KATHRIN FOSHAG, TERESA RUCKELSHAUß, ANN-KATHRIN SCHLIESZUS, NICOLE AESCHBACH & ALEXANDER SIEGMUND

The Impact of Structured Professional Development on Promoting Education for Sustainable Development (ESD) in Higher Education

Evaluation of Course Components and Their Effects on Professional and Personal Contexts

ABSTRACT

In the pursuit of supporting competence development and advancing Education for Sustainable Development (ESD) in higher education teaching, a structured and graduated academic staff development program was developed and implemented at select model universities in Germany from 2020 to 2023. Through accompanying research, pre- and post-course surveys were conducted to evaluate the existing level of ESD knowledge and identify effects of course participation. Participants recognized the personal and professional relevance of the course content, and the engagement led to increased interest and motivation to embrace ESD principles. Participation in the program not only serves as a catalyst for ESD integration but also provides practical insights into implementation, positioning it as a valuable tool for promoting the widespread adoption and integration of sustainable development practices in higher education teaching. The article summarizes the findings and develops impulses for the integration and expansion of ESD in higher education.

Keywords: Education for Sustainable Development – professional development – higher education – evaluation

ZUSAMMENFASSUNG

Mit dem Ziel, die Kompetenzentwicklung zu unterstützen und Bildung für nachhaltige Entwicklung (BNE) in der Hochschullehre zu fördern, wurde an ausgewählten Modellhochschulen in Deutschland von 2020 bis 2023 ein strukturiertes und gestuftes Weiterbildungsprogramm für Hochschullehrende entwickelt und durchgeführt. Im Rahmen der Begleitforschung wurden Vor- und Nachbefragungen durchgeführt, um Einblicke in das Vorwissen zu BNE zu erfassen und Effekte der Kursteilnahme zu ermitteln. Die Teilnehmenden erkannten die persönliche und berufliche Relevanz der Kursinhalte und die Teilnahme führte zu einem gesteigerten Interesse und einer erhöhten Motivation der Lehrenden, BNE-Prinzipien zu übernehmen. Die Kursteilnahme dient nicht nur als Katalysator für die BNE-Integration, sondern bietet auch praktische Einblicke in die Umsetzung. Der Beitrag fasst die Erkenntnisse aus der Begleitforschung zusammen und leitet daraus Impulse für die Integration und Ausweitung von BNE in die Hochschulbildung ab.

Schlagwörter: Bildung für nachhaltige Entwicklung – Weiterbildung – Hochschullehre - Evaluation

Sustainable Development and Education for Sustainable Development

Political Framework

The fundamental principles of sustainable development were first articulated at the UN Conference in Rio de Janeiro in 1992 in Agenda 21 (UNITED NATIONS 1993). In the 2030 Agenda, which was adopted in 2015, transformation towards a sustainable future was identified as a central objective (UNITED NATIONS 2015). The 17 Sustainable Development Goals (SDGs) and their 169 targets encapsulate diverse perspectives on current challenges, and SDG 4 emphasizes the pivotal role of quality education in achieving these global objectives. Essential competences such as critical and systems thinking are crucial for informed and responsible decisions towards sustainability, which are included in the concept of Education for Sustainable Development (ESD) (SDG 4.7). UNESCO's "Education for Sustainable Development: Towards achieving the SDGs" ("ESD for 2030") provides the current guiding political framework for implementation and structural integration.

ESD views teaching and learning as a collaborative endeavor, fostering participatory quality education through its methodological-pedagogical approach. The concept has the claim and the potential to promote the acquisition of knowledge, attitudes, and values by learners, both individually and collectively, which are necessary to enable them to actively shape a sustainable future. Several strategic papers and reforms have designed the landscape of ESD in Germany, including the National Action Plan on Education for Sustainable Development, which outlines Germany's contribution to the UNESCO Global Action Programme (National Platform ESD 2017). Additionally, research studies have examined the effectiveness of ESD in transforming behavior and attitudes towards sustainability within educational settings (BOEVE-DE PAUW et al. 2015, ICIHNOSE 2019, GRUND & BROCK 2020).

Importance and Implementation of Education for Sustainable Development especially at Universities

The need for sustainable development stems from the scientific evidence that current patterns of production and consumption are exceeding the planet's ecological limits (LENTON et al. 2008, SCHELLNHUBER 2009). Recent research shows that global warming is continuing, with far-reaching consequences for ecosystems and human societies (IPCC 2023). At the same time, studies on biodiversity loss show an alarming decline in biodiversity (HABIBULLAH 2022, PÖRTNER et al. 2021). These developments threaten not only the ecological integrity of the planet, but also the foundations of human prosperity and economic and social stability (OTTO et al. 2020). Scientists therefore emphasize the

urgency of a paradigm shift towards sustainable practices that promote ecological regeneration, increase resource efficiency, and address social equity (SACHS et al. 2019, VAN BERG, MAGRO & MULDER 2019).

The urgent need for sustainable development is also reflected in an increased attention to sustainability-related topics throughout the educational sector (BASSEN et al. 2018, GRUND & BROCK 2022). This growing focus underscores the transformative potential of ESD as a holistic educational concept in empowering learners to actively contribute to a more sustainable future.

Despite increasing awareness of sustainable practices, significant international and regional differences exist in the implementation of ESD goals in education policy. In Germany, a lack of structural integration remains across all educational sectors. In schools, for example, we observe limited subject coverage (primarily geography, biology, and sports), a lack of prominent institutions, and a bias towards technical education (GRUND & BROCK 2022). These deficits result from insufficient time, staff, other resources, and opportunities for professional development within educational institutions, despite widespread support for broader ESD integration among both teachers and learners (GRUND & BROCK 2022, for universities see also CHRISTIE ET AL. 2015, MELLES 2019, RUCKELSHAUß et al. 2023).

Universities play a crucial role not only in shaping the next generation of global leaders and experts but also as hubs for academic staff development and experimentation (NAP 2017, HOLST & SINGER-BRODOWSKI 2022). To promote ESD and to share transformative knowledge and pedagogical approaches, lecturers must be empowered and enabled to foster a foundational set of "sustainability-relevant key competences" (RIECKMANN 2020). This is underlined in the roadmap "ESD for 2030" and the position paper of the National Platform for Education for Sustainable Development on ESD and digitalization, which calls for an academic staff development offensive for multipliers and the development of digital education programs on ESD (National Platform ESD 2023). The implementation of ESD professional development programs in higher education is of great importance, since students, as future decision-makers and teachers, have a particularly strong leverage and transfer effect in society.

In this context, the qualification of lecturers as multipliers in the formal educational sectors of schools, vocational training, and higher education play a central role. However, it is evident that ESD lacks systematic and structural integration in universities and higher education institutions across Germany, with a notable absence of corresponding extensive in-service professional development programs for lecturers (GRUND & BROCK 2022).

At universities, comprehensive curricular integration of ESD is lacking, as evidenced by the absence of sustainability topics in module handbooks, study programs, and examination regulations (GRUND & BROCK 2022). Moreover, sustainability and ESD issues are notably absent from professional development courses offered by higher education didactics (HOLST & SINGER-BRODOWSKI 2022). Lecturers themselves also consider the professional development opportunities to be insufficient (RUCKELSHAUß & SIEGMUND, under review).

To meet SDG target 4.7's mandate that all learners acquire the necessary knowledge and skills for sustainable development by 2030, there is a decisive need to establish high-quality, research-based development opportunities for lecturers through accessible structures and offerings (UNESCO 2021, GRUND & BROCK 2022). Given the imperative for lecturer professionalization, embedding ESD competences needs to be addressed across various levels: "ESD-related thematic and methodological competence should be actively promoted in trainer qualifications and further education across all subjects and disciplines" (GRUND & BROCK 2022, own translation).

The Development of Higher Education Pedagogies and its Relation to Education for Sustainable Development

There is an increase in the number of higher education pedagogy centers and their associated certifications. This signifies the growing importance of teaching within the traditionally research-focused higher education landscape, solidifying the position of academic staff development within German institutions (SEIDL, SALDEN & METZGER 2022). This shift is evident in the increasing emphasis on pedagogic skills during recruitment and application processes in the higher education sector (STANG & BECKER 2022). Furthermore, initiatives like the Bologna Process and the professionalization of higher education teaching through the "Teaching Quality Pact" by the Federal Ministry of Education and Research, which allocated two billion euros to German higher education institutions from 2011 to 2020, have contributed to a gradual rebalancing of priorities between research and teaching (EGGER & MERKT 2016, BMBF 2022, STANG & BECKER 2022).

Academic staff development plays a pivotal role in advancing ESD in higher education by equipping lecturers with the necessary knowledge and skills to teach ESD effectively. In the realm of action-oriented teaching, academic staff development, peer collaboration, and guidance become increasingly important when addressing the gap between theoretical knowledge of university pedagogies and its practical implementation (SCHMIDT & TIPPELT 2005). Both university teaching itself and programs for further professional development in university pedagogies must align with action-oriented learning paradigms to bridge the gap between theoretical expertise and practical application (SCHMIDT & TIPPELT 2005), and thus release the potential of ESD to improve the quality of university teaching as a whole. ESD and academic staff development can be regarded as "natural allies" that can support and enrich each other, respectively (EGGENSPERGER & KLÖBER 2023).

Research Aim and Methodology

The article discusses the importance of integrating ESD into university teaching and highlights the role of academic staff development courses in promoting this integration. The

overall aim of the project was to promote the integration and institutionalization of ESD in academic institutions, thus contributing to the embedding of sustainability principles and practices in higher education institutions. This article highlights the importance of this issue by presenting findings from our survey based on research on an ESD course program. We began by providing background information on the evolution of university pedagogies and its connection to ESD. Next, we describe the course program, elaborate on the research questions guiding this article and outline the course evaluation process. We then characterize the participants, analyze the motivational effects and interest development related to ESD, and critically reflect on the survey conducted. In the final section, we contextualize our results within existing research and draw insights for ESD in university teaching.

The Project "Learning to Teach Sustainability"

The project "Learning to Teach Sustainability: Promoting Education for Sustainable Development (ESD) in Higher Education. Development of cross-university further education programs and structures with a focus on teacher training at selected universities in Germany" elaborated and implemented academic staff development courses to promote ESD and sustainability competences among lecturers at the federal level (funded by the Federal Ministry of Education and Research, BMBF) and at the state level in Baden-Württemberg (funded by the Ministry of Science, Research and the Arts Baden-Württemberg, MWK, and the Ministry of the Environment, Climate Protection and Energy Baden-Württemberg, UM). The courses were offered at 13 model universities at state and federal level.

In developing, delivering, and assessing the ESD course program, the following research questions were addressed:

- How does participation in a course impact the evaluation of significance and self-assurance within (the framework of) university teaching based on ESD?
- What is the effect of course participation on lecturers' motivation?
- How do lecturers participating in a course perceive the influence of their teaching on students' knowledge, attitudes, and behavior towards sustainable development?
- Which teaching formats and methods used in the courses are considered most fruitful by the lecturers?

Research addressing these questions can contribute to a better understanding of the role of lecturers' self-reported knowledge of ESD in promoting sustainable development within higher education institutions and preparing students to actively engage in creating a more sustainable future. Therefore, the focus has been on strengthening higher education pedagogies and bridging the theory-practice gap in the context of Higher Education for Sustainable Development (HESD).

Overview of Course Procedures

The program consists of basic and advanced one-day courses, offered either in person or online, and facilitated by two course leaders. The courses were accompanied by coaching and an e-learning program, with the objective of facilitating the promotion of possibilities, knowledge and integration of ESD in higher education teaching. They were accessible to all academic disciplines and status groups of university employees with group size not exceeding 16 participants.

Both the basic and advanced courses are designed not only to teach the concept of ESD but also to embody its principles in the teaching approach, which is consistently reflected throughout the program. ESD requires a particular learning culture by applying methods that activate learners, encourage them to think critically, and apply systems thinking. Therefore, many methods are first practically tested and then reflected at the meta-level during the courses so that participants can later adapt them easily to their own teaching. The course outline is illustrated in a visual and creative manner, either on a flip chart (in in-person courses) or on a digital whiteboard (in online courses), to guide the participants and help them follow the common thread and create an appreciative atmosphere. Elaborations on course procedures and detailed descriptions of specific methods can be obtained from RUCKELSHAUß et al. (2022), SCHLIESZUS et al. (2022) and SCHLIESZUS et al. (forthcoming).

The basic course focuses on the fundamentals of sustainable development and ESD as an educational concept. These are developed in a participatory way with an interactive input in quiz format and the jigsaw[1] method. As the course progresses, participants experiment with various methods that are particularly suitable for ESD, in that they stimulate controversial discussions, for example fostering controversial discussions.[2] In addition to fixed units such as the dilemma discussion (LIND 2003), the course also offers flexibility to adapt to the needs of each specific group. The course is designed so that the methods can be adapted to different teaching/learning settings, considering the interdisciplinary composition of the group of lecturers. The participants experience the methods from a learner's perspective and discuss application scenarios and possible adaptations to their respective teaching at a meta-level.

The advanced course focuses on anchoring ESD in the lecturers' own teaching. Participants get to know other relevant methods and gain an insight into various ESD approaches

[1] The Jigsaw Method is a cooperative learning strategy developed by Elliot Aronson in 1971, designed to promote collaboration among students. In this approach, a lesson is divided into segments, with each student assigned a specific segment to learn and then teach to their peers. This method encourages interdependence, as students must rely on one another to complete the overall understanding of the topic, similar to assembling pieces of a jigsaw puzzle (MENGDUO & XIAOLING 2010).

[2] Discussion formats in the context of ESD are pedagogically valuable as they promote critical thinking and the ability to understand complex interconnections. They offer learners the opportunity to explore different perspectives and reflect on their own views, leading to a deeper understanding of sustainability issues. They also strengthen communication skills and the ability to collaborate, which are essential for solving global challenges.

through videos that experts from different disciplines have recorded exclusively for the course, in which they show how they implement ESD in their teaching. Additional input is given through a live presentation from an external expert followed by a discussion. A peer exchange builds the core of the advanced course. The participants work in pairs or groups of three to align their own courses more closely with ESD, either by including sustainability competences in the learning objectives or by integrating ESD methods into the course. A plenary presentation of the results rounds off the session so that the learners can also inspire each other respectively.

Approaches included in either of the courses are six thinking hats (DE BONO 1989), real world stories (adaptation of the card game 'Black Stories'), picture description tandem, climate fresk (adaptation of the structure-formation technique), body outline as well as other reflection and feedback methods. How different aspects of the courses foster interdisciplinary cooperation is also described in SCHLIESZUS et al. (2022). Furthermore, RUCKELSHAUß et al. (2022) discuss the role of norms and values in online settings with examples from the course format presented here.

Questionnaire for Course Evaluation

In evaluating the impact of ESD courses in higher education, a questionnaire survey (see supplementary material in the appendix) was conducted with lecturers to assess the effectiveness of these courses in enhancing lecturers' ESD self-reported knowledge and motivation. The survey aimed at understanding the perceived influence of the courses on lecturers' knowledge, attitudes, and instructional approaches related to ESD. Through structured questionnaires, quantitative data was collected to systematically evaluate the courses' impact on participants' understanding of sustainable development concepts and their self-reported ability to integrate ESD principles into their teaching practices. Additionally, the survey explored perceived barriers and facilitators to implementing ESD in higher education settings.

The study comprised a total of 19 courses, comprising 11 basic and 8 advanced courses. The 19 courses were conducted in two formats: 6 were held in person, while 13 were conducted digitally. For all courses, participants filled out a standardized questionnaire survey prior to and following their course attendance, either digitally or in print depending on the format. A total of 152 valid cases from all courses were included in the analysis, with complete data sets available for 76 participants.

The survey was conducted to establish a baseline and track changes in course impact over time through shifts in selected indicators.

Results of Course Evaluation

The following results provide insights into the effectiveness of the course program designed to promote the integration of ESD in higher education teaching. Through a comprehensive evaluation, the study examined key aspects of the program's effectiveness, including its influence on participants' understanding of ESD, their motivation to address sustainable development challenges in their teaching, and the evaluation of different course formats in the basic and advanced course offerings.

Participants

The group of participants in this study mainly consisted of academic staff. Humanities, natural sciences not directly related to sustainability and health / medicine tended to have the highest representation (humanities / human sciences 19.6%, natural sciences (except those directly related to the environment/sustainability) 11.6%, health / medicine 11.6%, educational sciences 10.1%, social sciences 8.7%, economic sciences 7.2%, environmental/ sustainability sciences (incl. ecology, geography, sustainability management, etc.) 6.5%, engineering sciences 4.3 %, law 2.9%, other 10.1%, not answered 7.2%). The gender distribution of participants showed a majority of females. Around a quarter of the participants were aged between 30 and 34, while the majority were under 50. Approximately 40% of the participants had a maximum of five years of teaching experience, while 13% had over 20 years of experience in teaching at the university level. The proportion of lecturers whose courses were not attended by students becoming school teachers (42.8%) was similar to that of lecturers who (also or exclusively) taught courses to prospective school teachers (47.8%).[3]

[3] Teacher training in Germany is conducted in three phases. First, prospective teachers complete a teacher training course at a university or teacher training college, which lasts between six and ten semesters, depending on the teaching profession. In the second phase, the traineeship or preparatory service, graduates receive practical training lasting between 12 and 24 months at study seminars and schools. The traineeship ends with the second state examination. Upon successful completion of this phase, graduates are eligible to enter the third and final phase of teacher training, which is school service with in-service training.

Lecturers' Motivation and Interest in Engaging with ESD

The assessment of the courses revealed that 55% of participants rated their course (basic and advanced courses) as 'extremely useful', while 33.3% rated it as 'rather useful' (Fig. 1). Only a minority of participants did not see any advantage in taking one of the courses.

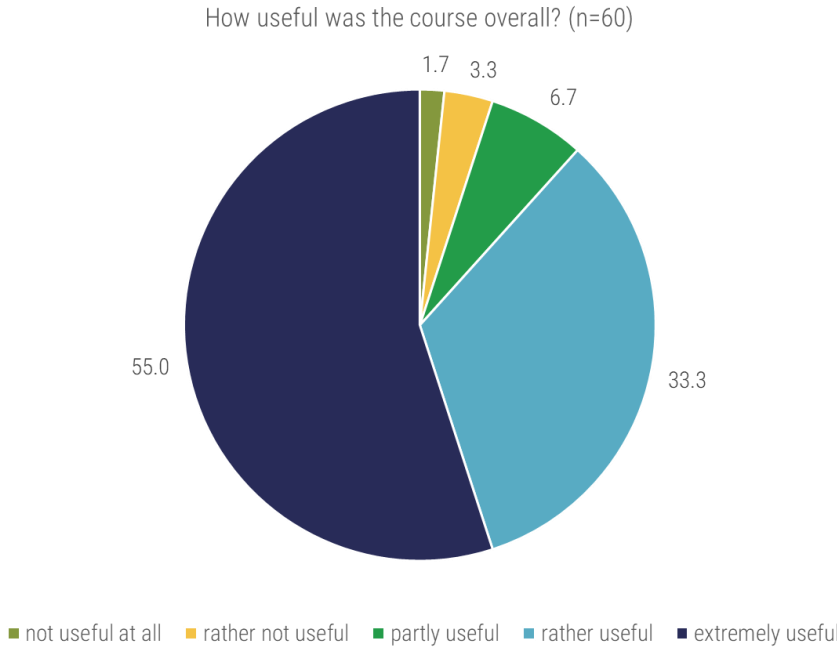

Figure 1
General evaluation of course participation by participants for basic and advanced courses combined.

Participants' self-reported understanding of ESD has significantly improved after taking either one of the courses or both, the basic and advanced courses. Prior to participation, most lecturers rated their knowledge on ESD as low or very low, but after completing the course, they predominantly rated their knowledge as good or very good (Fig. 2).

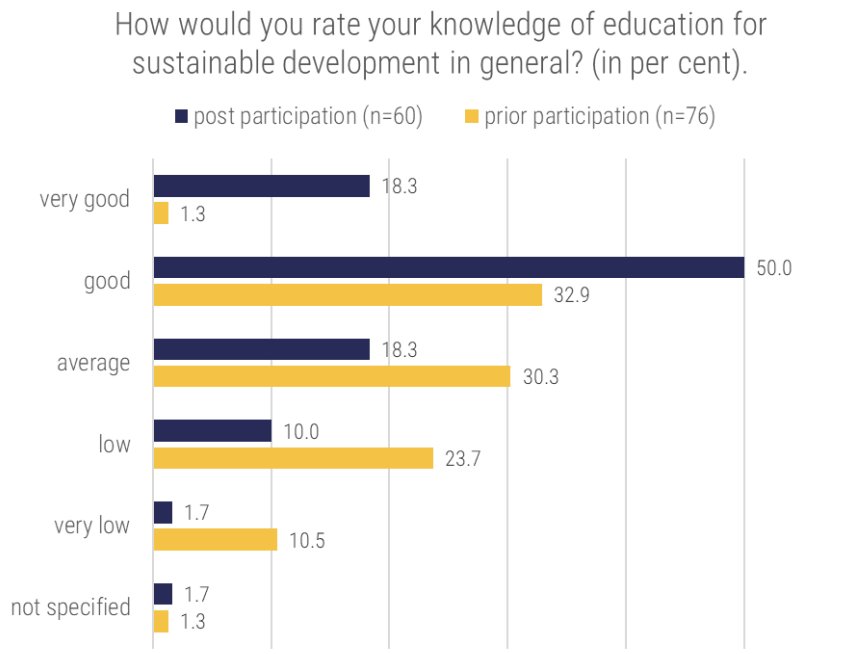

Figure 2
Self-described knowledge of ESD and competence to integrate ESD in teaching prior to and post course participation.

Furthermore, the participants expressed a high motivation to address sustainable development challenges in their teaching after the course, with low motivation being uncommon, and minimal differences observed between basic and advanced courses (Fig. 3). The results of the questionnaire survey indicated a strong link between participants' engagement with ESD and their motivation to teach in higher education according to ESD principles.

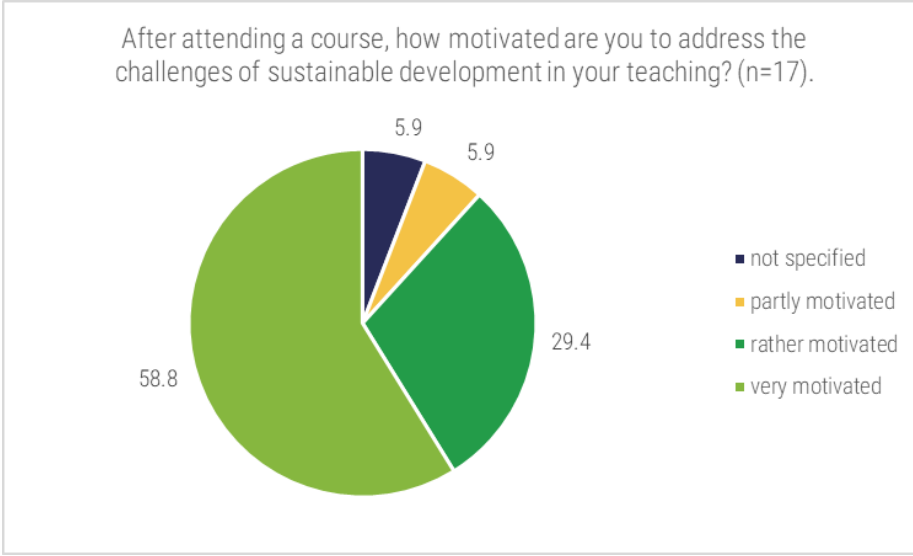

Figure 3
Lecturers' motivation to integrate ESD in their teaching activities (after participation in basic or advanced courses).

Moreover, lecturers expressed a significant increase in interest in sustainable development issues after actively engaging with ESD concepts (Fig. 4).

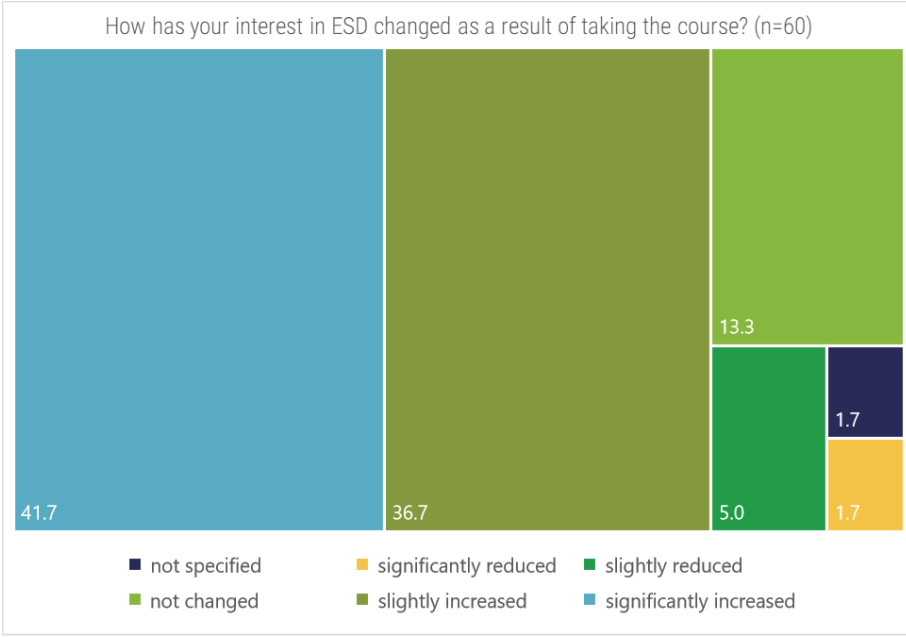

Figure 4
Lecturers' self-described development of interest in (E)SD after course participation.

The survey findings highlight that those lecturers who participated in the program felt a heightened sense of purpose and relevance in their teaching, recognizing the transformative potential of integrating sustainability principles into higher education (Fig. 5). Many respondents reported that ESD provided a meaningful framework for contextualizing their subject matter (85%), fostering a sense of responsibility for equipping students with the knowledge and skills necessary to address pressing global challenges (50,9%) (Tab. 1).

Table 1: Results for selected items reflecting the assessment of the impact and relevance of teaching in the context of ESD from the perspective of lecturers after course participation

	N	Minimum	Maximum	Mean	Standard Deviation	Percentage of agreement with the statement (‘fully agree’, ‘rather agree')
Implementing ESD: Sustainable development is a cross-cutting theme that can easily be linked to existing teaching and project content.	60	1	5	4.38	0.958	85%
Teaching impact: I see university teaching as a transformative experience that produces experts who are also active members of society.	57	2	5	4.46	0.709	91,2%
Teaching Impact: My teaching helps students understand how their actions can contribute to global justice.	57	1	5	3.46	1.181	50,9%
Teaching impact: I can help students to recognise structural relationships in the field of sustainable development.	57	1	5	3.88	0.965	66,6%

In addition, the comparison of participants' pre- and post-surveys shows that participation has a positive impact on the self-perceived effectiveness of participants' teaching. After completing the course, they confirm that they are more likely than before to empower students to act sustainably and responsibly and, in general, to contribute to a sustainable future for all (Fig. 5).

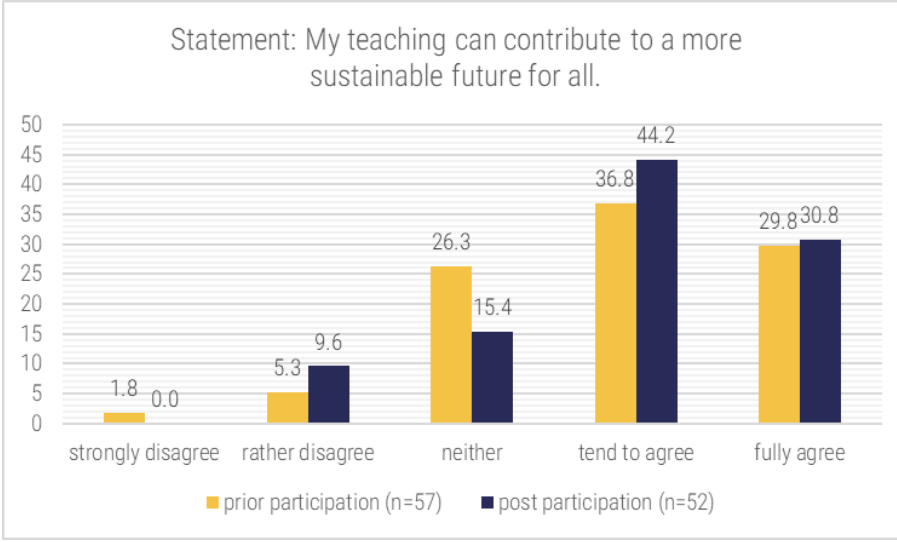

Figure 5
Assessment of the statement: "My teaching can contribute to a more sustainable future for all" by lecturers before and after attending a course.

Evaluation of Course Methods

The course provided valuable support for lecturers to implement ESD in their courses, particularly in terms of methodology and handling contentious and normative issues. Active formats and hands-on methodological approaches, such as practical exercises, were rated most positively by participants (Fig. 6). While certain elements of the course received ambiguous ratings, there were no methods or contents that the majority considered to be useless and therefore rejected. In general, both open and structured discussion formats, such as peer exchange and the dilemma discussion method, were rated as particularly valuable, aligning with their recognized pedagogical values.

The input in a quiz format on (E)SD basics used in the basic course was also rated positively. The "Visualize!" method, which allows participants to graphically represent their understanding of sustainable development at the beginning of the basic course and discuss it, received mixed reviews, but was considered by many participants to be quite useful. Less positively rated elements like a good practice video were adjusted to the participants' needs or removed during the project in an iterative course development process.

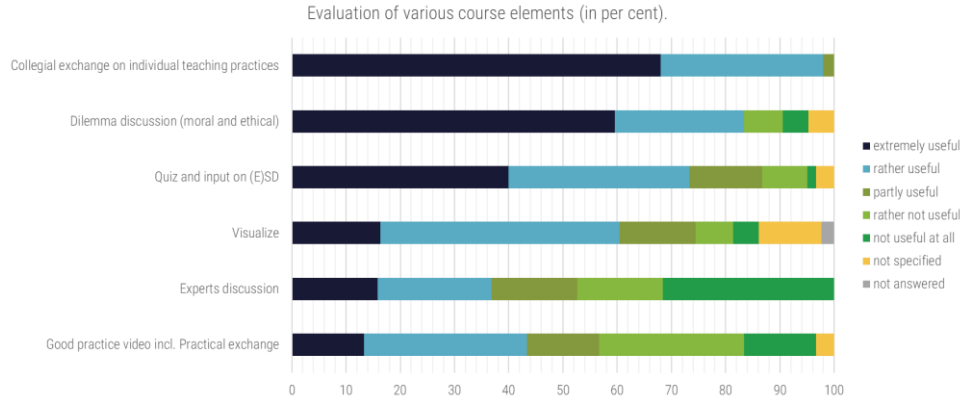

Figure 6
Evaluation of different course elements by the participants (basic and advanced courses).

Discussion

The results show that the above-described professional development course on ESD was perceived useful by most of the lecturers participating in the survey (Fig. 1). This generally underlines lecturers' need for professional development courses especially in the field of ESD, which was also found in a variety of other studies (e.g., Etzkorn 2018, Grund & Brock 2022, Holst & Singer-Brodowski 2022).

Furthermore, we found that the course has increased the self-reported knowledge on ESD: lecturers describe a higher level of knowledge of the concept of ESD after the course than before (see Fig. 2). This can be an important precondition to enabling lecturers to put ESD into practice. Nevertheless, the self-reported increase of knowledge observed by our survey refers uniquely to the short-term effects of the course. To assess whether knowledge was acquired, retained in the long term, incorporated into practice and relevant competences were developed, a longitudinal study design with other types of questions would be necessary. Furthermore, it is important to keep in mind that knowledge of sustainable development and the ESD concept alone does not enable lecturers to practice ESD in their teaching: BRUNDIERS et al. (2021) for example show that many different competence facets are necessary for ESD implementation.

Another important finding was that after the course, most lecturers report an increased interest in ESD and a rather or very high motivation to implement ESD more strongly into their teaching in the future (see Fig. 3). Motivated lecturers are pivotal for an effective integration of ESD in university teaching in manyfold ways: In the short term, lecturers who are motivated and feel prepared to incorporate ESD principles and methods into their teaching demonstrate increased enthusiasm and engagement in the classroom. This motivation can lead to dynamic and interactive learning experiences, capturing students' attention and fostering a sense of relevance in relation to global sustainability challenges. In the long term, this initial motivation can contribute to a transformative impact on higher education: Lecturers who sustain their commitment to ESD principles may influence institutional change by advocating for curriculum revisions, interdisciplinary collaborations, and the integration of sustainability across various disciplines (BARTH & RIECKMANN 2012, CEBRIÁN & JUNYENT 2015).

The survey results do not contain explanations in which way the course contributed to motivate lecturers. Nevertheless, oral feedback from the participants at the end of the courses showed that it was especially when lecturers reflected on the personal and disciplinary relevance of sustainable development that they felt increasingly motivated to implement ESD in their teaching. This should be taken into account for designing future professional development courses on ESD and could be examined more deeply in future studies.

Regarding the formats used in the ESD courses, the survey showed that lecturers considered collegial exchange on their individual teaching practices as most useful. This is in line with findings from other studies: For example, BOEVE DE PAUW et al. (2022) showed in a longitudinal study that academic staff development can improve lecturers' self-efficacy especially when they focus on the lecturer's own ESD practice. Considering the broad range of competences required for educators implementing ESD in their teaching practice (see for example the framework "A rounder sense of purpose", VARE et al. 2019), the importance of such peer exchange becomes clear: Many of the competences, such as supporting learners in actively engaging, reflecting their own values and responsibilities etc. cannot be directly transported by a trainer to the lecturers as simple solutions and action schemes for teaching. They rather require collective reflective processes and exchange among lecturers on how to align their (sub)discipline's specific topics and teaching formats with ESD principles. To

give an example: Supporting learners to actively engage for sustainable development can look very different in a laboratory course in chemistry than in a reading seminar in French literature studies. Collegial exchange enhances not only the search for individual solutions which fit the respective lecturers' needs and context, but also contributes to social connectedness among lecturers, showing them that they are not alone with their questions and challenges in teaching ESD topics (BARTH & RIECKMANN 2012, FERREIRA 2009).

While the participants in this study do not fully represent the diversity of disciplines, experiences and perspectives across the higher education sector, they represent a broad variety of disciplines and thus provide an impression on lecturers' views across disciplinary boundaries. Furthermore, the underlying reasons for the increased self-reported knowledge on ESD and the high motivation to implement ESD in one's own teaching after the course cannot be explained by the survey. Further studies could focus on this, for example with qualitative research methods that are more suitable for in-depth analyses.

Despite the mentioned limitations, the current study can be an encouragement for expanding professional development programs in the field of higher education, as it shows that such courses are generally perceived useful by the lecturers. Furthermore, it hints at two important aspects which should be taken into account when designing ESD courses for higher education lecturers: Discussing the relevance of sustainable development for the lecturers personally and for their discipline can increase the lecturers' motivation. And providing opportunities for peer exchange in order to reflect on individual contexts and challenges when practicing ESD can be an important leverage point for enhancing practical ESD implementation. In this way, the present research contributes to supporting efforts to further integrate ESD in higher education.

Outlook

Lecturers consistently highlighted in their reflections that structural constraints within their universities limit their ability to effectively implement ESD in their teaching practices. While motivated and practically skilled lecturers are pivotal for implementing ESD in higher education, anchoring sustainable development also requires a comprehensive, institution-wide commitment. Manyfold studies[4] show that long-term success necessitates structural changes, policy support, and a collective effort from academic institutions to embed sustainability at its core: sustainable development in higher education demands not only ESD incorporation into individual courses but also systemic changes in institutional practices, for example in the field of campus management and operations, participatory decision-making and embeddedness in local communities and transdisciplinary networks – in short: orienting the whole institution toward sustainability. Whole institution approaches (WIAs) aim at "linking the formal and informal (hidden) curricula" (HOLST 2023: 1015) by

[4] For an overview on research studies on this topic, see HOLST 2023.

integrating the socio-physical context into sustainability learning. This contributes to a holistic understanding by all members of the institution of what sustainable development means and how they can act sustainably in their own lives. A recent study by HOLST et al. (2024) with almost 3000 participants (teachers and lecturers as well as students from universities, schools and vocational training institutions) shows that WIAs are related to effective sustainability learning in different ways: educators and learners who experience more sustainability in their educational institution feel more motivated and empowered to contribute to sustainability themselves. Furthermore, the study revealed that WIA implementation is the strongest predictor among various variables of sustainable action beyond the educational institution, i.e., in daily life.

Thus, while capacity building and motivation of lecturers remains a crucial catalyst for ESD in higher education institutions, it is important to consider the whole institution and to embed sustainability into all areas of action. This can also help to avoid conflicts between what is taught and what is lived in higher education institutions – relieving lecturers from ambivalences and goal conflicts which could potentially make it difficult for them to teach sustainability authentically. When universities become "micro-cosm[s] of a sustainable society" (STERLING 2003: 344), they can be germ cells for a more sustainable world. Empowering lecturers is one important step in this journey.

Conclusion

The article discusses the significance of integrating ESD into university teaching and the role of professional development courses in promoting this integration by drawing on the example of an ESD course delivered through the project "How to teach sustainability". The project's overall aim was to encourage the integration and institutionalization of ESD in academic institutions and thus to contribute to embedding sustainability principles and practices in higher education institutions.

Participating in professional development courses on ESD can contribute to equipping lecturers with the necessary knowledge, pedagogical tools, and innovative approaches to effectively integrate ESD principles into their teaching. The course aimed at providing a deeper understanding of the multidimensional aspects of sustainable development, enabling lecturers to convey the significance of environmental, social, and economic considerations to students and to implement participative and creative teaching methods which correspond to the pedagogical impetus of ESD. The courses were designed in an interdisciplinary setting to support lecturers to incorporate ESD across various disciplines by elaborating ideas for their own teaching through discussing with colleagues with a similar or very different disciplinary background. Thus, an interdisciplinary approach for teaching was fostered by the very design of the course. The courses aimed at empowering lecturers to design engaging and contextually relevant learning experiences that inspire students to become active contributors to sustainable development.

In summary, we were able to show that course participants recognized the personal and professional relevance of the course content and that participation led to increased interest and motivation to adopt ESD principles. Participation can therefore not only act as a catalyst for the integration of ESD, but also provide practical insights into its implementation.

When lecturers collaborate with colleagues from other disciplines, as well as with non-academic staff members inside and stakeholders outside the university, sustainability can become ingrained in the institution's ethos, fostering a holistic and transformative impact on higher education.

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Dr. Kathrin Foshag is a researcher and lecturer at the TdLab Geography at the Institute of Geography and Geocommunication at Heidelberg University. Her research interests include adaptation to the impacts of climate change (in particular the increasing frequency and intensity of heat events in urban areas), transdisciplinary methods for integrating expertise from practice partners, and Education for Sustainable Development. In cooperation with the Heidelberg Center for Education for Sustainable Development at the Heidelberg University of Education, she is leading the Geography module in the Master of Education program, linking pedagogy and science in the field of climate change and sustainable development.

Corresponding author
Dr. Kathrin Foshag
kathrin.foshag@uni-heidelberg.de

Teresa Ruckelshauß (M. Sc.) works as a research assistant at the Heidelberg Center of Education for Sustainable Development in the Department of Geography - Research Group for Earth Observation (^{r}geo) at Heidelberg University of Education. The environmental economist is involved in different projects that promote the professional development of university teachers and other multipliers at the university. Her research focus is on higher education for sustainable development.

Ann-Kathrin Schlieszus is a research assistant at Institut Futur, Department of Education and Psychology, Freie Universität Berlin. She studied geography, French and biology for secondary school teaching. At present, she is part of the National ESD-Monitoring and works in a research project focusing on Whole Institution Approaches to sustainability. Her research interests are education for sustainable development in school and higher education, transformative learning, holistic learning approaches and pedagogy.

Dr. Nicole Aeschbach is a Senior Scientist in the 3D Geospatial Data Processing (3DGeo) Research Group at Heidelberg University and at the Heidelberg School of Education (HSE). Her research and teaching interests lie in the fields of environmental and climate change, and on sustainability as a cross-cutting issue. She designs and implements research-based, participatory teaching and learning settings within the geography degree programmes and

at the HSE. Her research at the interface of science and society focuses on the climate crisis, in particular on issues of mitigation, i.e. the reduction of greenhouse gas emissions ("climate action"). She combines approaches from the natural and technical sciences with the social sciences and humanities, brings together perspectives from academia and practice, and designs future-oriented university teaching.

Prof. Dr. Alexander Siegmund, Professor of Physical Geography and Prorector for Research, Sustainability, and Digitalization at Heidelberg University of Education, is also an Honorary Professor at the University of Heidelberg. As the Director of the Research Group for Earth Observation (^{r}geo) and Chair holder of the UNESCO Chair on Observation and Education of World Heritage and Biosphere Reserves, he advocates for applied remote sensing, GIS, and various facets of environmental and geo education. With over 20 years of experience, he has led national and international projects, contributing to research on climate systems and climate change education. As the Managing Director of the Heidelberg Center of Education for Sustainable Development, he actively promotes the integration of ESD into higher education and emphasizes sustainability communication.

Supplementary Material

Excerpts from questionnaire t1 with relevant items (post participation) (translation)

Questionnaire (excerpt)	
Question	**Answer options**
How beneficial did you find...	1 = Not at all beneficial 2 = Rather not beneficial 3 = Partly beneficial 4 = Rather beneficial 5 = Extremely beneficial -1 = No answer -9 = Left blank
...Visualize?	
...the dilemma discussion?	
…the quiz with input on (E)SD?	
…the good practice video and discussion about it?	
…working on your own courses in pairs/trios?	
…the overall exchange in tandems/small groups?	
…the exchange with experts?	
How would you rate your knowledge of the concept "Education for Sustainable Development" in general?	1 = Very low 2 = Low 3 = Average 4 = Good 5 = Very good -1 = No answer -9 = Left blank
To what extent do you agree with the following statement? Sustainable development is a cross-cutting issue that can be easily integrated into existing teaching or project content.	1 = Strongly disagree 2 = Somewhat disagree 3 = Neither agree nor disagree 4 = Somewhat agree 5 = Strongly agree -1 = No answer -9 = Left blank
To what extent do you agree with the following statements?	1 = Strongly disagree 2 = Somewhat disagree 3 = Neither agree nor disagree 4 = Somewhat agree 5 = Strongly agree -1 = No answer -9 = Left blank
I see higher education teaching as a transformative experience that produces experts who are also active members of society.	
My teaching leads students to understand how their actions can contribute to global justice.	
I can support students in recognizing structural connections in the field of sustainable development.	
My teaching can contribute to a more sustainable future for all.	

How has your interest in the topic of (Education for) Sustainable Development changed due to the workshop? My interest has...	1 = ... significantly decreased. 2 = ... somewhat decreased. 3 = ... not changed. 4 = ... somewhat increased. 5 = ... significantly increased. -1 = No answer -9 = Left blank
How motivated are you to increasingly engage with the challenges of sustainable development in your role as a higher education teacher in the future?	1 = Not at all motivated 2 = Rather not motivated 3 = Partly motivated 4 = Rather motivated 5 = Very motivated -1 = No answer -9 = Left blank