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Sustainability in Higher Education

Engaging Students and Universities in Co-Creating Sustainable Learning Environments

ABSTRACT

In this article, we explore how universities can effectively teach sustainability. First, we identify key pedagogical approaches (interdisciplinarity, participatory learning, and real-world application), competencies (critical, reflective, and strategic thinking), and institutional requirements (curriculum integration and campus sustainability) based on the literature on Education for Sustainable Development (ESD). Second, we present the interdisciplinary seminar "Sustainable Strategy Development", which we attended during the 2023/24 winter term, as a practical example of ESD in action. Third, we critically assess Heidelberg University's current institutional sustainability efforts using the criteria identified in ESD-related literature. Our findings suggest that while Heidelberg University is on the right track, further improvements are necessary to meet its ESD obligations and ambitions. One effective way that we identify here is establishing more seminars that not only enable students to develop the necessary competencies using innovative teaching methods, but also allow them to actively participate in the design of their sustainable learning environment. We conclude that sustainability education is most effective when the university itself plays a central role in the teaching process.

Key words: Education for Sustainable Development – interdisciplinarity – participatory learning – sustainability

ZUSAMMENFASSUNG

Dieser Beitrag untersucht, wie Nachhaltigkeit an Universitäten effektiv gelehrt werden kann. Dazu identifiziert er zunächst zentrale pädagogische Ansätze (Interdisziplinarität, partizipatorisches Lernen, anwendungsbezogenes Lernen), Kompetenzen (kritisches, reflektives und strategisches Denken), und institutionelle Voraussetzungen (integrative Lehrpläne und Nachhaltigkeit auf dem Campus) in der Literatur, die sich auf Bildung für nachhaltige Entwicklung (BNE) bezieht. Anschließend stellt er das interdisziplinäre Seminar „Sustainable Strategy Development" als Beispiel angewandter BNE vor, an dem die AutorInnen dieses Beitrags im Wintersemester 2023/24 teilnahmen. Schließlich werden die aktuellen institutionellen Nachhaltigkeitsbemühungen der Universität Heidelberg vor dem Hintergrund der in der Literatur identifizierten Kriterien kritisch untersucht. Diese Analyse zeigt: Während die Universität Heidelberg den richtigen Weg eingeschlagen hat, sind weitere Verbesserungen nötig, um den auf BNE bezogenen Anforderungen und Ambitionen gerecht zu werden. Eine entsprechende Möglichkeit ist die Etablierung von Seminaren, die nicht nur innovative Lehrmethoden zur Vermittlung notwendiger Kompetenzen einsetzen, sondern Studierenden darüber hinaus die aktive Gestaltung einer

nachhaltigen Lern- und Lehrumgebung erlauben. Der Beitrag kommt deshalb zu dem Schluss, dass BNE dann besonders effektiv ist, wenn die Universität selbst eine zentrale Rolle in den auf Nachhaltigkeit ausgerichteten Lehrangeboten spielt.

Schlagwörter: Bildung für nachhaltige Entwicklung – Interdisziplinarität – Nachhaltigkeit – partizipatorisches Lernen

Introduction

In light of global challenges posed by climate change and the necessary social transformation, sustainability has become a critical issue for all sectors, including higher education. The UN Sustainable Development Goals (SDGs) further underscore the importance of embedding sustainability into various institutional frameworks. This raises an important question: how can universities effectively teach sustainability? During the 2023/24 winter term, we took part in the interdisciplinary seminar "Sustainable Strategy Development" organized by the Marsilius Kolleg, Institute for Advanced Study at Heidelberg University. The seminar emphasized a comprehensive approach to sustainability and was open to students of all disciplines. It covered a wide range of topics, from understanding transformation processes and stakeholder roles to differentiating between *sustainability* strategies and *sustainable* strategies. The knowledge gained was put into practice in an interactive workshop during which we worked on developing a sustainability strategy specifically for Heidelberg University.

This hands-on approach, which we will elaborate upon below, highlighted the importance of translating theoretical knowledge into practical application. It demonstrated how interdisciplinary and participatory methods can deepen understanding and foster essential competencies in sustainability and for sustainable development. Additionally, this experience also emphasized the potential of such educational initiatives to contribute meaningfully to institutional sustainability efforts. The participation in the seminar made us further wonder how well these practical elements are embedded in the broader theoretical explanations on effective ways of teaching sustainable development and how they can be integrated effectively into university curricula.

Thus, we pose the following question: How does Heidelberg University implement higher education for sustainable development, and how can this implementation be improved? In order to answer this question, we follow three steps: First, based on a short literature review, we develop a conceptual framework which broadly summarizes key pedagogical approaches, competencies, and institutional changes for Education for Sustainable Development (ESD). Second, we use this framework to contextualize current ESD implementation efforts by the Heidelberg University. Third, we give insights into the seminar "Sustainable Strategy Development" and illustrate how it might serve as good practice for the institution in general.

The Beginnings of Teaching Sustainability in Higher Education

Since the first UN Conference on Human Environment at Stockholm in 1972, followed by subsequent intergovernmental conferences in Belgrade (1975), Tbilisi (1978), and Moscow (1987), the potential of environmental education has been widely recognized. By now, the role of higher education in advancing international sustainable development is well established. Today's understanding of ESD was significantly shaped by the 1992 United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro, where 178 member states adopted Agenda 21, a framework of action which – amongst other objectives – called for "reorienting education towards sustainable development" (United Nations 1992, Chapter 36).

As sustainable development is famously understood as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (UNITED NATIONS 1987 IV, Paragraph 1), ESD expands the understanding of higher education for sustainability beyond the environmental dimension and integrates social as well as economic considerations: "ESD empowers everyone to make informed decisions for environmental integrity, economic viability and a just society for present and for future generations while respecting cultural diversity" (UNESCO 2013).

With the UN Decade of Education for Sustainable Development (DESD) from 2005 to 2014, the international community aimed at the implementation and evaluation of ESD principles and strategies on different levels and in different contexts. While the final report notes that the DESD indeed contributed to the institutionalization of ESD and facilitation of pedagogical innovation, it nonetheless identifies several challenges for realizing the full potential of ESD, such as the alignment of education and sustainable development sectors as well as the establishment and distribution of best practices (see UNESCO 2014).

Since then, literature on sustainability in higher education has further investigated the necessary conditions as well as guiding principles of effective ESD and has discussed different innovations in pedagogical approaches within university teaching. In the remainder of this section, we will give a brief overview of this strand of literature and develop a broad conceptual framework for the evaluation of ESD efforts in the context of universities. This framework will later serve to contextualize ESD at Heidelberg University broadly and the Sustainable Strategy Development seminar more specifically.

We follow Sterling (2001), who defines sustainability education as "transformative learning response that subsumes education about sustainability (facts) and education for sustainability (values and capacities) into a 'reflective and participatory process'" (as cited in CHEN 2019: 81). Our research interest focuses on education for sustainability, and our analysis identifies both pedagogical approaches and the principles and competencies related to sustainable development. Additionally, we consider the institutionalization of ESD in curricula and its broader implications for the university.

Howlett, Ferreira, and Blomfield (2016: 306) argue that pedagogical innovation in sustainability education has progressed too slowly, emphasizing the urgent need for action. They call for "a rethinking and revision of current higher education curricula to foster the

interdisciplinary understanding of social, economic, and environmental factors" essential for effective sustainability teaching. Differentiating between the content (the information), process (how information is shared with learners), and reflection (how learners internalize information), the authors emphasize interdisciplinarity, critical thinking, and reflection as new foci of education.

As already mentioned, sustainability challenges are inherently complex, driven by the interconnectedness of ecological, economic, sociological, political, and ethical aspects of holistic transformative efforts. As Howlett, Ferreira, and Blowfield (2016) argue, this interconnectedness is not represented in the structure of universities. Rather, university structures are separated along disciplinary lines and into mostly independent departments and curricula. Furthermore, universities remain reserved when faced with a transformation of their "unidirectional, hierarchical and disciplinary approach" (HOWLETT et al. 2016: 310) due to deficits in communication between and across disciplines, institutional path dependencies and bureaucratic politics. Still, trans- and interdisciplinary approaches could not only improve genuine and transformative learning; they also teach students to comprehend and navigate different cultural worldviews and ways of thinking. In ESD theory, this is considered a necessary competence for creating more sustainable societies (CHEN 2019).

Critical thinking, understood as thinking "that analyses thought, that assesses thought, and that transforms thought for the better" (PAUL 2007), undoubtedly lies at the heart of the educational processes and goals of the university. However, many students do not feel like they are actually learning this key graduate competence, but rather generic competence as opposed to discipline-specific knowledge. Thus, Howlett, Ferreira, and Blomfield (2016) refer to Glaser (1942) when they emphasize that educators must actively create a link between sustainable development and the "persistent effort [required for critical thinking] to examine any belief or supposed form of knowledge in the light of the evidence that supports it and the further conclusions to which it tends" (GLASER 1942: 5).

Consequently, one key goal of ESD is to engage students in an active reflection of their own beliefs, values, and thinking processes. Therefore, ESD tries to lead to students opening up towards challenging and transforming their prior assumptions constantly. Adding a personal perspective and subjective involvement in and with the reflective phase of educational designs, ESD thus has the potential to activate and facilitate deep transformative learning. These reflexive practices "enable individuals to change their habits of expectation and, as a result, develop more accurate perceptions, avoid premature cognitive commitments and achieve greater flexibility and creativity" (HOWLETT at al. 2016: 313).

Mulder (2014) makes the case for strategic thinking capacities being a central requirement for sustainable development. In face of ever-changing challenges posed by a holistic approach to sustainable development – in contrast to discipline-specific tasks – students must learn how to "develop strategies to handle new problems" (MULDER 2014: 244). Asking how this pedagogical element of ESD should be institutionalized in universities, he calls for the integration of sustainable development and strategic thinking rather than following an add-on approach. Building upon prior knowledge within the own discipline

and treating strategic thinking as solid component across the curriculum, "contributes to the learning effect […] and to the 'sustainability' of [sustainable development] teaching" (ibid.). Thus, strategic thinking should become part of scholars' everyday thinking, not some kind of specialization. Various teaching tools and techniques come to mind when integrating strategic thinking into courses in higher education, such as backcasting (i.e., defining a desirable future prior to strategically identifying possible programs and policies; see HOLMBERG & ROBERT 2000), so-called "Socio-Technical Maps" (i.e., a comprehensive mapping of current developments, dynamics, and stakeholders in a specific industry or problem area, see ROHRACHER 2002), the discussion of real-life cases, or interactive games.

Analyzing the achievements of the DESD and the international developments that led to the emphasis of sustainable development in higher education, Leal Filho, Manolas, and Pace (2015) identify several gaps to be addressed by universities. Interestingly, they do not only name sufficient institutionalization and financing or innovative interdisciplinary teaching methods aiming to convey specific sustainable development-related competencies, i. e. understanding of complexity and interdependencies or critically questioning systems and policies. According to the authors, also campus sustainability itself needs to be improved: "Universities need to practice what they preach by reducing their use of and dependency on non-renewable resources" (LEAL FILHO et al. 2015: 125).

In summary, the integration of sustainability in higher education has developed significantly since the 1972 Stockholm Conference with ESD emerging as a key focus. ESD emphasizes not only environmental concerns but also social and economic dimensions, with an overarching goal of inspiring students to make informed decisions for a sustainable future. Key pedagogical approaches in ESD include interdisciplinarity, participatory learning, and real-world relevance. These approaches foster critical, reflective, and strategic thinking competencies, which are essential for addressing complex sustainability challenges. Furthermore, to be effective, ESD must be integrated into the curriculum rather than treated as an add-on. Additionally, universities should enhance campus sustainability to align their practices with their teachings.

After establishing a conceptual framework for ESD and highlighting key pedagogical approaches that foster critical, reflective, and strategic thinking, it is important to examine how these theoretical insights translate into practice within specific educational settings. In the following section, we will focus on the "Sustainable Strategy Development" seminar in which we participated during the winter term of 2023/24. This seminar serves as a specific example of how sustainability education is implemented at Heidelberg University. We will explore the seminar's structure, content, and outcomes, assessing how effectively it embodies the principles of ESD discussed above, and identifying areas where further integration or improvement might be necessary.

Sustainable Strategy Development – An Interdisciplinary Seminar at Heidelberg University

The seminar on sustainable strategy development, taught by molecular biologist Thomas Rausch and political scientist Max Jungmann, was part of the interdisciplinary lectures offered by the Marsilius Kolleg during the winter term 2023/24. Marsilius Kolleg aims to promote interdisciplinary research at Heidelberg University and strives to build bridges between different scientific cultures. Its broad scope includes yearly fellowships for professors (Marsilius Kolleg Fellowship) and early career scholars (Young Marsilius Fellows), designed specifically to facilitate interdisciplinary research projects. In addition, it organizes a variety of public events to foster science-society dialogue, and since 2018/19, the Kolleg lays a strong focus on science communication and knowledge transfer and hosts a science communication professorship each term. Further, it offers courses open to all students featuring lecturers from multiple academic disciplines. The seminar "Sustainable Strategy Development" that we participated in consisted of three full-day sessions and one two-hour introductory round and brought together participants from diverse academic and international backgrounds, ranging from molecular biotechnology to economics and political science.

The seminar focused on integrating sustainability into strategic decision-making across both public and private sectors. It was designed to equip participants with the knowledge and skills needed to address contemporary sustainability challenges and effectively incorporate them into organizational strategies. The goal of the seminar was to provide a comprehensive understanding of current environmental, social, and economic sustainability challenges. It also covered the fundamentals of strategy development and stakeholder engagement, emphasizing the importance of a holistic approach to sustainable development.

The seminar began with an exploration of the pressing need for transformative change in the face of global sustainability challenges. Participants were introduced to the concept of planetary boundaries and the importance of staying within these limits to ensure a sustainable future. Following sessions introduced various frameworks and concepts related to sustainability transformations, including regenerative economies and sustainable business model innovation, as well as effective ways of managing change within organizations to support sustainability transformations and the importance of engaging various stakeholders in sustainability strategies. Further, the seminar emphasized the need of setting SMART – specific, measurable, achievable, relevant, and time-bound – objectives in sustainability planning as well as introduced the participants to some practical aspects of strategy development, including problem definition, data collection and analysis, and effective ways of presenting recommendations. The final sessions covered the challenges of implementing sustainability strategies and managing change.

From a pedagogical perspective, the seminar heavily relied on active student participation and backing the theoretical explorations of the field with practical applications. During

the first block of theory-driven sessions, presentations by one or two students from different backgrounds (in terms of discipline, study level and international perspectives) introduced various tools and concepts of sustainable development and were followed by group discussion concerning real-world cases in business and politics. These theoretical sessions served as a foundation for the second part of the seminar: a knowledge- and discussion-based workshop aimed at developing a sustainability strategy for Heidelberg University. The workshop, which took place during the final day of our seminar, encouraged participants to apply and extant on the concepts discussed in the earlier session. Students were divided into groups and tasked with identifying relevant areas for sustainability development ranging from infrastructure, mobility, and energy efficiency, to both internal and external services within the academic and administrative sectors. Each group developed specific measures, discussed the current situation, and presented goals along with the expected impacts. The specific measures that resulted from the seminar will be discussed in more detail later.

Building on the theoretical framework of ESD, this seminar reflects a clear implementation of those principles. The focus on interdisciplinary collaboration and the practical application of sustainability strategies during the workshop demonstrates how the goals of ESD can be translated into educational practice. As outlined in the theory, ESD is aimed not only at raising awareness for sustainability issues but also at equipping students with critical thinking skills, decision-making capabilities, and problem-solving approaches that are central to addressing global sustainability challenges. Further, the seminar also incorporated insights from various disciplines – such as political science, environmental science, and economics – moving beyond the typical silo-thinking within the disciplines and thus enriching the learning experience. Additionally, in line with the key pedagogical approaches highlighted in ESD, this course emphasized participatory learning, where students were actively engaged and involved in creating a new sustainability strategy for Heidelberg University, which will be discussed in depth below. These active learning strategies and the fact that it was incorporated into a "real-world" application of creating said sustainability strategy allowed for direct application of theoretical concepts into practical scenarios.

The measures we discussed during the final workshop, which was part of the last day's session, addressed various aspects of campus operations and broader institutional policies. For instance, we discussed ways to reduce energy consumption by enhancing heating efficiency and transitioning to renewable energy sources, such as solar panels across campus, to lower the university's carbon footprint and optimize energy usage. Further, we emphasized the importance of green building practices and efficient technological management. Some suggestions included upgrading street lighting to more energy efficient systems. Participants also proposed several measures for improving the overall waste management, including the implementation of a waste separation system across campus, and minimizing the use of paper and plastic, particularly in laboratories. In addition, to promote sustainable eating habits, proposals included encouraging vegan food consumption and improving overall food quality. Some of the suggestions also recommended tracking emissions from waste and promoting initiatives like "Too Good to Go" in the Mensa to minimize food waste. In

terms of transportation, suggestions included offering free public transport between campuses, enhancing bicycle lanes, and promoting car-sharing and bike-sharing initiatives for students and employees of the University. In addition, some suggestions included creating incentives for less carbon-intensive travel options for researchers and setting flight budgets. The results of the workshop also underscored the need for ongoing sustainability research and suggested establishing awards for outstanding research in this field. Additional proposals included creating a permanent sustainability lab and providing more opportunities for students to engage in transdisciplinary studies as well as creating an overall initiative for cross-disciplinary sustainability projects in order to integrate sustainability into the general university governance structure.

The broad scope of some of the measures we discussed during the final workshop presented above, demonstrates some of the possibilities of realizing a truly holistic approach to sustainability at Heidelberg University. Beyond that, it highlights the benefits of incorporating practical sessions where students are directly encouraged to discuss real-life scenarios. This aligns with the theory behind ESD, as elaborated upon above.

Sustainability at Heidelberg University

As mentioned earlier, effective ESD does not only build up on innovative pedagogical approaches aimed at specific competencies. Rather, it relies on an in-depth institutionalization of these approaches across teaching, research, and administration. According to our framework, this relates to both the integration of sustainable development related courses in curricula and campus sustainability. Against this background, this section will shed light on current sustainability efforts at Heidelberg University and evaluate them critically.

On its website related to sustainability in teaching, the university states that it offers courses focused on environment, climate, and sustainability each semester and at all levels of study. It also mentions an excursion to the United Nations Climate Change Conference (UNFCCC), taking place on a yearly basis. It is aimed at advanced undergraduate und postgraduate students of all faculties and can be credited for several disciplines in a module for comprehensive competencies (Heidelberg University 2024d). However, these excursions did not take place in the past few years.

Additionally, the website lists the courses and seminars on sustainability in the summer semester 2024 categorized by different fields of study. Of the forty-seven courses, seven are aimed at students qualifying to become teachers (“Lehramt”), four at humanities and theology, thirteen at law, economics, and social sciences, twenty-two at mathematics, engineering, and natural sciences, and one at medical students. For students qualifying to become teachers, the Heidelberg School of Education (HSE) has introduced a program for additional and cross-cutting qualifications (“Zusatz- und Querschnittsqualifikation”, ZQQ), containing of 15 ECTS points that can be added flexibly to students’ curricula (Heidelberg School of Education 2024).

Beyond these discipline-specific courses and seminars, different centers at Heidelberg University offer events and workshops for students and staff members alike. We already mentioned the Marsilius Kolleg, which was established to bridge the disciplinary divide between natural sciences on the one hand, and humanities as well as social sciences on the other in both teaching and research. Students that have actively participated in two of the so-called "bridge seminars" ("Brückenseminare") as well as another lecture or seminar for non-specialist audience, receive the Marsilius Certificate confirming their additional interdisciplinary qualification. Aimed at lecturers and academic advisers, the heiSKILLS Competence and Language Centre at Heidelberg University offers courses and workshops on new methods and concepts in teaching. Their goal is to enable teaching staff to develop their own ESD lectures and seminars. In addition, heiSKILLS is also developing a course program on transformative skills for a sustainable future especially designed for students.

According to Heidelberg University's website, it is the first university in the state of Baden-Württemberg to centralize its sustainability ambitions in research, teaching, and communication at a dedicated center – the Heidelberg Center for the Environment (HCE) (Heidelberg University 2024c). HCE was established in 2011 in the context of the university's excellence strategy. In addition to supporting and financing interdisciplinary bottom-up research initiatives, the HCE also hosts the Sustainability Think Tank (STT), which was created in November 2023 (Merz 2024). Within the SST, several working groups consisting of staff members in research, teaching, and administration as well as students participate in the bottom-up development of the university's first sustainability strategy. The seminar on Sustainable Strategy Development was designed to contribute to this already ongoing process. We were able to present the ideas and measures that were developed in the workshop of the seminar at the second STT plenary assembly that took place in April 2024. The assembly brought together members of the different working groups as well as representatives of the university's rectorate.

Even though a comprehensive sustainability strategy is still in the making, Heidelberg University has already developed an integrated concept for climate protection, which the directorate approved in September 2023. Based on greenhouse gas balance, it identifies the biggest emitters over all areas of operations and defines a catalogue of measures for effective emission reduction. These include for example awareness campaigns and competitions, replacing energy-inefficient equipment and devices, energetic restorations, and the expansion of bicycle infrastructure (Heidelberg University 2024b).

This brings us back to the initial question posed in this section: How does ESD at Heidelberg University perform against our evaluation criteria? As described earlier, the university places a high importance on sustainability in both teaching and campus sustainability. Although there is an extensive list of lectures and courses addressing ecological, social, and economic sustainability, those that effectively integrate these subjects into the curriculum often remain within specific departments and are limited in their interdisciplinarity. In contrast, courses and seminars specifically designed to create synergies tend to be treated as

supplementary options. Furthermore, participation in such courses is not mandatory, relying instead on individual student interests. This approach inevitably leads to a bias in the audience, as many courses tend to "preach to the converted".

A similarly ambiguous picture arises when looking at the sustainability efforts on campus. Even though Heidelberg University is already working on climate protection and sustainability measures and is actively engaging students in participating in related processes and institutions such as the STT, many students do not feel satisfied with the university's sustainability measures and ambitions. In a study conducted by the Student Council's ("StuRa") Department for Ecology and Sustainability in April 2024, 80 % of more than 700 students that participated would welcome climate protection measures that constrain their everyday life, while only 9 % of the participants think that Heidelberg University is already doing enough (HEIDELBERG UNIVERSITY 2024a).

Conclusion

In this article, we addressed how universities can effectively teach sustainability. After identifying key pedagogical approaches (interdisciplinarity, participatory learning, real-world application), relevant competencies (critical, reflective and strategic thinking) and institutional requirements (curriculum integration and campus sustainability), we assessed the seminar Sustainable Strategy Development against the backdrop of these criteria. Further, we critically evaluated the current sustainability efforts in research, teaching, and administration at Heidelberg University.

Overall, we conclude that, with a long list of sustainability-related courses, the creation of institutions like the Marsilius Kolleg and the HCE, and with the ongoing bottom-up development of a comprehensive sustainability strategy, Heidelberg University is on the right track when it comes to the ESD. However, there is still room for improvement in fulfilling its ESD obligations and ambitions. As we have shown, effective ESD must extend beyond offering sustainability-related courses. It should create a learning environment that is inherently sustainable while also providing opportunities for students to actively participate in shaping this environment. This is why we believe the seminar Sustainable Strategy Development should serve as a good practice example for future classes. It employed innovative teaching methods to foster essential competencies, while directly connecting them to real-world applications within our own learning environment. This approach not only strengthened the link between theory and practice but also redefined the role of the university in shaping sustainability education.

Looking ahead, the initiatives currently underway at Heidelberg University lay a strong foundation for ongoing progress in its sustainability efforts. By actively involving students in the co-creation of sustainable learning environments, the university can amplify its impact in actively shaping a generation ready to tackle global sustainability challenges. Together, these initiatives can improve sustainability education in ways that will benefit our university community and society at large.

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