

# A University's Journey Toward Education for Sustainable Development Across All Disciplines

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### Why Teaching Sustainability in Universities?

THE CONCEPT OF SUSTAINABILITY CAN BE TRACED BACK TO ARISTOTLE AND medieval forest regulations before being more precisely defined in the 18th century by Carl von Carlowitz in the context of sustainable forestry. While the principle was applied almost exclusively in forestry and fisheries for nearly 200 years, it gained global political significance from the mid-20th century onwards due to environmental issues, the Club of Rome's report "The Limits to Growth" (1972), and the Brundtland Report (1987). From a scientific perspective, the urgent necessity for sustainable approaches becomes evident upon examination of the state of our planet. Recent research vividly underscores pressing ecological challenges<sup>2</sup> alongside substantial social inequalities that must be addressed to enable both current and future generations to live dignified lives while preserving nature as the foundation of all life<sup>3</sup>.

Over the past decades, sustainability science has emerged as a transdisciplinary field dedicated to tackling these challenges. It encompasses *science about sustainability*, aiming to understand the functioning of complex physical, biological, and social systems, as well as *science for sustainability*, which seeks to inform sustainable policies and foster positive societal transformations<sup>4</sup>.

This dual approach is indispensable for universities. Institutions of higher education serve as critical spaces for generating knowledge about sustainability while simultaneously equipping students with the expertise and ethical grounding necessary to drive sustainable change in society. Without this foundational commitment to sustainability, universities risk neglecting

144

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2 Richardson, K., Steffen, W., Lucht, W., Bendtsen, J., Cornell, S. E., Donges, J. F.,... & Rockström, J. (2023). Earth beyond six of nine planetary boundaries. *Science Advances*, 9(37), <https://doi.org/10.1126/sciadv.adh2458>

3 <https://ourworldindata.org/economic-inequality> (last accessed on 2025/02/07)

4 Kates, R. W. (2011). What kind of a science is sustainability science? *Proceedings of the National Academy of Sciences*, 108(49), 19449-19450. <https://doi.org/10.1073/pnas.1116097108>

their responsibility to future generations and the pressing imperatives of the present.

Universities are required to integrate education for sustainable development (ESD) into their curricula not only for factual reasons but also based on international and supranational obligations. At the UN level, the Agenda 2030, particularly Sustainable Development Goal (SDG) 4.7, explicitly calls for integrating ESD, identifying universities as key actors in achieving all 17 SDGs. This is further supported by UNESCO's 'ESD for 2030' (2020–2030) framework, which defines higher education as a priority field of action. At the European level, the European Green Deal emphasises the role of universities as drivers of innovation for ESD. At the same time, the EU Sustainability Competence Framework (GreenComp) of 2022 serves as a guiding tool for university teaching. Additionally, the Bologna Process incorporates sustainability as a core topic of higher education, as stated in the Rome Ministerial Communiqué (2020).

When a university embraces ESD, it complies with political mandates and strengthens its strategic role. Integrating ESD into university teaching significantly contributes to the institution's social responsibility. By equipping students with sustainability skills, universities empower graduates to actively shape sustainable decisions in business, government, and society. In doing so, universities respond to the growing professional relevance of sustainability skills, which are increasingly demanded in today's job market. Furthermore, ESD supports students' personal and professional development by imparting specialised knowledge and enhancing their practical ability to take action. ESD also offers interdisciplinary value by fostering dialogue between different academic fields and promoting a participatory culture within and beyond the university. Anchoring sustainability in its educational mission enhances a university's attractiveness to prospective students and cooperation partners, positioning it as a forward-thinking and socially responsible institution.

This article examines how Julius-Maximilians-Universität Würzburg (JMU), Germany, addresses these requirements and expectations, striving to integrate ESD into all its degree programs as a cross-cutting teaching focus. JMU is one of the oldest universities in the German-speaking world, offering a comprehensive range of subjects characteristic of a classical university, including some engineering programs. It offers 280 degree programs and serves approximately 25,000 students and 4,600 employees, including around 480 professors<sup>5</sup>.

### **How can a university integrate Education for Sustainable Development into its curricula?**

The term ESD, as initially defined by UNESCO in 2015, is used in various meanings and dimensions depending on the level of education in question and the national peculiarities of the concept of education. JMU adopts an understanding of ESD that aligns with the definition provided by UNESCO and is compatible with the educational mission of German universities: *“Education for Sustainable Development opens eyes to the interconnections*

5 <https://www.uni-wuerzburg.de/en/>

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and interdependencies of our world, sharpens awareness of the challenges of our time, and imparts the competencies needed to address them as effectively as possible”<sup>6</sup>. Accordingly, acquiring knowledge is combined with critical and systemic thinking and integrated into the ability to take concrete action. As a key requirement for university-level ESD, JMU emphasises that ESD must be science-based and foster critical reflection on the content and methods of ESD. This form of university-based ESD is called Higher Education for Sustainable Development (HESD).

However, the question of *how* HESD should be implemented remains unresolved. A straightforward approach would be establishing one or more study programs specifically dedicated to sustainability. This is a path that some universities have taken, and in recent years, JMU has also launched two sustainability-focused degree programs: “*Computer Science and Sustainability*” (B. Sc.) and “*Social Science Sustainability Research*” (M. Sc.). Yet, considering the breadth and depth of the challenges facing humanity and the diversity of questions that often require unconventional solutions, JMU has decided to position EDS as a cross-cutting theme embedded in all programs of study rather than treating it as a standalone subject. In doing so, the university acknowledges the contributions that all disciplines can make to tackling sustainability challenges. It follows international recommendations to integrate ESD across all subjects rather than as a separate school discipline<sup>7</sup>.

### **What fundamental principles should Education for Sustainable Development follow at a university?**

Scientific rigour and critical reflection, as fundamental requirements of a university-level HBNE programme, necessitate establishing a shared understanding of its content’s foundational principles. The HBNE initiative at JMU, which was developed by the ‘Studium und Lehre’ (Study and Teaching) division at the living lab *Nachhaltigkeitslabor WueLAB*<sup>8</sup>, adheres to the following core principles:”:

#### **1. Principle of Sustainability**

JMU is committed to sustainable development’s guiding principle, which is considered ecologically sound, socially balanced, and economically efficient. In this context, planetary boundaries, coupled with a focus on ensuring a dignified life for all and conserving nature as the basis of all life, provide the external framework for sustainable development.

#### **2. UN Sustainable Development Goals (SDGs)**

The 17 Sustainable Development Goals<sup>9</sup>, focusing on their specific targets and indicators, serve as a framework and thematic basis for HBNE. Beyond the substantive content, the political processes that shaped the

6 <https://www.unesco.de/bildung/bildung-fuer-nachhaltige-entwicklung> (last accessed on 2025/02/07)

7 <https://mgiep.unesco.org/article/unesco-mgiep-s-approach-to-embedding> (last accessed on 2025/02/07)

8 <https://www.uni-wuerzburg.de/wuelab/lehre/> (last accessed on 2025/02/07)

9 <https://ourworldindata.org/sdgs> (last accessed on 2025/02/07)

SDGs and the contradictions and limitations inherent in the SDG framework may also be critically examined.

### 3. Concepts of Planetary Boundaries

The concepts of planetary boundaries originating from Earth system science<sup>10</sup>, just and safe Earth system boundaries<sup>11</sup> and global commons<sup>12</sup> provide a scientifically based reference framework for evaluating the current state of the Earth system, particularly in relation to human actions. These frameworks also facilitate the identification of options for action that incorporate planetary sustainability and the principle of justice.

### 4. Strengthening Competencies for Sustainable Development

University ESD incorporates the emphasis on fostering competencies from general ESD frameworks into the competency-oriented goals of the Bologna Process and EU higher education policy<sup>13</sup>. Alongside promoting knowledge and methodological competencies, the programme emphasises the self-awareness and social dimensions required for effective action in sustainability contexts.

By adhering to these principles, the HBNE programme at JMU ensures consistency with established scientific frameworks and educational policies, fostering robust, reflective, and competency-driven education for sustainable development.

## How can Education for Sustainable Development be effectively integrated as a cross-cutting task into all academic subjects?

Incorporating new content into university degree programmes to address contemporary societal challenges is not a novel concept per se. Yet, the systemic integration of knowledge, critical thinking, and skills as a cross-cutting theme into all disciplines remains relatively exceptional. At JMU, this integration has been facilitated by a fortunate interplay between favourable political conditions and an initiative emerging from within the institution.

148

### 1. Legal and Political Framework

The Bavarian Higher Education Innovation Act (*Bayerisches Hochschulinnovationsgesetz*) mandates universities advance ESD. Furthermore, a framework agreement between Bavarian higher education institutions and the Bavarian Ministry of Science commits

- 10 Richardson, K., Steffen, W., Lucht, W., Bendtsen, J., Cornell, S. E., Donges, J. F.,... & Rockström, J. (2023). Earth beyond six of nine planetary boundaries. *Science advances*, 9(37), <https://doi.org/10.1126/sciadv.adh2458>; Rockström, J., & Gaffney, O. (2021). *Breaking boundaries: The science of our planet*. Dorling Kindersley Ltd.
- 11 Rockström, J., Gupta, J., Qin, D. et al. Safe and just Earth system boundaries. *Nature* 619, 102–111 (2023). <https://doi.org/10.1038/s41586-023-06083-8>
- 12 Rockström, J., Kotzé, L., Milutinović, S., Biermann, F., Brovkin, V., Donges, J.,... & Steffen, W. (2024). The planetary commons: A new paradigm for safeguarding Earth-regulating systems in the Anthropocene. *Proceedings of the National Academy of Sciences*, 121(5), e2301531121. <https://doi.org/10.1073/pnas.2301531121>
- 13 Davies, H. (2017). Competence-based curricula in the context of Bologna and EU higher education policy. *Pharmacy*, 5(2), 17. <https://doi.org/10.3390/pharmacy5020017>

institutions to raise awareness of sustainability issues, impart knowledge about societal challenges, and equip students with the skills to address these challenges. In alignment with this commitment, JMU has further set an explicit goal in its contract with the Ministry of Science to embed ESD into its teaching and degree programmes.

## **2. University-driven Initiatives**

Over the past decade, various JMU institutions have independently pursued activities related to environmental education and ESD. Building on these foundations, a university-wide initiative was launched in 2022 to connect all ESD stakeholders and interested parties. This initiative aimed to foster the exchange of goals and practical experiences regarding ESD and to identify strategies for establishing ESD as a systemic and cross-disciplinary teaching focus across all degree programmes.

This initiative has brought together professors, other teaching staff, students, and administrative personnel, reflecting broad representation from all university groups. Key measures include:

- **Biannual Networking Meetings:** These meetings support exchanging best practices, sharing teaching experiences, and developing implementation approaches.
- **Virtual Exchange Platform:** This platform has over 200 members who collaborate and share knowledge on HESD.
- **Student Parliament Resolution:** The student parliament's resolution was a significant milestone. It advocated for the mandatory inclusion of ESD in all curricula and further strengthened the movement's momentum.

The integration of HESD at JMU has been particularly effective due to the convergence of political objectives with grassroots initiatives within the university. This dynamic has been critical, given the specific organisational structure of German universities, which, although state-funded, operate with a significant degree of autonomy. Notably, this autonomy extends to the university and its faculties, which retain considerable independence in curriculum design. Thus, the role of university governance is essentially to articulate broad goals, leaving the specifics of implementation to individual subdivisions.

A turning point in JMU's progress was the unification of these internal and external drivers, achieved under the leadership of the vice president responsible for sustainability. A comprehensive sustainability strategy for the university was developed through an inclusive, participatory process, introducing a dedicated field of action focused on "study and teaching." The strategy incorporated many of the objectives put forth by ESD advocates and students, translating them into concrete milestones with designated responsibilities. University management formally adopted this sustainability strategy in 2024 which is now in the implementation phase.

JMU's approach to integrating ESD as a cross-cutting issue demonstrates the necessity of aligning institutional initiatives with broader political mandates while fostering bottom-up engagement from stakeholders across the university. By leveraging external legal frameworks and internal advocacy, JMU has established a model highlighting the importance of participatory governance, interdisciplinary collaboration, and sustained support for systemic change.

### **What steps are being taken towards systemic implementation?**

The systemic integration of the fundamental principles of HBNE (Higher Education for Sustainable Development) at JMU is being advanced through a comprehensive and multi-faceted approach targeting various institutional levels.

To begin with, the university's overarching 'Teaching Mission Statement' and the corresponding faculty-specific "Teaching Mission Statements" are being revised to embed the principles of HBNE as foundational guidelines for teaching and learning. The primary aim here is to ensure that the goal of sustainability becomes an integral feature of the institutional framework. Aligned with this, qualification objectives and competencies shaped by the Bologna Process and linked to HBNE are being systematically incorporated into the module descriptions of every academic programme. This approach seeks to secure the structural integration of sustainability into curricula while establishing formal obligations tied to programme (re-)accreditation processes.

Moreover, special emphasis is placed on integrating sustainability themes across existing courses in all disciplines. This aims to highlight the connections between sustainability and the respective subjects, allowing students to recognise and appreciate how their field of study contributes to addressing sustainability challenges. This integration will be pursued wherever feasible and contextually meaningful within the existing curricular framework.

JMU will introduce a supplementary study programme entitled "Core Competences in Sustainability" to further enhance sustainability-related competencies. This programme involves several micro-credentials that students are strongly encouraged to pursue. A central component of this initiative is a self-directed learning course titled 'Interdisciplinary Sustainability Sciences,' which is currently under development and is anticipated to launch in the winter semester of 2025/2026. This course will be offered to all students as a virtual resource in German and English to ensure accessibility for international participants. The course curriculum comprises twelve chapters covering various topics, including poverty, climate change, biodiversity, resource management, ethical and psychological foundations, economics, law and local climate impacts. These topics will be examined from interdisciplinary perspectives by JMU faculty from various fields, such as theology, computer science, biology, chemistry, mathematics, physics, economics, literature, medicine, and law. The chapter structure integrates theoretical insights with practical applications, catering to both global and local dimensions of sustainability.

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The overarching purpose of this course is to foster an interdisciplinary understanding of sustainability as a unifying theme relevant to all fields of study and aspects of life. It focuses on providing all JMU students with the knowledge and skills necessary to incorporate sustainable thinking and action throughout their university education and professional careers. Another part of the additional study programme involves a unit tailored to discipline-specific perspectives on sustainability issues developed and delivered by individual faculties.

In parallel with these student-directed initiatives, a dedicated faculty training programme titled 'Higher Education for Sustainable Development' has been initiated to support instructors aiming to provide HESD with a robust intellectual and methodological foundation. This training programme lets participants acquire practical and theoretical expertise via online and in-person sessions. The Centre for Scientific Education and Teaching and the Sustainability Laboratory at JMU support the programme. It features a core module on university teaching methods and pedagogy alongside elective courses on topics such as problem-based learning, democracy education, and active teaching strategies. Additionally, a sustainability-specific scientific module offers elective courses on themes such as climate protection, biodiversity conservation, sustainable economics, ethics, psychology, and planetary health sciences.

This comprehensive package of measures for implementing and embedding HBNE at JMU has been developed through extensive consultations with deans of studies from all faculties, university committees, administrative representatives, and students. The outlined measures will be enforced through target agreements negotiated between university and faculty leadership to ensure timely and consistent application.

This strategic and collaborative approach lays the foundation for the long-term incorporation of sustainability into JMU's institutional culture, fostering a systemic transformation that aligns with global educational standards and sustainability priorities.

### **Which challenges arise in implementing Education for Sustainable Development across all disciplines?**

152

The goal of JMU to establish HESD as a cross-cutting task within the teaching of all study programs is comprehensive and ambitious<sup>14</sup>. Due to a university's loosely coupled organisational structure and the largely autonomous decision-making powers of its faculties and professors, the authority of central governance in imposing such measures faces significant limitations. Academic staff must be helped to recognise the relevance and necessity of integrating HESD into their teaching and voluntarily adapt their practices. Furthermore, the governing bodies, which are comprised of representatives from various university groups, should be enabled to recognise that implementing the HESD concept strengthens individual

14 In 2025, the German UNESCO Commission and the Federal Ministry of Education and Research awarded JMU, as the first comprehensive university in Germany, the 'National Award - Education for Sustainable Development' in recognition of this far-reaching concept.

disciplines, faculties, and the university as a whole while enhancing its attractiveness to students, researchers, and potential collaborators.

Handling potential concerns and objections is essential for effectively implementing the concept. A fundamental objection could arise from the perception that mandating sustainability in teaching might infringe on academic freedom, particularly the freedom of teaching. This issue demands the utmost care in Germany, where two dictatorships suppressed academic freedom in the 20th century. The constitution of the Federal Republic of Germany explicitly states in Article 5: “Arts and sciences, research and teaching shall be free”<sup>15</sup>.

Concerns about a potential restriction of academic freedom can be addressed by clarifying that a fundamental overhaul of curricula is neither intended nor necessary. Instead, instructors and departments are only asked to make targeted updates to their educational offerings in alignment with current research and scholarship in sustainability-related areas. Such an approach also aligns with students’ expectations, labour market requirements, societal needs, and legal regulations. In this sense, academic staff follow a long-standing tradition exemplified by their predecessors throughout JMU’s history, which dates back to 1402. The autonomy of university teaching and the constitutional guarantee of academic freedom remain intact, as teaching staff retain the authority to determine which academic topics related to sustainability to address in their teaching and the formats and methods they choose to employ.

Critical objections to sustainability and ESD must be considered carefully and thoroughly at the teaching content level. A commonly voiced criticism is that sustainability lacks scientific rigour and represents merely a transient trend reflective of contemporary societal moods, akin to other fleeting phenomena that will eventually fade. Another concern relates to the political dimension: sceptics perceive discussions around sustainability as ideologically motivated, driven by the political agendas of green or leftist movements seeking to infiltrate the educational sector. Lastly, “sustainability” is often criticised for its conceptual vagueness. It is considered overly broad, imprecise, and subject to inflationary use, making it unsuitable as a solid foundation for an educational framework.

153

These concerns can be counteracted by ensuring that teaching related to sustainability is founded on clearly defined and transparently communicated principles (as outlined earlier) and grounding it wherever possible in scientific evidence. Additionally, it is crucial to encourage discussions about the premises and limitations of scientific knowledge. By anchoring ESD within a scientifically based and critically reflective approach, it becomes clear to faculty and students that sustainability encompasses highly relevant and complex questions across all knowledge areas— the humanities, natural sciences, social sciences, medicine and others. Addressing these challenges frequently requires innovative approaches and interdisciplinary perspectives that transcend traditional academic boundaries and offer an attractive field for scientific enquiry.

15 [https://www.gesetze-im-internet.de/englisch\\_gg/englisch\\_gg.html#p0035](https://www.gesetze-im-internet.de/englisch_gg/englisch_gg.html#p0035)

The inclusion of sustainability topics in higher education is increasingly perceived by teaching staff not merely as a potential threat to their academic freedom or an additional workload but as a stimulating enrichment of their teaching practices. Central to this perception is the inherently interdisciplinary nature of sustainability studies, which transcends traditional disciplinary silos and offers novel perspectives. As such, HESD has the potential to act as a catalyst for fostering interdisciplinary thinking and research, generating benefits that extend far beyond the topic of sustainability itself. Interdisciplinarity, however, should not be misunderstood as a simple and comfortable path to scientific conclusions. It can only bear fruit worthy of university standards when solidly founded on strong disciplinary research and extensive scientific expertise.

From a professional standpoint, many teaching staff also find it intellectually rewarding that HESD encourages moving beyond the conventional focus on the knowledge base of a discipline within academic teaching. Instead, it involves engaging students in discussions of practical applications and implications. In conversations with teaching staff, a conceptual framework developed by the Swiss Academy of Sciences proves helpful, as it categorises the potential contributions of science into three types of knowledge: “Science needs to submit three types of knowledge to public debate: Systems knowledge about structures, processes, variabilities, etc.; target knowledge about the targets of future development and scenarios; transformation knowledge about the transition from the current to a future target situation”<sup>16</sup>.

Another helpful approach involves complementing the traditional “teaching about sustainability” strategy with a “teaching for sustainability” approach, in which the transmission of knowledge is enriched by critical reflection and ethical considerations, ultimately fostering actionable competencies<sup>17</sup>. Many teaching staff consider this HESD-driven development a much-needed impetus to strengthen competency-oriented learning. By incorporating sustainability aspects, it becomes possible to make higher education more contemporary and forward-looking, enhancing both the quality of teaching and the employability of graduates.

Implementing ESD in universities represents a long-overdue yet necessary undertaking that presents substantial challenges for all stakeholders. To achieve successful implementation, governance, administration, and internal university initiatives must collaborate effectively to translate HESD-related objectives into binding and coherent formal regulations. A crucial aspect of this process is focusing on clearly articulated foundational principles, thereby minimising the risks of arbitrariness and contentious ambiguities. The communication of the HESD concept should employ precise, academically oriented language, avoiding trendy or fleeting terminology to prevent unnecessary misunderstandings or resistance within the academic community.

154

16 [https://scnat.ch/en/uuid/i/6fc6028b-5a36-53a3-b259-48cfca10753-Visions\\_of\\_Swiss\\_scientists](https://scnat.ch/en/uuid/i/6fc6028b-5a36-53a3-b259-48cfca10753-Visions_of_Swiss_scientists) (last accessed on 2025/02/07)

17 Sterling, S. (Ed.). (2010). *Sustainability education: Perspectives and practice across higher education*. Taylor & Francis

One significant challenge in implementing HBNE at a traditional university with a wide range of disciplines lies in the diversity and disparity of disciplinary cultures and approaches. Addressing this challenge requires an openness to and respect for each discipline's perspectives on sustainability. Crucially, this diversity should not be viewed as a disadvantage but rather as a strength that enriches the implementation process. By grounding efforts in shared core principles of HBNE, this variety can be reframed as an opportunity to foster interdisciplinary dialogue among faculties and disciplines.

Above all, HESD must not be perceived as a concealed mechanism ("Trojan horse") for introducing fundamental structural or hierarchical changes within universities, as this perception risks undermining its core message and creating unnecessary opposition. Despite these precautions, it is evident that the participatory processes inherent to HESD and its interdisciplinary framework will foster an organic developmental trajectory. This process will positively influence universities' values, practices, and institutional culture in the long term. —