision-making processes are necessary, requiring a mental shift (De Haan, 2006, p. 20). Therefore, ESD aims at providing competences like critical

[5] By sustainability, we do not mean a static state, but refer to the concept of sustainable development as defined by the SDGs (see above), knowing full well that the SDGs can by no means be achieved without contradiction and that different priorities come into play depending on the situational context.

thinking, problem-solving strategies, and decision-making that ask for a more comprehensive understanding of education that addresses the whole person, including emotions and volition.

Attempts have been made in recent decades to answer these demands by researching outcomes or competences for sustainability. This led Paul Vare, Marco Rieckmann, and Nadia Lausselet to speak of a "Competence Turn" in education for sustainable development (Vare *et al.*, 2022, p. 4; Vare, 2022). Competences can refer to different approaches. One can be summarized as "context-specific dispositions" or "readiness" (Vare *et al.*, 2022, p. 4; Klieme *et al.*, 2008). This approach can be called instrumental and aims at providing skills for individual sustainable actions.

The second approach "aims to bridge the divide between the tradition of *Bildung,* an open term encompassing the formation of one's personality, and the notion of qualification as applied to vocational learning," and includes both motives and attitudes (Vare *et al.*, 2002) with reference to Heinrich Roth (Rieckmann, 2012) and Gerhard de Haan's *Gestaltungskompetenz* (*shaping competence*) (De Haan, 2006). This approach can be called critical and emancipatory, and the intention behind it is to teach people to reflect on controversies and problems in a participatory way. The concept of *Gestaltungskompetenz* was developed by De Haan and implemented in the BLK '21'[6] program for ESD in Germany. It was enhanced and further developed several times, but the core elements remain the same (De Haan, 2006, p. 21):

- Interdisciplinary learning in an open-minded[7] way, integrating new perspectives;
- Participative learning by working together and communicating;
- Innovative structures like collaborative projects with partners outside the educational system.

This educational concept is a competence-oriented educational approach that focuses on output (problem-solving strategies, concepts, and abilities for social action) whereas conventional teaching approaches focus on input and syllabus:

[6] The BLK '21' Program (Bund-Länder-Kommission für Bildungsplanung und Forschungsförderung = State-Federal States Commission for Educational Planning and Research Promotion) supported the introduction of ESD in schools from 1999 to 2004. It was part of the German strategy for Agenda 21 (UN, 1992).

[7] There is a broad debate about teaching open-mindedness and its risks (Tucker, 2023), which will not be discussed here. *Gestaltungskompetenz* primarily refers to the willingness to consider the perspectives, values, ideas, etc. of others, which differ from one's own, in order to develop an understanding of diversity in the world.

> 'Gestaltungskompetenz', or 'shaping competence', means the specific capacity to act and solve problems. Those who possess this competence can help, through their active participation in society, to modify and shape the future of society, and to guide its social, economic, technological and ecological changes along the lines of sustainable development (De Haan, 2006, p. 22).

It encompasses the following sub-competencies (De Haan, 2006, p. 22-25):

- Competence in foresighted thinking (able to deal with uncertainty, being able to think beyond the present, capacity to develop different options, creativity, fantasy, imagination);
- Competence in interdisciplinary work and learning (collaboration of different scientific fields, cultural traditions, etc., problem-solving strategies in everyday contexts);
- Competence in cosmopolitan perception, transcultural understanding and cooperation (curiosity and interest in other people, regions etc.);
- Learning participatory skills (participating in decision-making processes);
- Competence in planning and implementation skills (assess resources, create networks, calculate unintended side effects, attention to correlations between problems);
- Capacity for empathy, compassion, and solidarity (acting and communicating in the spirit of solidarity, working together);
- Competence in self-motivation and in motivating others (motivation to change oneself and encourage others to lead a fulfilled and responsible life);
- Competence in distanced reflection on individual and cultural models (critically examining one's own interests and desires, situating oneself in a cultural context).

This broader concept of ESD as oriented toward competences, which can include the first one, is also used by UNESCO (2020) and will be used in this contribution. This concept can be related to the pedagogical insights of pragmatism, especially the work of John Dewey, who pointed to the relationship between education and experiences of practical problem solving. Therefore, we use insights from pragmatism to develop a more concrete and theoretically-grounded perspective on educational processes.

Theoretical foundation in pragmatism[8]

The pragmatist philosopher John Dewey is well known for his educational approach to learning through experience. In 1916, he published *Democracy and Education* (Dewey, 1980 [1916]), a work still highly relevant 100 years after its initial publication – as recent publications demonstrate (Waks; English, 2017; Cochran, 2010). In this book, Dewey connects education to democracy using a very broad sense of democracy as a way of life that forms "personal character and [determines] desire and purpose in all the relations of life" (Dewey, 1988 [1939], p. 225-26). This broad concept of democracy is not far from the notion of sustainable development as elucidated in the 17 goals for sustainable development described in the previous section: it entails a vision of the good life as a fulfilled life embedded in social relations and at peace with nature (Rosa, Henning, 2018). This means that conditions for a good life cannot be obtained in societies that only rely on economic growth and call for an ever-expanding circle of extraction, consumption, pollution, waste that crosses planetary boundaries.

While the 17 SDGs describe goals that partly contradict each other, Dewey's concept of democracy is related to education as a means to achieve the goal of a good life. His ideal of democracy praises experience, participation, experimentation, and pluralistic organizational forms (Knight Abowitz, 2017, p. 64), all aspects that are part of *Gestaltungskompetenz*. From Dewey's perspective, democracy is not an objectively described form of government but a normative ideal for a good and open society, and it needs to engage with a great "diversity of stimuli," as Dewey puts it. "The goal in democratic education is to struggle against isolation and separation so that our diverse and varied interests can interact and influence each other" (Thayer-Bacon, 2017, p. 229).

The general aim of education (in the tradition of *Bildung* (Mittelstraß, 2006) is the development of virtue or moral character (Waks, 2017a, p. 13). David Hansen states in his foreword to the *Centennial Handbook to Dewey's Democracy and Education*: "[T]o become educated, for Dewey, just is to become more open and engage with the world, which is precisely his notion of what it is to become a democratic citizen" (Hansen, 2017, p. XX). And in the preface to the book *John Dewey and our Educational Prospect*, Hansen states:

[8] In this section, we make use of some reflections that will probably be published in 2024 under the title "The Economy and Democracy as a Way of Life: How to Create Democratic Attitudes within Economic Ethics," by Bettina Hollstein in a volume edited by Michael Festl.

> Dewey argues in the pages of *Democracy and Education* that those who understand how to learn and who are by habit open to new learning are on the way to becoming democratic citizens. […] "[D]emocratic life" constitutes another name for a life of inquiring, communicating, and learning (Hansen, 2006, p. VII).

Engaging with the world and its diversity is always a kind of action since, for Dewey, every human action presupposes a social world or context within which it takes place (Waks, 2017a, p. 6). Activities that connect to the wider world provide the social element of learning (Rud, 2017, p. 36). Doing and getting feedback from the results of one's action provide experience, which is crucial for learning, in Dewey's view (Waks, 2017b, p. 18). 'Learning by doing' is therefore the most prominent quotation from Dewey and relates learning to action.

This aspect of learning through action and experience is of great importance for ESD since ESD is not limited to conveying information or knowledge but aims to provide insight, motivation, and commitment to act for sustainable development. This pragmatist approach was also used by Öhman and Sund (2021), who use the concept of "sustainability commitment" proposed by Scott (2011);[9] the latter combines the three interrelated aspects of (intellectual) knowledge, (emotional) motivation, and (practical) experience (Vare, 2022, p. 16).

> The model suggests that sustainability commitment should be a common goal for ESE [Environmental and Sustainability Education] and that a sound commitment is situated at the intersection of the intellectual, emotional and practical aspects of sustainability (Öhman; Sund, 2021, p. 16).

The pragmatist approach of active and situated learning through experience leading to sustainability commitment is therefore central to developing ESD.[10] "Living in the world with others means that our actions affect others and we need to use empathic imagination and communication to understand how others see the world" (English, 2017, p. 106). The use of communication, participation, and engagement with the world to form common experiences, understand others, and create solidarity is crucial to Dewey's educational approach and gives us a hint as to how to conceptualize a framework for ESD.

In sum, pragmatism connects education as experiences of problem-solving and democracy closely and offers a framework for ESD that not only teaches knowledge but

[9] Scott shows in his review essay that "the priority must be to engage young people with ideas about sustainability through imaginative teaching strategies that provide stimulating opportunities for learning, including practice at citizenly engagement" (Scott, 2021, p. 409).

[10] Pragmatism developed this aspect of the importance of empathic imagination and the "generalized other," especially in the writings of George Herbert Mead (1964).

integrates cognition, motivation, volition, emotions, and values. Therefore, the approach of *Gestaltungskompetenz* can be reformulated in pragmatic terms. Therefore, an educational framework for ESD based on pragmatist insights has to start with real problems in the life world (1) that affect the students and matter to them. It must provide the possibility to engage with the world and to come into contact with diverse and varied interests (2). It must provide the chance to communicate, participate, and interact in order to understand others, to make decisions in teams and to develop self-efficacy when getting feedback (3). If such a learning environment can be provided, the students might not only learn ESD but also develop as democratic citizens.

A case study: KLIMA-N

Since December 2022, the German Federal Ministry for Education and Research[11] has been funding a series of projects that probe and develop new ways to make the German university system sustainable. This is the funding program "Transformative Pathways for Sustainable Universities,"[12] part of the "Sustainability in Science Initiative" (SISI). Anchored in the 'whole institution approach," this program fosters the engagement of students, professors, and university staff as well as extramural partners in the projects. In total, ten projects are being conducted nationwide, and each project is conducted by an association of different universities and covers a wide range of topics, from finding ways for more sustainable energy usage and infrastructure management to establishing lasting sustainable practices in teaching and research contexts.

Among these, the "Klima-Network for More Sustainability in Thuringia" (KLIMA-N)[13] merits particular attention. This network is constituted by a cooperation of four universities in the German federal state of Thuringia: the University of Erfurt (Uni Erfurt), the University of Applied Sciences Erfurt (FH Erfurt), the University of Technology Ilmenau (TU Ilmenau), and the University of Applied Sciences Nordhausen (HS Nordhausen). Each of them contributes with their own respective subprojects: on ESD (Uni Erfurt), diversity and mobility (FH Erfurt), communication (TU Ilmenau), and energy and technical operations (HS Nordhausen). Each of

[11] *Bundesministerium für Bildung und Forschung* or, in short, BMBF.
[12] *Transformationspfade für nachhaltige Hochschulen*. More information about this program can be found here: https://www.fona.de/de/massnahmen/foerdermassnahmen/transformationspfade-fuer-nachhaltige-hochschulen.php.
[13] *Klima-Netzwerk für mehr Nachhaltigkeit in Thüringen*. More information on this project can be found on the website: https://www.fh-erfurt.de/news/detailansicht/die-fhe-wird-nachhaltiger.

these subprojects develop and showcase sustainable practices in their respective universities with the aim of adapting and implementing such practices in the other collaborating universities. The present contribution presents partial results of the subproject Education for Sustainable Development (ESD) at the University of Erfurt. We will briefly discuss the central aspects and goals of this subproject here, and in what follows we will present the first results of its implementation since December 2022.

The subproject ESD looks at exemplary seminars that take place at the University of Erfurt and fall into two general criteria. First, these seminars must treat sustainability in their content (sustainability comprehended in the broad sense proposed by the above definition of the SDGs). Second, they must be practice-oriented in their format, providing the possibility for real-world experiences in problem solving for the students as described in the pragmatist approach developed by Dewey. Both criteria are fundamental, given that we assume that ESD should not be reduced to conveying information but should incorporate experience (Dewey) as a means to acquire key competences (De Haan). We identified two seminars in the winter semester of 2022-2023 that were selected for evaluation, namely, the *StuFu Nachhaltigkeit*[14] (hereafter StuFu) for BA students (setting 1) and the *Capstone Seminar "Critical Minerals. Options for Diversifying German Raw Material Supplies"* for MA students (setting 2).

A central goal of the subproject is the evaluation of these seminars regarding their transformative effectiveness and the identification of conditions for the success of ESD. It means, among other things, an assessment of the potential of the seminars to produce changes in students' knowledge, motives, values, competences, and attitudes regarding sustainability. This evaluation comprehends the perspective of students, teachers, and external partners that are involved in the seminars. A second goal is the formulation of best practices guidelines for the implementation of ESD by this type of seminar in the remainder of the KLIMA-N network.

In what follows, we first present the results of the students' evaluation of the seminars' evaluation. We collected data concerning students' experiences through the application of in-presence and online questionnaires, whose design will be explained further below. Thereafter, we discuss how the findings shed light on effective practices that might be transferred to other educational settings.

[14] Studium fundamentale Course 'Service-Learning Sustainability'.

Setting 1: The service-learning Seminar "Sustainability"

At the University of Erfurt, one author of this paper, is the mentor – in cooperation with other colleagues – of a service-learning seminar on sustainability for BA students from different disciplines. Service-learning is a kind of experiential education: Students engage in activities addressing community needs (= service) and are provided with structural opportunities for reflecting on these activities (= learning).[15] The concept of service-learning is to teach and learn responsibility by providing courses oriented to real problems students can resolve in teams together with cooperation partners from business or other sectors of society. In the service-learning seminar "Sustainability," BA students from different disciplines are first provided with theoretical knowledge concerning sustainability goals and concepts, ESD, and skills in project management in teams. The students work on micro-projects in collaboration with extramural partners in teams of 3-5 students. These partners can be companies, schools, administrations, civil society organizations, etc. The projects aim to make a local contribution to sustainable development and are orientated towards the common good. At the end of the semester, students present their project results at a project fair and reflect on their learning experiences in a report. (Hollstein; Tänzer; Thumfart, 2013; Singer-Brodowski, 2017). By reflecting on their own actions in the project in the light of the theoretical knowledge acquired about sustainable development, students learn to reflect on their actions with regard to the concepts, values and goals of sustainable development and can establish a relationship between knowledge, action and judgement.[16]

At the beginning of the seminar, many students have little experience with sustainability, rather they take part in the course because it was recommended to them by fellow students. In the reflection reports, students often describe that developing and implementing a project was not only fun, but that they also experienced self-efficacy when they were able to contribute a solution to real problems in their local environment.[17] Crucial for the design of this service-learning seminar is the cooperation with extramural partners introducing real-life

[15] For a general overview of service learning, see Dolgon *et al.* 2017.
[16] Exemplary excerpt from a reflection report: "As often as I was confronted with it, it was only now, through the reflection work, that I really understood what the term sustainability entails [...]" (participant in the 'Musical instruments made from waste' project group – in this project, the students developed a project day on the topic of waste for 12-year-old pupils and tested it with a school class.) (Hollstein; Tänzer, 2013, p. 106, translation: B. H.)
[17] Exemplary excerpt from a reflection report: "Despite some challenges, we achieved our goal quite independently by giving the children and young people an idea of sustainability and allowing them to become active themselves." (Participant in the project group 'Healthy and sustainable eating with children in Erfurt' – in this project, the students developed and tested a cookbook in a district center with children from a socially deprived area) (Hollstein; Tänzer, 2013, p. 108, translation: B. H.).

problems, the theoretical input on concepts of sustainability and project management, the cooperation in teams of students to present a solution to these problems and the reflection on how all these things are related to each other in a report (Hollstein; Tänzer, 2013).

Setting 2: The Capstone Seminar

A capstone describes a project in which students gain hands-on experience by working on a real-world project. The Capstone Seminar is a key part of the Master's in Public Policy program at the University of Erfurt and has to be completed by each student. The capstone involves a third party, an employer from the "real world" who provides the problem that needs to be solved. The seminar is intended to give students the opportunity to apply their knowledge in a real-world setting while self-organizing and working as a team.

At the beginning of the semester, the students are assigned to a capstone project based on their indicated preferences and have one semester to carry it out. The project is broadly predefined by the third party, though the detail is developed in cooperation with the students. In the first phase of the project, students propose a 'deliverable' (end product) that they can develop during the semester. This proposal is then discussed with the third party until agreement is reached. During the semester, students meet with their academic supervisor weekly to discuss their ideas and progress but are largely responsible for the work themselves. The students develop the deliverable independently and as a team. At the end of the semester, at an agreed upon deadline, the students present their product to the third party and receive feedback. Overall, the contact with the third party is minimal. The students are in contact with them at the beginning and the end of the project and if there are questions in the intervening period, but they do not collaborate with them actively.

Each capstone project covers a different topic from the wide field of public policy. As a result, some capstone projects address sustainability, such as the capstone analyzed in the paper "Critical Minerals: Options for Diversifying German Raw Material Supplies."

The questionnaires' design

Given differences in the seminar settings and in order to make their particularities visible, two questionnaires were designed. The main difference regards language: while all students of the StuFu are German nationals, the Capstone Seminar was attended by mostly international students. Therefore, a German questionnaire was administered to the first, and an English one to the second.[18] Differences concerning educational level (undergraduate vs graduate) and the object of the two courses (collective projects vs individual projects) also played a role in differentiating between the two questionnaires. Despite such differences, however, both follow the same structure and sections. The conceptual framework of the evaluation and the aim of the sections remain the same in both.

We have drawn on an already existing evaluation questionnaire provided to students by the University of Erfurt each semester. But we reformulated it to convey issues specific to each seminar and focused on the effectivity of students' acquisition of key competences. Using the survey software *EvaSys*, we formulated a set of statements the students can disagree or agree with to varying degrees of intensity, from "I do not agree at all" to "I agree completely", following the model of a rating scale as originally developed by Rensis LIKERT (1932). The questionnaires allow us to investigate the students' own perception of the effectivity of specific learning conditions such as the interaction with other students and teachers, the relationship between class activities and working with external partners, and between their initial expectations and the results of their projects[19].

The questionnaires comprise four sections. The first consists of personal data, and the second asked students about their previous experiences with sustainability, both in their families and school life, to establish the initial situation concerning experiences and knowledge related to sustainability. These first two sections do not concern the students' perceptions of their participation in the seminars but provide us with critical information in understanding their perceptions. For example, students were asked to evaluate how much they agree with the following statements: *"2.5. My family was actively involved in sustainable action by, e.g., participating in projects benefiting the environment." "2.9. I was offered the opportunity to participate in sustainability projects at school."*

[18] The English questionnaire can be found in the annex.

[19] Half of the questionnaires were applied online and half in presence and both versions were completely anonymized in order to protect students' identity and personal data.

The third and fourth sections contain the evaluative part of the questionnaires, where students were asked to evaluate their participation in the service-learning activities with respect to two evaluating axes: learning experience (axis 1) and self-efficacy (axis 2). In the first axis, the question of the learning experience focuses on the *present* of the students as transformative agents and gives greater emphasis to the organized processes of learning. In the second, the question of self-efficacy focuses on the *future*, i.e., on how students feel about their potential to act as transformative agents after participating in the seminars. Both axes, therefore, understand the experience of learning sustainability as a formative process that not only affects the students' intellectual capabilities but also their fundamental *attitude* toward the world that surrounds them. Though learning experience and self-efficacy affect each other and are thus not fully distinguishable, we differentiated two axes to emphasize the students' experience in the present and their expectations of the future.

Axes 1: Learning experience

In the first axis, they were asked about how they evaluate their practical engagement with the theme of sustainability and how this practical engagement shaped their knowledge and skills acquisition. Emphasis was placed on the particularity of practical learning as a pedagogical strategy, and questions were formulated to grasp students' relationship to colleagues, teachers, and their practice partners. Dewey's pragmatism provided the main conceptual framework for this axis, as both seminars were conceived and conducted on the premise of learning in real concrete social environments. Drawing on Dewey's conceptual framework and the seminars' own aspirations, we asked students to rate the *quality* of their learning experience, i.e., how fruitful these experiences were for the achievement of their learning goals. An example of evaluation statement linked to this concept is: "*3.6. The engagement with a concrete problem gave me insights about sustainable development that I would not have gotten in a purely academic environment.*"

A second input was Gerhard De Haan's (2008) concept of *Gestaltungskompetenz*. This concept designates abilities for active participation in the shaping of more sustainable realities. A focal point of the many competences covered by the concept is the development of the capacity to identify non-sustainable developments in ecological, economic, and social interdependent relationships as well as to envision and implement individual and collective solutions (cf. Bkl-Programm Transfer-21, 2007, p. 12). De Haan proposes eight partial

competences that should be developed in the context of ESD (see above) Six of these partial competences were chosen based on their compatibility with the practical settings of the seminars analyzed as well as their operationalizability in the questionnaire design. They are the following:

(1) Foresighted thinking in the sense of building up knowledge in an open-minded way;
(2) Interdisciplinary work and learning;
(3) Cooperation and solidarity;
(4) Learning participatory skills in collective decision-making processes;
(5) Self-motivation and motivating others;
(6) Planning and carrying out by acting autonomously.

Each of these six competences is represented in the questionnaires' evaluation statements. But the statements are not direct translations of each of the competences and, in some cases, represent two or more of them. One example of an evaluation statement that encompasses one competence (here competence (1)) is: "*3.1. In the development and implementation of my project, the needs and expectations of different stakeholders in the extraction, trade, and supply chain of critical minerals were considered."* Alternatively, one example of a statement that addresses more than one specific competence (namely (2) and (3)) is the following:*"3.4. The interaction and exchange with colleagues from other academic backgrounds were important for the conceptualization of my project and its aims."*

Axis 2: Self-Efficacy

In the second axis, students were asked about how they perceive the influence of the learning experience in their sense of self-efficacy. We drew the latter concept from sociologist Hartmut Rosa's (2017) resonance theory. Resonance emerges in relationships of mutual transformation between an experiencing subject and an experienced world. A central aspect of this kind of relationships is the openness of subjects to be affected and, to the same extent, their capacity to 'answer' this affection with their own voice or agency. In this sense, self-efficacy, in Rosa's understanding, emerges in responsive relationships between world and subject. If the world is experienced as a runaway reality that is indifferent to subjects' agency, then motivation to act on this world might decrease. We assume that by being active participants in real-world

sustainability projects, students might experience a sense of responsiveness between themselves and the concrete world they help to transform. In turn, we assume that this experience might increase their sense of self-efficacy in facing future sustainability-related challenges. An example of an evaluation statement in this case is: *"4.3. The experience with the project helped me in acquiring knowledge and developing skills that can be transferred and applied to other dimensions of life."*

Initial findings

The students were asked to indicate how much they disagree or agree with the statements. The average of their answers, which run from 1 (disagree entirely) to 7 (agree entirely), will be evaluated as follows: between 1 and 2, very negative; between 2 and 3, negative; between 3 and 4, slightly negative; 4, neutral; between 4 and 5, slightly positive; between 5 and 6, positive; between 6 and 7, very positive.

As explained above, sections one and two were not considered part of the students' evaluation of the seminars but offer important information for interpreting their evaluation. It is important to notice, therefore, that students in the StuFu evaluated their previous experience with sustainability as slightly negative, with an average value of 3.3, while students in the Capstone Seminar evaluated theirs as slightly positive, at 4.6. Another important aspect is the difference between the two seminars in the level of divergence among answers. For the StuFu, the average deviation had a value of 1.46, while for the Capstone it was 1.94. It means that, although Capstone students tended to evaluate their previous experience with sustainability more positively than StuFu students, they also disagree more among themselves.

With respect to the evaluation of the seminars themselves, Table 1 shows the averages that correspond to the overall answers given by each group to the two main sections of the questionnaire, i.e., learning experience and self-efficacy. For a differentiated view, we will split the answers to axis 1 into two categories, as they evaluate distinct aspects of the learning experience. *Service-learning* questions focus on the value of practice for the learning process, while *Gestaltungskompetenzen* questions target the acquisition of specific skills and competences. The following averages do not reflect students' opinions about the statements but their perception of the statements' correspondence to their experiences.

Table 1 - Average Values Assigned to Evaluative Concepts

Courses / Concepts	StuFu Nachhaltigkeit	Capstone: Critical Minerals	Overall
Axis 1 – Learning Experience	4.97	5.8	5.39
Service-Learning	4.74	5.97	5.28
(1) Surplus value of practice	5.4	6.45	5.93
(2) Expected skills	4.2	6.27	5.24
(3) Unexpected skills	4.5	5.3	4.9
(4) Application of theory	4.7	6.27	5.49
(5) Impact of experience on concept	4.9	5.55	5.23
Gestaltungskompetenzen	5.22	6.22	5.72
(1) new knowledge	5.6	6.03	5.81
(2) interdisciplinarity	5.4	6.27	5.83
(3) cooperation	5.6	6.32	5.96
(4) collective decisions	5.6	6.27	5.94
(5) motivation	4.56	6.4	5.48
(6) autonomy	4.56	6.4	5.48
Axis 2 – Self-Efficacy	5.3	5.8	5.55
Overall	5.13	5.8	5.47

Source: Survey Conducted by the Authors in the Winter Term 2023 (Questionnaire in Annex).

The table shows the averages per section and per the previously defined evaluative axes. Students in the StuFu evaluated their learning experience (axis 1) overall as slightly positive at 4.97, while students in the Capstone evaluated theirs as positive, at 5.8. The differentiation in the evaluation of axis 1 also presents differences concerning more conceptual questions, such as the importance of experience in learning (service-learning), and more practical questions, such as the development of specific skills or capacities (*Gestaltungskompetenzen*). Table 1 shows composite scores for service-learning and *Gestaltungskompetenzen*, and additional scores for different aspects of service-learning and for each selected *Gestaltungskompetenz*. Students in the StuFu evaluated the service-learning items as slightly positive at 4.58, while students in the Capstone evaluated them as positive, at 5.97. It is interesting that the surplus value of practice was the highest ranked by both groups in this section. The *Gestaltungskompetenzen* were evaluated as positive by students in the StuFu at 5.22, and very positive by students in the Capstone, at 6.22. Concerning axis 2, students in both groups evaluated their sense of self-efficacy as positive, even though the average value was higher for

Capstone students. Overall, it can be noted that the Capstone students evaluated each section higher than the StuFu students.

Discussion

Since the aim of the project is to create guidelines for successful ESD, we analyzed and compared the specific context of two seminars. Though both seminars fulfill the basic criteria set at the beginning, they are aimed at students at different educational levels with different backgrounds and goals. By comparing these seminars, we were able to observe how contextual differences affect conditions of accomplishment for ESD. With this comparison we expect to create guidelines that are sensitive to contextual differences.

Theory vs Practice

Overall, the results point to a positive evaluation of the ESD seminars by the students. This positive evaluation confirms that, in principle, seminars that are sustainability-related and draw on practical learning experiences are suitable instruments for the implementation of ESD.

In both seminars, students attributed higher than average values to items related to cooperation. In the questionnaires, such items are inherently connected to interdisciplinarity and exchange among students for the development of their projects. Given their outstanding rating in both seminars, cooperation and interdisciplinarity may be used as cornerstones for the creation of ESD guidelines. Additionally, students rated the surplus value of practical engagement highly. This rating refers to the importance of practice for the gain of insights regarding sustainability that would not be possible in a purely academic setting. This indicates that an effective ESD seminar should emphasize practice. The feedback from the students thus confirms the importance of the three core elements of *Gestaltungskompetenz* by de Haan mentioned above.

But the questionnaire results did not clearly show the role of theory in the learning process. The StuFu seminar was the only one of the two settings in which theory was explicitly taught. Nonetheless, contrary to what we expected, StuFu students rated the application of theory relatively low in comparison to both their average responses and the Capstone students. The latter rated the application of theory higher than their average responses, even though theory was not part of the Capstone seminar. This circumstance might indicate that theory does not play as big a role as practice in this type of seminar, although there might be alternative

reasons for these results. First, as MA students, Capstone students have accumulated more theoretical knowledge than the StuFu students who are at the beginning of their studies. Second, the Capstone seminar is integrated into the MA theoretical framework, while the StuFu seminar is disconnected from the BA students' majors.

Background vs Orientation

Capstone students come from different national backgrounds, including developing countries, which might explain the higher divergence in their previous experience. But their profiles as MA students who chose to work on a sustainability-related topic seems to cohere with their greater personal engagement with sustainability. Despite their higher divergence in background experience, they tend to agree more in their (positive) evaluation of the seminar. This suggests that personal and academic inclinations are more important than background when it comes to ESD.

StuFu students are German nationals and share a common cultural and institutional background, which might explain the lower divergence in their answers to questions concerning past experiences. Additionally, students' answers to the mobility question (how they traveled to school) were exceptionally positive, contrasting with the mostly negative evaluation of past experiences. This exceptionality might reflect the benefit of a more sustainable urban infrastructure that is not available in developing countries where most of the Capstone students come from. Though this is a noteworthy discrepancy in relation to the evaluation of other background items, it is unclear how it affects the students' learning experience.

Our data indicates that students with more past experience and more personally engaged with the theme of sustainability (here the Capstone students) rate their learning experiences in the evaluated seminars higher. This suggests that preexisting knowledge and competences in the field of sustainability make it easier to appreciate the value of ESD. In this respect, experience and contact with sustainability should start as early as possible in order to generate positive experiences that further educational offers can build on. The introduction of ESD at an early age is a valuable opportunity to systematically increase students' exposure to sustainability, which, in turn, increases the effectiveness of such educational activities. In sum, the observations mentioned indicate that common orientation and earlier exposure to sustainability problems have more impact on learning experiences than common background.

This seems to confirm Dewey's view that engaging with the world and its diversity provide experience which is crucial for learning.

Guidance vs Autonomy

The seminars also differ in terms of how much they emphasize guidance and autonomy. In the StuFu seminar, there is a combination of self-conducted microprojects and knowledge transfer via lectures to convey basic knowledge. Additionally, StuFu students are in regular contact with external partners throughout the implementation of their microprojects. In contrast, the Capstone seminar does not include aspects of knowledge transfer. Furthermore, although Capstone students meet on a weekly basis, there is no regular input from the external partner, which demands a higher level of autonomy by students making decisions and taking responsibility. These structural differences are reflected in the students' respective ratings of autonomy on the questionnaire. Capstone students attributed an especially high value to autonomy while StuFu students did not. Although these differences in the seminar settings might have impacted the students' evaluation of their autonomy, they reflect necessary variation, given the particular educational levels of the students as well as the seminar goals. Higher levels of autonomy correlate with higher self-efficacy.

Self-Efficacy

We argued above that students' orientation and the contextual setting of the seminar might have influenced disparities in the evaluation. Despite such differences, however, students in both groups rated their sense of self-efficacy highly after attending the seminars. Among other things, their positive evaluation of self-efficacy reflects their perception of becoming more sustainability-conscious, more capable of identifying unsustainable practices as well as identifying and promoting sustainable ones. Furthermore, they also reflect students' perception of becoming more confident in their capacity to intervene in and influence collective decision-making processes to produce more sustainable futures. This indicates that practice-oriented ESD tends to produce positive transformation in students' attitudes despite differences in background, orientation, and seminar settings. Consequently, this also indicates that there is room to tailor and adapt such seminars to specific contexts and needs. Self-efficacy is a prerequisite for commitment to sustainability and thus – as Öhman and Sund explained above – for ESD.

Limitations

The application of questionnaires for the collection of quantitative data in the context of learning experiences implies certain limitations that we would like to briefly indicate. First, we drew on conceptual tools and frameworks that proved difficult to translate into operationalizable questions. Theoretical concepts such as 'experiential learning' or 'self-efficacy' are less operationalizable than concrete concepts such as the specific *Gestaltungskompetenzen*. This might reflect the fact that students attributed higher values to items related to the latter than to those related to the former.

A limitation particular to the assessment of our case studies is the lack of control groups. Being able to contrast our findings with such a group would have allowed us to provide a better interpretation of our results. As both seminars employ the criterium of practical orientation, we could benefit from the comparison of both with seminars that are theoretically oriented. Such a comparison could give us a better understanding of the transformative effectiveness of practice. Another particular limitation of our study concerns the lower number of participants (n=21 in total). As such, our results should be understood as simply showing a trend among students' perceptions in both seminars.

We believe that these first results provide us with important indicators that can be used as a roadmap for further research into students' experiences in such educational settings. StuFu students are required to write a reflective report of their experiences by the end of each semester. We envision the possibility of analyzing anonymized versions of these reports as a way to grasp, in a more nuanced and qualitative way, how students interpret and articulate their learning experiences.

Final remarks

Going back to our theoretical framework, we reaffirm that a pragmatist approach to ESD has to start from real problems in the students' life world (1) that affect them in a vital way – i.e., not only intellectually – and are therefore meaningful to their practical experiences. This principle seems to be confirmed in how past experiences shaped the interests of students differently in the Capstone and the StuFu seminars. A pragmatist approach suggests that seminars should also provide students with the possibility to engage with the world and to come into contact with diverse and varied interests (2). Our data has shown that greater diversity in

terms of national background (as in the Capstone group) is associated with a higher rating of ESD. To the same extent, a greater diversity of problems might benefit ESD.

Not only local problems, which students might be familiar with in their everyday lives, are effective as a foundation for transformative engagement. Rather, global problems that pertain to different and distant life worlds might provide effective experiential platforms for exercising key ESD competencies and skills. Finally, in this approach, students must be given the chance to communicate, participate, and interact in collective decision-making processes (3). This enables students to exercise their abilities to comprehend others' perspectives and needs in their decisions as well as to improve their sense of self-efficacy as agents capable of listening and responding effectively to the demands of an increasingly complex world.

In sum, based on our research we would like to suggest the following best practice guidelines for ESD seminars regarding their transfer to other universities:

- Seminars that are sustainability-related and draw on practical learning experiences are suitable instruments for the implementation of ESD.
- Cooperation and interdisciplinarity may be used as cornerstones for the creation of ESD seminars.
- Effective ESD seminars should give emphasis to practice and real-life problems.
- Personal and academic inclinations are more important than background when it comes to ESD.
- Pre-existing knowledge and competences in the field of sustainability make it easier to appreciate the value of ESD.
- The introduction of ESD at an early age is a valuable opportunity to systematically increase students' exposure to sustainability, which, in turn, increases the effectiveness of such educational activities.
- Higher levels of autonomy correlate with self-efficacy.
- Practice-oriented ESD tends to produce positive transformation in students' attitudes despite differences in background, orientation and seminar settings. Consequently, this also indicates that there is room to tailor and adapt such seminars to specific contexts and need.

Pragmatist insights pointing to diversity (inter- and transdisciplinarity), practical problems, cooperative problem-solving and participation are therefore valuable for the

development of ESD seminars in actual contexts of higher education, but ESD has always to be adapted to the specific situational context of the students addressed.

REFERENCES

BKL-PROGRAMM TRANSFER-21 (ed.) **Orientierungshilfe**: Bildung für nachhaltige Entwicklung in der Sekundarstufe I. Begründungen, Kompetenzen, Lernangebote. Berlin, 2007. Available at: https://www.globaleslernen.de/sites/default/files/files/link-elements/blk-transfer_2021_20orientierungshilfe.pdf. Access: 15 July 2023.

COCHRAN, M. (ed.). **The Cambridge Companion to Dewey**. Cambridge: Cambridge University Press, 2010.

DE HAAN, G. The BLK '21' programme in Germany: a 'Gestaltungskompetenz'-based model for Education for Sustainable Development, in: **Environmental Education Research**, 12:1, p. 19–32, 2006.

DE HAAN, G. Gestaltungskompetenz als Kompetenzkonzept der Bildung für nachhaltige Entwicklung. *In*: BORMANN, I.; DE HAAN, G. (ed.). **Kompetenzen der Bildung für nachhaltige Entwicklung**. Wiesbaden: VS Verlag für Sozialwissenschaften, 2008.

DEWEY, J. Democracy and Education. *In*: BOYDSTON, J. A. (ed.) **The Middle Works**: 1899–1924, v. 9. Carbondale and Edwardsville: Southern Illinois University Press, 1980 [1916].

DEWEY, J. Creative Democracy – The Task Before Us. *In*: BOYDSTON, J. A. (ed.) **The Later Works**: 1925-1953, v. 14. Carbondale and Edwardsville: Southern Illinois University Press, 1988 [1939].

DOLGON, C.; MITCHELL, T. D.; EATMAN, T. K. (ed.). **The Cambridge Handbook of and Community Engagement**. Cambridge: Cambridge University Press, 2007.

ENGLISH, A. R. (2017): Experience and Thinking: Transforming our Perspective on Learning. On Chapter 11: Experience and Thinking, *In*: WAKS, L. J.; ENGLISH, A. R. (ed.). **John Dewey's Democracy and Education**. A Centennial Handbook. New York: Cambridge University Press, 2017.

HANSEN, D. T. Preface. *In*: HANSEN, D. T. (ed.). **John Dewey and Our Educational Prospect**. A Critical Engagement with Dewey's Democracy and Education. Albany: State University of New York Press, 2006.

HANSEN, D. T. (2017): Foreword. *In*: WAKS, L. J.; ENGLISH, A. R. (ed.). **John Dewey's Democracy and Education**. A Centennial Handbook. New York: Cambridge University Press, 2017.

HOLLSTEIN, B.; TÄNZER, S. Die Lernkultur im StuFu Nachhaltigkeit. Zusammenfassung und Reflexion. *In*: HOLLSTEIN, B.; TÄNZER, S.; THUMFART, A. (ed.). **InnoNet Bildung**

für nachhaltige Entwicklung. Gemeinsam Nachhaltigkeit gestalten. Das Innovationsnetzwerk BNE und das Studium Fundamentale Nachhaltigkeit als Impulsgeber für vernetztes Handeln, gefördert vom Bundesministerium für Bildung und Forschung. Erfurt: InnoNet, 2013.

HOLLSTEIN, B.; TÄNZER, S.; THUMFART, A. (ed.). **InnoNet Bildung für nachhaltige Entwicklung**. Gemeinsam Nachhaltigkeit gestalten. Das Innovationsnetzwerk BNE und das Studium Fundamentale Nachhaltigkeit als Impulsgeber für vernetztes Handeln, gefördert vom Bundesministerium für Bildung und Forschung. Erfurt: InnoNet, 2013.

KLIEME, E.; HARTIG, J.; RAUCH, D. The concept of competence in educational contexts. *In*: HARTIG, J.; KLIEME, E.; LEUTNER, D. (ed.). **Assessment of Competencies in Educational Context.** Göttingen: Hogrefe Publishers, 2008.

KNIGHT ABOWITZ, K. "A Mode of Associated Living": The Distinctiveness of Deweyan Democracy, On Chapter 7: The Democratic Conception in Education. *In*: WAKS, L. J.; ENGLISH, A. R. (ed.). **John Dewey's Democracy and Education**. New York: Cambridge University Press, 2017.

LIKERT, R. A technique for the measurement of attitudes. **Archives of Psychology**, *[S. l.]*, v. 22, p. 5-55, 1932.

MEAD, G. H. **Selected Writings**. Chicago: University of Chicago Press, 1964.

MITTELSTRAß, J. The Future of the University and the Credibility of Science and Scholarship. **Ethical Perspectives**, *[S. l.]*, v. 13, n. 2, p. 171-189, 2006. DOI: 10.2143/EP.13.2.2016629. Available at: https://www.researchgate.net/publication/250133778_The_Future_of_the_University_and_the_Credibility_of_Science_and_Scholarship. Access: 15 July 2023.

ÖHMAN, J.; SUND, L. A Didactic Model of Sustainability Commitment. **Sustainability**, *[S. l.]*, v. 13, n. 6, p. 3083, 2021. DOI: 10.3390/su13063083. Available at: https://www.mdpi.com/2071-1050/13/6/3083. Access: 15 July 2023.

RIECKMANN, M. Future-oriented higher education: Which key competencies should be fostered through university teaching and learning? **Futures**, *[S. l.]*, v. 44, p. 127–135, 2012. DOI: 10.1016/j.futures.2011.09.005. Available at: https://www.researchgate.net/publication/232364850_Future-oriented_higher_education_Which_key_competencies_should_be_fostered_through_university_teaching_and_learning. Access: 15 July 2023.

ROSA, H. **Resonanz**. Eine Soziologie der Weltbeziehung. Berlin: Suhrkamp, 2017.

ROSA, H.; HENNING, C. **The Good Life Beyond Growth**. London, New York: Routledge, 2018.

RUD, A. G. Giving Form and Structure to Experience, On Chapter 3: Education as Direction. *In*: Waks, L. J.; English, A. R. (ed.). **John Dewey's Democracy and Education**. New York: Cambridge University Press, 2017.

SCOTT, W. A. H. Sustainable schools and the exercising of responsible citizenship—A review essay. **Environmental Education Research**, *[S. l.]*, v. 17, p. 409–423, 2011. DOI: 10.1080/13504622.2010.535724. Available at: https://www.tandfonline.com/doi/full/10.1080/13504622.2010.535724. Access: 15 July 2023.

SINGER-BRODOWSKI, M. Pedagogical content knowledge of sustainability. A missing piece in the puzzle of professional development of educators in higher education for sustainable development. **International Journal of Sustainability in Higher Education**, *[S. l.]*, v. 18, n. 6, p. 841-856, 2017. DOI: 10.1108/IJSHE-02-2016-0035. Available at: https://www.emerald.com/insight/content/doi/10.1108/IJSHE-02-2016-0035/full/html. Access: 15 July 2023.

THAYER-BACON, B. Healing Splits: Dewey's Theory of Knowing, On Chapter 25: Theories of Knowledge. *In*: WAKS, L. J.; ENGLISH, A. R. (ed.). **John Dewey's Democracy and Education**. New York: Cambridge University Press, 2017.

TUCKER, L. Open-mindedness: A double-edged sword in education. **Theory and Research in Education**, *[S. l.]*, v. 21, n. 3, p. 241-263, 2023. Available at: https://philarchive.org/rec/LUKOAD. Access: 15 July 2023.

UNITED NATIONS (UN). **Local Agenda 21**. 1992. Available at: https://sustainabledevelopment.un.org/outcomedocuments/agenda21. Access: 15 July 2023.

UNITED NATIONS (UN). **Resolution "Transforming our world**: the 2030 Agenda for Sustainable Development". Adopted on 25 September 2015. Available at: https://sdgs.un.org/2030agenda. Access: 15 July 2023.

UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANIZATION (UNESCO). **UN Decade of Education for Sustainable Development, 2005-2014**: the DESD at a glance. 2005. Available at: https://unesdoc.unesco.org/ark:/48223/pf0000141629. Access: 15 July 2023.

UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANIZATION (UNESCO). **Education for sustainable development**: a roadmap. ESD for 2030. 2020. Available at: https://unesdoc.unesco.org/ark:/48223/pf0000374802. Access: 15 July 2023.

VARE, P. The Competence Turn. *In*: VARE, P.; LAUSSELET, N.; RIECKMANN, M. (ed.). **Competences in Education for Sustainable Development**. Cham: Springer, 2022.

VARE, P.; RIECKMANN, M.; LAUSSELET, N. Introduction. *In*: VARE, P.; LAUSSELET, N.; RIECKMANN, M. (ed.). **Competences in Education for Sustainable Development**. Critical Perspectives, Cham: Springer, 2022.

WAKS, L. J. Introduction to Part I. *In*: WAKS, L. J.; ENGLISH, A. R. (ed.). **John Dewey's Democracy and Education**. A Centennial Handbook, New York: Cambridge University Press, 2017a.

WAKS, L. J. Learning by Doing and Communicating, On Chapter 1: Education as a Necessity of Life. *In*: WAKS, L. J.; ENGLISH, A. R. (ed.). **John Dewey's Democracy and Education**. A Centennial Handbook, New York: Cambridge University Press, 2017b.

WAKS, L. J.; ENGLISH, A. R. (ed.). **John Dewey's Democracy and Education**. New York: Cambridge University Press, 2017.

WORLD COMMISSION ON ENVIRONMENT AND DEVELOPMENT. **Report "Our Common Future"**. 1987. Available at: https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf. Access: 15 July 2023.

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