

Digital Sustainability Education – Potential, Development Trends and Good Practices

Synthesis of the online workshop

“Digital Sustainability Education: Innovative Teaching Practices and Didactics in Times of Crisis”

Co-hosted by the Center for international Development and Environmental Research (ZEU) at Justus Liebig University Giessen and the Working Group Environmental Politics and Global Change of the German Political Science Association (DVPW) (25 – 26 March 2021)

Editors: Sandra Schwindenhammer, Katrin Strobehn, Helmut Breitmeier, Thomas Hickmann, Markus Lederer, Jens Marquardt and Sabine Weiland

With contributions from: Katrin Beer, Katja Biedenkopf, Martin Gerner, Nora Große, Tobias Gumbert, Jonas Hein, Natalie Kiesler, Lisa Pettibone and Ramona Teuber



Working Paper 03-2021

July 2021

Abstract

Digital sustainability education (DSE) is becoming increasingly relevant in higher Education for Sustainable Development (ESD) and spreads globally. DSE is fueled by the Covid-19-pandemic and urges lecturers, students and universities alike to break new ground in academic teaching. DSE impacts established approaches to ESD and raises questions of appropriate online teaching concepts, tools and enabling institutional, legal and political conditions. While lecturers are facing the challenge to conceptualize and implement innovative DSE concepts, students have to deal with new learning dynamics, requirements and obstacles. More and more universities are committed to or called upon to build enabling infrastructures for the spread and institutionalization of DSE. This working paper discusses core objectives and contextual conditions of DSE and sheds light on political, conceptual and didactical issues. It presents the outcomes of the online workshop “Digital Sustainability Education: Innovative Teaching Practices and Didactics in Times of Crisis” co-hosted by the Center for international Development and Environmental Research (ZEU) at Justus Liebig University Giessen and the Working Group Environmental Politics and Global Change of the German Political Science Association (25 – 26 March 2021). The paper maps eight good practice DSE teaching examples developed by lecturers from universities from different countries, introduces a toolbox and provides insights into individual and collective lessons learned. In doing so, the working paper contributes to current conceptual and political discussions on DSE and seeks to provide practical orientation for everyone engaged in the dynamic DSE field and university teaching in general.

Keywords: Digital Sustainability Education; Education for Sustainable Development; internationalization; online teaching concepts; online teaching tools

Table of Contents

ABSTRACT	ii
ACRONYMS AND ABBREVIATIONS	v
1. INTRODUCTION <i>(BREITMEIER, H.; HICKMANN, T.; LEDERER, M.; MARQUARDT, J.; SCHWINDENHAMMER, S.; STROBEHN, K.; WEILAND, S.)</i>	1
2. CONTEXTUAL CONDITIONS, DIDACTICAL CHALLENGES AND FORMS OF DIGITAL SUSTAINABILITY EDUCATION <i>(BREITMEIER, H.; HICKMANN, T.; LEDERER, M.; MARQUARDT, J.; SCHWINDENHAMMER, S.; STROBEHN, K.; WEILAND, S.)</i>	3
3. LESSONS LEARNED – MAIN RESULTS OF THE ONLINE WORKSHOP <i>(BREITMEIER, H.; HICKMANN, T.; LEDERER, M.; MARQUARDT, J.; SCHWINDENHAMMER, S.; STROBEHN, K.; WEILAND, S.)</i>	6
4. EIGHT GOOD PRACTICE EXAMPLES OF DIGITAL SUSTAINABILITY EDUCATION <i>(BREITMEIER, H.; HICKMANN, T.; LEDERER, M.; MARQUARDT, J.; SCHWINDENHAMMER, S.; STROBEHN, K.; WEILAND, S.)</i>	8
4.1 ONLINE SEMINARS AND LECTURE SERIES WITH (A)SYNCHRONOUS TEACHING ELEMENTS	9
4.1.1 “RESEARCH-ORIENTED ONLINE SEMINAR WITH CASE STUDY - POLITICAL PROCESSES IN BIOECONOMY POLICY” <i>(BEER, K.)</i>	9
4.1.2 “THE POLITICS OF SUSTAINABLE CONSUMPTION” <i>(GUMBERT, T.)</i>	11
4.1.3 “EUROPE’S CLIMATE AND ENERGY POLICY: INTERNAL AND EXTERNAL DIMENSIONS” <i>(BIEDENKOPF, K.)</i>	14
4.1.4 “TRANSFORMING OUR WORLD – THE CLIMATE CRISIS IN TIMES OF MULTIPLE CRISES” <i>(GROBE, N.)</i>	16
4.1.5 “WASTE PREVENTION: STRUCTURAL CHALLENGES AND LOCAL SOLUTIONS” <i>(PETTIBONE, L.)</i>	18
4.2 PLANNING AND SIMULATION GAMES	19
4.2.1 “CONSERVATION CONFLICTS IN COASTAL AREAS – A PLANNING GAME” <i>(HEIN, J.)</i>	19
4.2.2 “BIOSIMIN – EXPLORANDO LA BIODIVERSIDAD POR MEDIO DE SIMULACIÓN” <i>(GERNER, M.)</i>	22
4.3 ONLINE DEGREE PROGRAMS	25
4.3.1 “M.Sc. SUSTAINABLE TRANSITION” <i>(KIESLER, N.; TEUBER, R.)</i>	25
4.4 TOOLBOX AND METHODS <i>(BREITMEIER, H.; HICKMANN, T.; LEDERER, M.; MARQUARDT, J.; SCHWINDENHAMMER, S.; STROBEHN, K.; WEILAND, S.)</i>	28

CONFERENCE AND MEETING TOOLS	29
E-LEARNING PLATFORMS	30
COLLABORATION TOOLS, WHITEBOARDS AND MIND MAPPING TOOLS	30
SURVEY TOOLS	31
SCREENCASTING AND VIDEO SOFTWARES/ PLATFORMS	31
IDEAS FOR ASYNCHRONOUS DIGITAL TEACHING	32
IDEAS FOR SYNCHRONOUS DIGITAL TEACHING	32
5. CONCLUSION	
<i>(BREITMEIER, H.; HICKMANN, T.; LEDERER, M.; MARQUARDT, J.; SCHWINDENHAMMER, S.; STROBEHN, K.; WEILAND, S.)</i>	32
REFERENCES	34
ABOUT THE EDITORS	37

Acronyms and Abbreviations

CP	Credit Points
DSE	Digital Sustainability Education
DVPW	German Political Science Association
ECTS	European Credit Transfer and Accumulation System
ESD	Education for Sustainable Development
LMS	Learning Management Systems
SDG(s)	Sustainable Development Goal(s)
TOEFL	Test of English as a Foreign Language
UNCED	United Nations Conference on Environment and Development
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNGA	United Nations General Assembly
ZEU	Center for international Development and Environmental Research

1. Introduction

(Breitmeier, H.; Hickmann, T.; Lederer, M.; Marquardt, J.; Schwindenhammer, S.; Strobehn, K.; Weiland, S.)

“Universities in particular have a responsibility to create space for alternative thinking. They have a profound role to play in developing students’ dynamic qualities or so-called competencies. They will need these qualities to cope with uncertainty, poorly defined situations, and conflicting or at least diverging norms, values, interests and reality constructions” (Wals & Corcoran 2006: 103).

The importance of Digital Sustainability Education (DSE) is growing against the backdrop of increasing internationalization and the interconnectedness of global sustainability challenges. The United Nations 2030 Agenda and its 17 Sustainable Development Goals (SDGs) provide a framework for the management of complex environmental, social and economic problems. Each of these issues (e.g. climate change, depletion of biodiversity, ocean pollution, hunger, urbanization) is complex enough, but the interlinkages between them involve an even higher level of complexity for political analysis, management and education. Only some of these thematic interlinkages (e.g. the nexus between climate change and food or migration, or the water-energy-food nexus) have been considered by research or education more comprehensively and the complexity of these single issues or their interlinkages bear additional possibilities and opportunities for digital education and training in this field (Messner et al. 2019: 10; Muthu 2021). DSE is proposed as a suitable means for teaching transformative knowledge about sustainability nexus challenges and SDG dynamics. It involves a broad interdisciplinary perspective and academic teaching on sustainability benefits from collaboration among scientific disciplines at universities or between them. The internationalization of study programs contributed to the expansion of knowledge about sustainability and led to better, though still not satisfactory, integration of students from developing countries in these programs. Equal access to digital infrastructure and to DSE has not been realized for people from developing countries nor can this be fully taken for granted for all people in industrialized countries.

ESD as a cornerstone of sustainable development

The objectives of DSE are closely linked to the goals of Education for Sustainable Development (ESD). The latter emerged in the context of the United Nations process for sustainable development. It was first identified in the Agenda 21 (UNCED 1992), the action plan for sustainable development agreed upon at the United Nations Conference on Environment and Development 1992 in Rio de Janeiro. ESD is also a component of the current Sustainable Development Goals (SDGs) (UNGA 2015), representing a cross-cutting competence for sustainability that is relevant for all SDGs. More specifically, ESD is included in SDG4 Target 4.7, aiming to “ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture’s contribution to sustainable development” (UNGA 2015: 17).

Education represents a key element to encourage changes in knowledge, skills, attitudes and values that enable a profound sustainability transformation of society (Howlett et al. 2016). According to the United Nations Educational, Scientific and Cultural Organization (UNESCO), ESD equips people to develop competences to “reflect on their own actions, taking into account their current and future social, cultural, economic and environmental impacts, from a local and a global perspective” (UNESCO 2017: 7). Yet, not all education leads to more sustainability, e.g. when education focusses on growth objectives only. ESD aims at using a balanced, integrated approach to the economic, social and environmental dimensions of sustainable development and thus addresses in particular the “ill-defined, highly-complex real-world problems” (Brudermann et al. 2019: 1), such as climate change, poverty, unjust distribution of wealth and unsustainable consumption patterns. It further contributes to building a vision of sustainable development in and for different contexts (UNESCO 2015, 2020). To create a more sustainable world, people must become change makers and set out in new directions (Cebrián & Junyent 2015). ESD empowers them to act in complex situations in a sustainable way, and to “take informed decisions and responsible actions for environmental integrity, economic viability and a just society for present and future generations” (UNESCO 2017: 7; see also Barth et al. 2007; Napal et al. 2020).

Wals and Corcoran (2006) as well as de Haan (2008) stress the relevance of the concept of “Gestaltungskompetenz” (*shaping competence*) which aims at enabling actors to critical thinking, systems thinking, to understand complex sustainability problems, and to develop action skills. The development of such competencies sets higher education for sustainable development apart from institutions that provide training or conditioning. Higher education for sustainable development seeks to enable critical sustainability discourses and transformative learning dynamics, thereby questioning the prescription of particular lifestyles or codes of behavior or convergence towards a particular set of privileged values and interests (Wals & Corcoran 2006: 103). According to Wals and Corcoran (2006: 107), four shifts characterize transformative learning for sustainable development: *transdisciplinary shifts* (looking at sustainability issues from a range of disciplinary angles but also in ways not confined by any discipline), *transcultural shifts* (looking at sustainability issues from a range of cultural perspectives but also in ways not confined by any one culture in particular), *transgenerational shifts* (looking at sustainability from different time perspectives – i.e. past, present and future) and *transgeographical shifts* (looking at sustainability issues from a range of spatial perspectives – i.e. local, regional and global).

ESD is an integral component of quality education, as part of the concept of lifelong learning. It should be included in all educational institutions, from preschool to tertiary education, as well as in non-institutionalised and informal education. University education and higher education in general, which are in focus of this working paper, thus form a crucial site for ESD to educate students to develop sustainability competencies. ESD requires a holistic and transformative approach that not only addresses learning contents and outcomes, but also the pedagogy and the learning situation. Thus, beyond integrating the sustainability topics in higher education curricula, ESD also requires adapted learning settings and learner-centred teaching methods. To this end, ESD necessitates “an action-oriented,

transformative pedagogy, which supports self-directed learning, participation and collaboration, problem-orientation, inter- and transdisciplinarity and the linking of formal and informal learning” (UNESCO 2017: 7). Therefore, ESD should be innovative, practice-oriented, interactive, activating, reflexive and transformative; imparting competencies for interlinked thinking, for shared perspectives, for critical questioning and for the practical transfer of sustainability-related teaching content; opening up new spaces for thinking, orientation and action in university sustainability teaching. This type of pedagogy is indispensable to enable the development of the key competencies needed for promoting sustainable development.

Higher education for ESD goes digital

Digital sustainability education (DSE) is a part of ESD and, as such, a way of achieving transformative sustainability learning outcomes aiming at the development of sustainability competences. Universities and higher education institutions around the world increasingly regard information technologies and online learning systems as critical means to keep pace with the needs, desires, and requirements of students (Coman et al. 2020). DSE takes advantage of the global spread and application of information and communication technologies and the growing relevance of digital media as a source for information about sustainability (Grund & Brock 2018). While it can thus be an efficient route to spread the sustainability message and to foster sustainability competences, DSE also poses a number of challenges to make it a successful format for ESD.

This working paper deals with the potential and limits, development trends and good practices of DSE – in times of the pandemic crisis, but also at other times. It starts with discussing contextual conditions, didactical challenges and political dimensions of DSE (section 2) and outlines the results of an online workshop on digital sustainability education (section 3). It maps eight good practice DSE teaching examples (co-)authored and developed by lecturers from universities from different countries (sections 4.1 – 4.3) and outlines tools and methods in a DSE toolbox (section 4.4). By doing so, the working paper contributes to current conceptual and political discussions on DSE and intends to provide practical orientation for everyone engaged in the dynamic DSE field and university teaching in general.

2. Contextual conditions, didactical challenges and forms of digital sustainability education

(Breitmeier, H.; Hickmann, T.; Lederer, M.; Marquardt, J.; Schwindenhammer, S.; Strobehn, K.; Weiland, S.)

Proponents of DSE in higher education for sustainable development argue that it favors more “flexible learning—anytime, anywhere, and more interactive—that is centered around students and both synchronous and asynchronous communication” (Napal et al. 2020: 2). Synchronous communication respectively teaching describes the simultaneous, direct interaction and communication between lecturers and students during a class whereas asynchronous teaching includes delayed, indirect interaction and exchange between lecturers and students (Lambach & Kärger 2021: 22). The combination of both, asynchronous and synchronous, teaching elements as well as the mixture of presence and online

classes qualifies as hybrid or blended teaching (Hawliitschek & Merkt 2018: 188-190). When well prepared, a real interaction and a collaborative learning environment can be created in DSE (Leal Filho et al. 2021). DSE teaching tools involve videos or other multimedia materials, virtual classroom activities, games, or educational animations or simulations (Napal et al. 2020: 2). In DSE, digital teaching and learning shift focus from teacher-centered to student-centered education (Coman et al. 2020: 3). In this regard, DSE urges lecturers to become designers of learning in technology-rich environments, and, to that end, to consider and manage a constantly increasing number of tools and resources (Napal et al. 2020: 2). However, when incorporating DSE into higher education and university teaching programs, an ongoing challenge remains the integration of innovative digital learning systems so as to reinforce and support both teaching and learning (Coman et al. 2020). Moreover, content and practice of DSE closely interact with broader systemic and internationalization dynamics.

DSE and the internationalization challenge

DSE enables internationalization through various means. First and most obvious, students as well as teachers do not have to be in the same room for classes, as digital teaching and class participation can be done from any location as long as broadband is available. The Covid-19-pandemic has shown that remote classes via communication platforms like Zoom, Microsoft Teams or BigBlueButton work and can at least complement classical modes of interaction (see also section 4.4). Particularly the possibility to include lectures and contributions from other countries or even continents for specific input is an option that will most likely also be used in a post-pandemic world. We also see a trend that students follow whole programs or at least specific modules at other universities, thus complementing classical student exchange. More problematic and more demanding for both lecturers and students are forms of hybrid or blended teaching as very often the technical challenges are high and only large investments into video-conference systems will allow joint seminars and live streaming where a larger number of students is present in two different locations but still interact digitally. Second, DSE can and should promote the taking up of international sustainability issues or work comparatively on various problems which have different local or national characteristics. Finally, and more problematic digital education should be self-reflective and self-critical regarding its international environmental footprint. The big digital divide across different segments of national societies and between the Global North and South will not easily be closed. Thus, digital classes on sustainability topics are and will most likely remain a possibility only for the elites. Digitalization is not per se leading to democratization. Furthermore, the energy demand of online classes, particularly when using cameras and/or video streaming, have to be considered. DSE could thus be problematic from a sustainability perspective, even though a comparative assessment of different modes of ESD (e.g. online vs. in the classroom) should still be carried out.

The Covid-19-pandemic as a burning lens for sustainability problems

According to a survey on the impact of the Covid-19-pandemic on DSE, the pandemic brought to the fore the difficulties and challenges related to upgrading – in a short period of time – the higher education system to better harness digital technologies (Leal Filho et al. 2021). However, the Covid-19 crisis also

created opportunities for long-term collaboration and sharing experiences in presence-based university contexts (Leal Filho et al. 2021). DSE is not only affected by the Covid-19 crisis, but the pandemic is also inherently linked to core topics of sustainability transformations. As a contextual factor, Covid-19 represents less of a technical challenge for DSE, but rather a social one. Above all, the pandemic exacerbates social interactions among students, prevents critical political debates and limits the students' motivation to engage in the topic. According to a survey among students in Germany during the early phase of the pandemic, a lack of social life and problems with motivation and concentration were seen as their two most common challenges (Winde et al. 2020). In response to these issues, institutions involved in sustainability education have developed new formats such as lecture series about sustainable development and Covid-19 or interactive blogs for students to present their essays (Cusanus 2021). The good practices summarized in this working paper (see section 4) demonstrate the various ways how an interactive and creative DSE helps navigating through the Covid-19 crisis.

Beyond this contextual dimension, Covid-19 provides a unique opportunity to discuss sustainability issues in connection to the pandemic. In other words: Covid-19 can be used as a burning lens for sustainability problems such as complex governance challenges, the contested nature of science and expertise, or the social consequences of political responses to the crisis. Covid-19 can be linked to sustainability education in at least three ways: By a) developing memorable comparisons (e.g. flatten the curve and planetary boundaries), b) by highlighting the complex relations between the pandemic and unsustainable practices (e.g., diseases due to environmental degradation), and c) by merging Covid-19 to fundamental questions of a sustainability transformation (e.g., will Covid-19 be used to mobilize for or against a carbon intensive reboot of the economy?) (Ginzky & Neßhöver 2020; Oxenfarth 2020; Samuel 2020). Overall, long-term transformation knowledge and conceptual debates in sustainability research can be a fruitful starting point to explore the various structure, normative and socio-political challenges when dealing with the pandemic. As such, sustainability education can shed light on the positive and negative consequences of the crisis, promote an interdisciplinary perspective on the problem, and encourage students to think beyond sectoral solutions when dealing with complex societal transformations.

Didactical challenges related to DSE

After the outbreak of the Covid-19-pandemic, many lecturers were suddenly confronted with the task to shift their courses to virtual formats. Such enforced change to digital teaching entails numerous difficulties and new teaching challenges. According to a survey among 238 individuals from 147 different universities in 47 countries on the impact of a Covid-19-crisis on sustainable development teaching, lecturers reported a significant increase in teaching workload and difficulties in digital teaching, such as assessing students' engagement, different performances of students with different resources to work from home (e.g. internet connection, own computer at home) and time-consuming preparation of online classes (Leal Filho et al. 2021: 11266). Lecturers are also concerned regarding the effectiveness of their DSE teaching due to the lack of personal interactions and dialogues with students and subsequent reduction in motivation, the lack of interactions with other lecturers, and a lack of support from university

administration (Leal Filho et al. 2021: 11267-11268). The majority of surveyed lecturers engaged in DSE also lack training to teach digital sustainability courses, miss synchronous interaction with students and feel that direct face-to-face student engagement is necessary for the effective teaching of sustainability content (Leal Filho et al. 2021: 11268). Digital teaching also creates new didactic challenges for lecturers. Students' decision of keeping the webcams off during online classes provides an illustrative example. An online survey among 407 students conducted between December 2020 and January 2021 identifies the following reasons behind their choice not to agree to keep their webcams on during online classes: anxiety, fear of being exposed, shame and shyness (19.4%), because turning on the webcam is not mandatory and because everyone keeps the webcam turned off during online classes (11.3%), because they are not adequately equipped or prepared for online courses (10.1%), because they wish to ensure the privacy of their home and personal space (8.4%), because other people may walk into the background (7.9%), because they carry out other activities in parallel (7.4%), and finally, because they value their comfort and convenience (7.4%) (Gherheş et al. 2021: 6). A solution to students' anxiety, fear of being exposed and shame could be to recreate a classroom atmosphere similar to the classroom in classical education (Gherheş et al. 2021: 10). From a technical perspective, online platforms could allow for only the lecturers to see all students and not for all students to see each other or to allow students to choose which of their colleagues to see during classes (Gherheş et al. 2021: 10). However, the "keeping webcams on or off"-example well illustrates the importance of new didactical tasks for DSE lecturers. Lecturers are called upon to encourage active online interaction and to create a focused atmosphere to allow for an increase in the sharing of those who keep their webcam on during online classes. Through active interaction, students would no longer have the opportunity to perform other activities in parallel with online classes, such as completing projects for other subjects, eat, drink coffee or clean, or to use a mobile phone for various applications and games (Gherheş et al. 2021: 10).

3. Lessons learned – main results of the online workshop

(Breitmeier, H.; Hickmann, T.; Lederer, M.; Marquardt, J.; Schwindenhammer, S.; Strobehn, K.; Weiland, S.)

The exchange of lecturers and others working in education for sustainable development is critical for the further development of DSE, especially regarding the conception, implementation and institutional dissemination of good DSE teaching approaches. Aiming at professional exchange, the online workshop "Digital Sustainability Education: Innovative Teaching Practices and Didactics in Times of Crisis" on 25 – 26 March 2021 brought together 36 dedicated DSE practitioners from various universities and educational institutions from Germany, France, the Netherlands, Belgium, and Chile. The online workshop was co-hosted by the Center for international Development and Environmental Research (ZEU)¹ at Justus Liebig University Giessen and the Working Group Environmental Politics and Global Change of the DVPW² and involved a roundtable discussion, three group work breakout sessions and an in-depth exchange of

¹ For further information about ZEU: <https://www.uni-giessen.de/fbz/zentren/zeu>

² For further information about the Working Group Environmental Politics and Global Change: <http://www.ak-umwelt.de/>

experiences concerning DSE teaching. During the group works, the participants discussed potential and challenges of higher DSE with regard to (1) didactic methods, (2) internationalization, and (3) Covid-19 crisis and sustainability in general, and collected their ideas on a Miro whiteboard (results are depicted in figure 1).

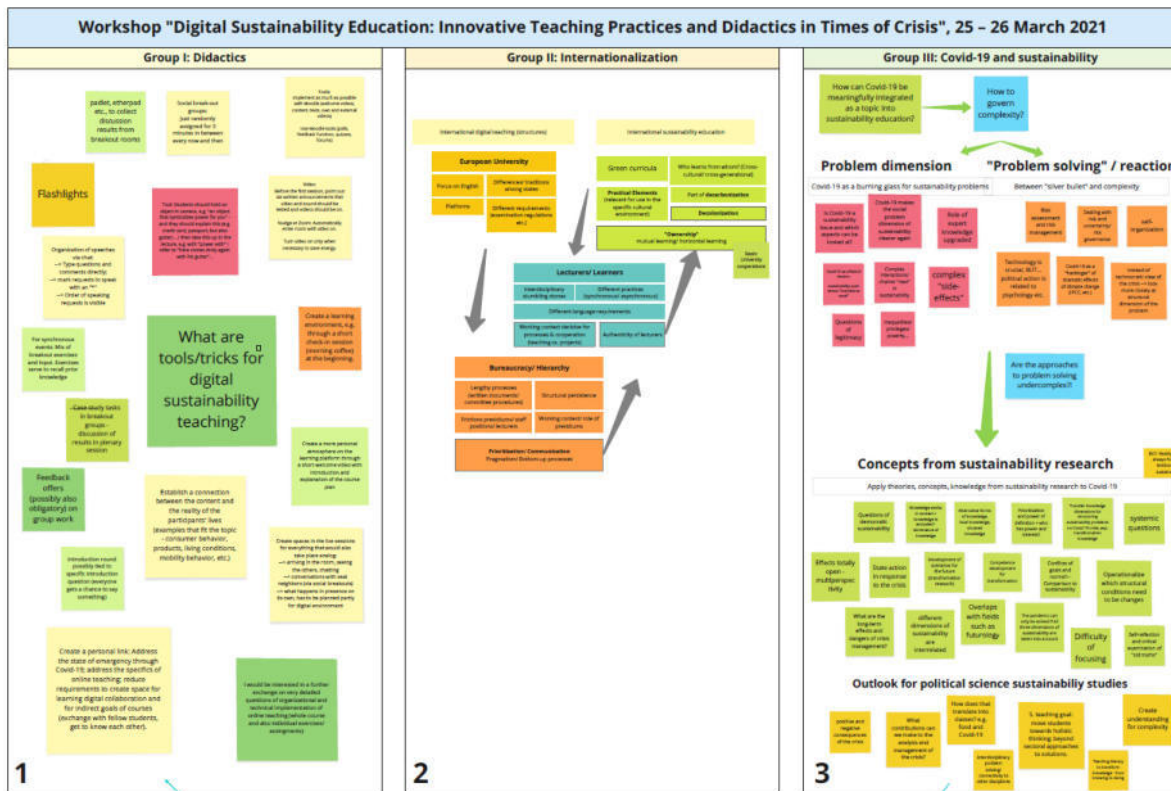


Figure 1: Results of group works, collected on Miro whiteboard

The workshop participants agreed that DSE opens up a variety of new possibilities for educators, learners and educational institutions in general. Digital courses can be designed more interactively, collaboratively and internationally, and also offer a variety of opportunities to impact society, i.e. in the fields of sustainable consumerism, energy politics or environmental conflict mediation. However, the workshop also confirmed that DSE requires a higher workload for lecturers than face-to-face teaching. The participants agreed that good digital teaching requires a lot of preparation. Especially if lecturers aim to develop and train particular competencies of their students like reasoning or presentation skills, translations from on-site to online formats are not easy and need novel course designs.

The good practice teaching examples in section 4 show how such a translation is possible.³ Moreover, digital teaching is received differently by students. Those students with good prior knowledge and high self-motivation might easily adapt to virtual discussions and presentations, while other students from a less privileged starting position seem to have much more problems to cope with the lack of personal interactions and learning experiences. The participants agreed that there is also a need to adjust our

³ For further good practice teaching examples and ideas, refer to Freise 2021; Konrad 2021a, b; Rosner-Merker 2021a, b, c; and Arbeitskreis Hochschullehre der DVPW (n.d.).

expectations regarding digital teaching. Despite their usefulness during the Covid-19-pandemic, digital teaching formats cannot fully replace face-to-face formats, particularly in the social sciences that are based on controversial debates. As soon as the situation allows, digital formats should be used in a targeted manner and connected with on-site formats.

The workshop identified four key tasks to be addressed to ensure good DSE teaching practices: (1) to take away the anonymity of digital event formats, (2) to realistically formulate expectations of oneself and the students to leave no one behind, especially with regard to dealing with new software formats, (3) to continuously develop courses interactively through (continuous) student feedback, (4) to ensure the personal didactic and methodological training of the lecturers. The workshop also concluded that the future success of DSE depends on conducive political, institutional and legal framework conditions and a smart intertwining of digital and classroom presence formats within university teaching, which must also be mastered beyond the crisis.

There are three key messages that stand out when teaching DSE:

1) *Leaving no one behind!* As lecturers, we need to give all participants the opportunity to take part in the course in a meaningful way. In on-site and even more in digital teaching formats, this includes above all being accessible inside and outside of the course and providing a protected practice room in which students are encouraged to bring in own perspectives and raise questions.

2) *Use problem orientation as a great opportunity for activating digital formats!* Online games and simulations on sustainability problems are ideally suited to let students apply their knowledge in hands-on situations. Service learning is another example, where students, for instance, calculate the ecological footprint of their university and create podcasts with suggestions for reducing it. Moreover, online formats also allow for cooperation between universities located in the Global South to exchange perspectives on global sustainability challenges.

3) *Make normativity of teaching explicit!* Research and knowledge on sustainability contributes to the preservation of the ecosystems of our planet. Without drawing horror scenarios, we are at a critical point in time to preserve the earth as a habitat for us and for future generations. While we as political scientists cannot save the world, we teach a generation that will hopefully do so.

4. Eight good practice examples of digital sustainability education

(Breitmeier, H.; Hickmann, T.; Lederer, M.; Marquardt, J.; Schwindenhammer, S.; Strobehn, K.; Weiland, S.)

The following DSE teaching examples were presented and discussed at the online workshop. They are (co-)authored by the DSE lecturers Katrin Beer (Otto-von-Guericke-Universität in Magdeburg), Tobias Gumbert (University of Münster), Katja Biedenkopf (KU Leuven), Nora Große (Freie Universität Berlin), Lisa Pettibone (FernUniversität in Hagen), Jonas Hein (Kiel University), Martin Gerner (Technische Universität Dresden) and Natalie Kiesler and Ramona Teuber (both Justus Liebig University Giessen). The sample covers a wide range of teaching formats – online seminars, lecture series, planning and simulation games and online degree programs – in different stages of maturity. While some examples

have been already applied in teaching for several semesters, others are still in the development or early application phase. The examples combine asynchronous and synchronous teaching elements by, on the one hand, implementing online classes, during which students can directly interact with each other and the lecturer and are engaged in discussions and group works during the course. On the other hand, some good practice examples highlight how students' self-study can be supported with asynchronous teaching elements, e.g. by providing recorded lectures, podcasts, quizzes and encouraging students to engage in chatting and online discussions beyond the official seminar time. Whereas the majority of the good practice examples was conducted completely online recently, some examples were already offered/ have the potential to be offered in a hybrid way by means of combining presence (if necessary: in rotating groups) and online teaching. In the following tables each author provides an overview of the respective teaching context, contents, learning objectives, required resources of students as well as required technical infrastructure and applied digital teaching tools. The authors also provide valuable insights in their practical teaching experiences and share individual as well as collective lessons learned.

4.1 Online seminars and lecture series with (a)synchronous teaching elements

4.1.1 "Research-oriented online seminar with case study - political processes in bioeconomy policy" (Beer, K.)

Title of the course	Research-oriented online seminar with case study – political processes in bioeconomy policy
Lecturer's name	Katrin Beer
Development context (course of study); location (university) and previous course frequency	The original course has been developed in 2019 in the context of the political science research project "Bio-Ökopoli" at FernUniversität in Hagen for master students of interdisciplinary environmental sciences (long distance) by Daniela Perbandt. The course has been modified and adjusted for bachelor students of social sciences at Otto-von-Guericke-Universität in Magdeburg by Katrin Beer.
Topic and contents	The research-oriented seminar introduces students to theories and methods of policy analysis in environmental sciences and to the developing policy field bioeconomy policy in Germany and the European Union. The students conduct case studies in groups for different sub-areas of bioeconomy policy with a focus on conflicts of goals and the role of sustainable development in political processes.
Learning objectives and competencies to be imparted	The students acquire basic knowledge about bioeconomy policy and related policy fields and about theories and methods of policy analysis. They acquire in-depth knowledge about the analytical framework Political Process Inherent Dynamics Approach and the policy sub-area they choose for their case study (e.g. biofuels or bioplastics policy). They practice empirical research methods (literature research, document analysis with MaxQDA, data preparation) and the presentation and discussion of research results at a simulated virtual science conference. In the online seminar, they also learn and practice how to use different online collaboration tools and how to work together in a research team remotely.
Required competencies/ resources of students	Required competencies: Basics of scientific work, basic computer skills, German language skills.

	Required resources: Laptop or equivalent internet-enabled working device, ideally a strong and stable internet-connection, microphone and webcam are ideal, but not mandatory.
Required technical infrastructure at the university	For this course at Otto-von-Guericke-Universität, the following components have been used: University information system "LSF" for course description and registration, learning platform "Moodle" for course content, video platforms (FernUniversität in Hagen, Otto-von-Guericke-Universität and personal Youtube account) for course videos, Otto-von-Guericke-Universität Zoom account for live meetings, additional free and personal online collaboration tools (Yopad, Cryptpad, Padlet, Mentimeter), Moodle tools (for surveys, topic selection, assignments, feedback). The very basic components are a video conferencing tool for live-sessions and a web platform for the storage of learning content.
Application of which digital tools	LSF, Moodle and Moodle activities (assignment, chat, feedback, file, forum, group choice, h5p, label, page, quiz, survey, wiki), Youtube, mediaserver FernUniversität in Hagen and Otto-von-Guericke-Universität, Zoom and Zoom tools (breakout rooms, surveys, whiteboard, comment function, chat), Yopad, Cryptpad, Padlet, Mentimeter, video production and cutting with Power Point, Zoom and Shotcut.
Forms of examination	Online quizzes, assignments (summary, poster, abstract, essay, podcast – depending on number of credit points and students' choice), online presentation (live or recorded).
Qualitative individual/ collective experience report/ description of "lessons learned" from teaching...	<p>The original course has been developed by colleagues at FernUniversität in Hagen who are experienced with distance learning formats. The course has been offered twice at FernUniversität in Hagen and twice at Otto-von-Guericke-Universität so far. Lessons learned from these four runs are the following:</p> <ul style="list-style-type: none"> ■ Record a short welcome video, where you introduce yourself and the course structure, and make it available on the start page of the course platform. ■ Take time to explain online tools and give the students time to practice the use of these tools. ■ Less is more: Too many tools and platforms are confusing. They all have some advantages and disadvantages. It is better to use few constantly than to try new ones all the time. Very basic tools, like Etherpad, worked better for us than more advanced tools with many functions, like Adobe Connect. ■ However, giving a tool overview at the beginning can be helpful. I tried and discussed different tools with the students and let them choose the tools they preferred for their group work. This takes some time that gets lost for work on the actual course content, but I think it is worth it. ■ Moodle is very powerful and comes with many functions. Using different media (literature, links to homepages, embedded videos, audio files) and functions (quiz, feedback, etc.) is quite easy and helps to have some variety in the course. Where possible, use integrated Moodle tools instead of external ones. ■ Information for live-meetings can be stored on Moodle as well, e.g. instructions for group work in breakout rooms can be written on Moodle pages or stored in PDFs that are made available on the Moodle platform during the live session. The combination of Zoom and Padlet works quite well, too. ■ Zoom was the video conferencing tool that worked best for us. We tried Adobe Connect, Jitsi Meet and BigBlueButton as well, but had more technical issues with these other tools.

	<ul style="list-style-type: none"> ■ It helps to have backup options for the live-meetings and to give instructions to the participants, what to do if something does not work properly (use Moodle chat or email for communication of technical problems, use Zoom chat if audio does not work, etc.). Think of everything, that could go wrong, and prepare for it. ■ Ideally, have someone as technical assistant in live meetings. ■ In contrast to presence teaching, where some things just happen alongside (seeing each other, small talk with neighbors, small talk in breaks), you need to take some additional time to create a good course atmosphere online. Make sure that the participants see and hear each other often, take time for an extensive introduction round (asynchronous or live) before or during the first meeting. It improves the atmosphere a lot and it is worth taking the time. ■ Try to motivate the participants to turn on their cameras from the beginning to make the online-course more personal. Use the respective pre-settings in Zoom (camera automatically on). ■ Activate all the participants at the beginning of and during each session, do not have them sit in front of the computer passively for too long. Try to include interactive elements every 10 to 20 minutes, if possible (survey, flashlight method, discussion/group work/partner work in breakout rooms). ■ You do not have to give long inputs in the live sessions. Think about recording a video and storing it on the learning platform. Recording with Power Point or Zoom is quite easy and this gives the students more flexibility. Use live-sessions for interaction. ■ A short flashlight at the beginning of each live-session is possible in small groups, the students gave very positive feedback for that. In bigger groups you can use a short survey for arriving in the session. ■ Give students some possibilities to influence the organization of the course. Let them choose tools to be used, topics, focal points, tasks, etc. Ask them about their experience with online learning - you can learn from them, too. ■ Give the opportunity for feedback in the middle of the course and adjust your plan, if necessary. ■ Instructions for tasks need to be very detailed. ■ Giving time limits for tasks can be helpful (we had open tasks without defined end and the students ended up spending far too much time for some tasks). ■ Be prepared, but do not try to be perfect. Just experiment with the possibilities and take students along. Everyone will learn something anyway, also from mistakes and fails. Perfect quality is not necessary.
--	---

4.1.2 “The politics of sustainable consumption” (*Gumbert, T.*)

Title of the course	The politics of sustainable consumption
Lecturer’s name	Tobias Gumbert
Development context (course of study); location (university) and previous course frequency	Political science BA programs, University of Münster. I have conducted the course on a weekly as well as on a bi-weekly basis.
Topic and contents	<p>Topic: An illustration of the multidimensionality of consumption actions and decisions</p> <p>Idea: The topic of sustainable consumption has dominated the public debate for a long time. Individuals are constantly confronted with new information,</p>

	<p>rational decisions, morally ‘right’ choices, etc. and have developed and internalized particular views, political attitudes and values, and might even have strong emotions towards sustainable choices. It is of course the same with students. In most cases, they have not had sufficient opportunities to reflect on these issues before coming to class, but they are still very much part of the way they build and defend arguments. The central idea of the seminar was therefore to integrate specifically designed methodical exercises (four in total) throughout the semester, which would help students to turn their implicit knowledge outwards and connect these insights to readings from the field of sustainable consumption politics and governance.</p> <p>Basic course structure:</p> <ol style="list-style-type: none"> 1. Introduction 2. Sustainable consumption research (2 sessions) 3. Interdisciplinary perspectives (2 sessions) 4. Political theory and ethics (2 sessions) 5. Political instruments and institutions (4 sessions) 6. Research design <p>The exercises were tailored to the specific sessions: (1) Are my consumption choices rational? Subjective expected utility tests for evaluating rational choices in sustainable food behaviors. (2) Are my consumption choices guided by personal freedom? A philosophical thought experiment on different scenarios involving freedoms and sustainable consumption choices. (3) Towards whom or what am I responsible through consumption? A mapping of personal social relations based on regular consumption choices. (4) How are my consumption choices socially embedded? Conducting “consumption interviews” with friends or family in order to evaluate the contexts (e.g., infrastructures, social dependencies) in which they make choices.</p> <p>In one semester, these exercises were to be carried out individually at home, the following semester the course did them “live” via Zoom. Subsequently, students were asked to “write up” their experiences and results in essay form, which were reviewed by two additional students (peer feedback). We exchanged the results the following week in class.</p>
<p>Learning objectives and competencies to be imparted</p>	<p>There is of course the overall objective to learn about models and strategies of regulating and steering sustainable consumption and the inherent complexities of the object of sustainable consumption itself. But on a more substantial level, the learning objectives for students comprise, first, to acknowledge their individual attitudes and preferences (through the exercises), second, to think beyond their individual perspective and situate these experiences in broader contexts (through course readings and essay writing), and, lastly, to reflect on the plurality (and legitimacy) of possible attitudes (through class discussion and peer feedback). Since most seminars are based on text discussions and often prioritize a systemic level of analysis (which should be a focus of political science classes, mind you), individual reflections are often neglected. However, when analyzing sustainable consumption politics, I consider these aspects particularly relevant to evaluate and assess political instruments, which of course predominantly focus on individual behavior change. This is crucial for really understanding the underlying mechanisms of these instruments (e.g., nudging). In the same vein, it is also about developing a sensibility towards the fact that daily life is susceptible to various political instrumentalizations. The perspective of ethics (which often takes a leading role in the exercises) does not prompt us to naively support or reject political approaches immediately, but rather to weigh and jointly discuss their merits.</p>

Required competencies/ resources of students	<ol style="list-style-type: none"> 1. Readiness to engage with personal values and emotions and, most importantly, share them with others. 2. Reading and personal writing requirements were relatively high, due to essays and peer feedback.
Required technical infrastructure at the university	Stable online connection.
Application of which digital tools	Digital platform to upload and share essays/feedback, “live” spreadsheets, online survey tools (or use function in Zoom), breakout rooms (in Zoom), Mindmapping tools or padlets (Miro, Xmind, etc.).
Forms of examination	Essays, term paper.
Qualitative individual/ collective experience report/ description of “lessons learned” from teaching...	<p>In retrospect, the idea for this course objective probably sprung from many conversations with colleagues teaching sustainability-related classes who often reported the same thing: the way students argue in class about sustainability issues, there is something left to unpack which guides individual perceptions, but regularly there is no time, or the class room is just not the place to do that. It had to be built into the course design. The course also benefited from the support and guidance offered by the Centre for Teaching in Higher Education at the University of Münster.</p> <p>In terms of practical implementation, templates to structure each session (especially those with “live” exercises) were very helpful. Students were also extremely grateful for guiding questions that suggested possibilities how to “start a conversation” between the individual experiences triggered by the exercises and the course material.</p> <p>My experiences with conducting the course are however heavily influenced by the dynamics of the pandemic. Deadlines are always helpful to get things done, but during Covid-19-teaching, and especially concerning essay writing and peer feedback, they were essential (not my words, that is from the course evaluations). I did the first seminar in a bi-weekly rhythm, with rather flexible deadlines (in order not to overburden students during the time), and attendance dropped significantly over the course of the semester. The following term, I switched to weekly sessions, “live” exercises, and strict deadlines for handing in assignments, and student motivation and attendance was extremely high throughout the course lifetime. There might be some effect of “normalizing digital learning environments” at play here, but I believe that especially the weekly meetings are necessary to regularly address (and secure) the learning objectives.</p> <p>Lastly, digital sustainability education is not something we should view as second best which “needs” to be done if the circumstances do not allow for meeting face to face. Digital tools, like Mentimeter, had found their way in real life classrooms prior to the pandemic, and their application in class has the potential to make specific processes (like evaluations or short surveys) more efficient and transparent. That some sessions could actually be better prepared and designed in the digital realm took me by surprise. Sorting people in small groups for discussion, having a short chat with each group, being available for questions, sharing documents and links with the class, and many other aspects made the experience sometimes much more immersive and worthwhile for me than I had initially anticipated. So, what lies before us is to think about and map out which benefits and positive insights we have experienced in 2020 and 2021 through digital sustainability teaching, and how we might transfer some of them to actual classrooms. In the end, that conversation will have to be broader than</p>

	discussing software tools and hardware installations, and bring up questions like: which learning objectives can be better realized at home? Which method or exercise could be used to bring a point better across than “just” discussing it? Which experts might be available for a short statement or guest lecture? Which (online) research assignments can we do together in class?
--	---

4.1.3 “Europe’s climate and energy policy: internal and external dimensions” (*Biedenkopf, K.*)

Title of the course	Europe’s climate and energy Policy: internal and external dimensions
Lecturer’s name	Prof. Dr. Katja Biedenkopf
Development context (course of study); location (university) and previous course frequency	<ul style="list-style-type: none"> ■ MSc Comparative and International Politics (NL) ■ MSc International Politics (EN) ■ MA European Studies (EN) ■ MSc Sustainable Development (EN) <p>KU Leuven</p>
Topic and contents	Analysis of European Union climate and energy policy
Learning objectives and competencies to be imparted	<p>Course objectives:</p> <ul style="list-style-type: none"> ■ Providing students with in-depth knowledge of the main European Union climate and energy policies ■ Providing students with in-depth knowledge of the politics and processes that have led to its current policies ■ Enabling students to critically analyze EU climate and energy policies <p>Learning outcomes:</p> <p>Upon completion of the course, successful students will be able to:</p> <ul style="list-style-type: none"> ■ Identify the main debates and concepts in the analysis of internal and external EU climate and energy policies ■ Explain the origins and development of the main internal and external EU climate and energy policies ■ Explain the politics and processes surrounding EU climate and energy policies ■ Critically analyze internal and external EU climate and energy policies
Required competencies/resources of students	Student are expected to display a keen interest in European Union politics in general and climate and energy policy in particular.
Required technical infrastructure at the university	Online learning platform
Application of which digital tools	<ul style="list-style-type: none"> ■ Online modules that consist of short videos, texts, questions, and quizzes. ■ Online discussion and group work in break-out rooms. <p>In the course, I made extensive use of case studies that required students to apply the knowledge that they acquired through the online modules. Each session was structured in the following way:</p> <ul style="list-style-type: none"> ■ Students were asked to complete an online module at their own pace (asynchronous online teaching) but prior to the respective synchronous online session. The modules consisted of videos, texts, questions and quizzes with the aim to teach the students a certain concept, theory or approach. At the end, a specific real-life scenario that related to the module’s content was described (case study). Students were given

	<p>different tasks at the end of the case study. These tasks aimed at applying the theoretical knowledge in a real-life scenario.</p> <ul style="list-style-type: none"> ■ During the synchronous online session, students were first given the opportunity to ask questions about and share reflections on the online module. They were then split in small groups and asked to complete the task that was given at the end of the case study. At the end of the session, each group reported back and presented their results to the entire student group. ■ The purpose of the case studies was, on the one hand, to deepen students' knowledge acquisition by "experiencing" it instead of merely learning it by heart. On the other hand, the case studies aimed at training different skills such as collaboration within a team and drafting various kinds of authentic texts (strategies, press releases, laws, policy evaluation plans etc.).
Forms of examination	<ul style="list-style-type: none"> ■ Short writing assignments in relation to the case studies: 50% ■ Policy analysis paper: 50%
Qualitative individual/ collective experience report/ description of "lessons learned" from teaching...	<p><i>How has the didactic concept of the course been developed (e.g. exchange with colleagues, inclusion of students, own didactic training)?</i></p> <ul style="list-style-type: none"> ■ Own didactic training through academic literature and internet resources ■ Discussion with colleagues at academic conferences <p><i>What has to be considered during practical implementation of the course (e.g. technical, institutional or other obstacles)?</i></p> <ul style="list-style-type: none"> ■ The instructions in the online module need to be very clear since students cannot ask clarification questions at this stage. In particular, the tasks at the end of the case studies need to be clear and unequivocal. The purpose and objective of the exercise needs to be described. <p><i>What can other lecturers learn from the experiences made so far in the course (tips, tricks, warnings)?</i></p> <ul style="list-style-type: none"> ■ The students appreciated the interaction in small groups and the hands-on tasks since this was not very common during the Covid-19-pandemic. Yet, it was not always easy since even more explanations were necessary. ■ I personally would recommend experimenting with different forms of case studies. Not only the students need to learn. I also always learn from trying out different methods, contents and tasks. ■ I specifically try to enable students to train skills in addition to acquiring knowledge. This has turned out more challenging than anticipated since it is difficult to establish whether students have improved certain skills. It also means that they require support and instructions on the different authentic writing assignments: How to write a press release? How to brief a minister? etc. <p><i>What needs to be changed in the future to further support the realization of digital sustainability education against the background of your own teaching experiences?</i></p> <ul style="list-style-type: none"> ■ Developing platforms on which teaching material such as case studies can be exchanged would be helpful since developing everything oneself is highly time intensive. There are, of course, already some case study databases but not many in the area of sustainability.

4.1.4 “Transforming our world – the climate crisis in times of multiple crises” (Große, N.)

Title of the course	Transforming our world – the climate crisis in times of multiple crises
	<p>The lecture series <i>Transforming our world – the climate crisis in times of multiple crises</i> is an overarching component of the four modules offered within our <i>Competence Area Sustainable Development</i>. The competence area is one out of eight elective areas within the <i>General Professional Skills</i> where Freie Universität Berlin Bachelor students should take 15 Credit Points (CP) during their study cycle. The four modules are <i>Managing, Communicating, Researching and Designing Sustainability</i> and include various project-based seminars, embracing crucial transformative learning/ higher ESD competences.</p>
Lecturer's name	<p>Nora Große (coordinator of the <i>Competence Area Sustainable Development</i> and Project Coordinator in Teaching for Sustainable Development at Freie Universität Berlin)</p>
Development context (course of study); location (university) and previous course frequency	<p>Freie Universität Berlin, Competence Area Sustainable Development/ General Professional Skills (see above). The modules incl. lecture series are offered every semester. The lecture series was transformed into an online course in the 2020 summer semester. The synchronous web meeting occurs every two weeks for 1.5 hours.</p>
Topic and contents	<ol style="list-style-type: none"> 1. Introduction to the lecture series and the Competence Area Sustainable Development 2. Anthropocene and Transformation (Status Quo analysis incl. key concepts of planetary boundaries, tipping points, climate crisis, 6th extinction) 3. Sustainable development – an oxymoron? (Global Political economy and justice perspective on common sustainability and development definitions/concepts/models and political agendas, incl. SDGs and their realization perspectives) 4. Transformation strategies and their critics (Introduction to concepts of efficiency, consistency and sufficiency strategies and real-life examples, efficiency critique of rebound effects) 5. Green Growth vs. Degrowth (Guest input and common discussion on the connection between economic growth and well-being, potential pathways of more growth-independent societies) 6. Free slot depending on students' wishes 7. Final student group presentations of their project ideas developed in their accompanying seminars
Learning objectives and competencies to be imparted	<ul style="list-style-type: none"> ■ Developing an understanding of different sustainability transformation concepts and strategies, incl. complexities, ambiguities and critiques ■ Critically reflecting and analyzing central sustainability concepts and strategies, esp. from an interdisciplinary social science perspective ■ Developing and practicing argumentation and communication skills by exchanging and negotiating sustainability perspectives and opinions
Required competencies/ resources of students	<ul style="list-style-type: none"> ■ Accessible to all B.A. study programs and years (no pre-knowledge) ■ Motivation for regular asynchronous self-study on Blackboard (recorded power points, videos, optional literature, 3-4 guiding questions / session) ■ Active participation in live online discussions every 2 weeks for 1,5 hours
Required technical infrastructure	<p>WebEx account, Blackboard access (Freie Universität Berlin's learning platform)</p>

Application of which digital tools	Mentimeter/Sli.do surveys to ask students during the live sessions about their ideas, understandings and open questions related to the self-study components
Forms of examination	No examination/grade for the lecture series. The entire module is pass/fail, which is largely based on students' group process of project development in the seminars and presentations of their project ideas during the last session.
Qualitative individual/collective experience report/description of "lessons learned" from teaching...	<p>As the module coordinator, I transformed the lecture series into a complete online-format as part of a larger online teaching process just before the start of the summer semester 2020 due to Covid-19. In fact, the courses' learning platform already contained several online elements that I could build on, including recorded lectures from previous guests, slides, further reading and a self-test. Reflecting on the experiences and course evaluations of previous semesters, I concluded that online teaching provided several advantages for our target group: Due to the Competence Area's elective nature, it is accessible to a large number (~300) and wide range of Bachelor students with very different study schedules, (inter-)disciplinary knowledge and motivations. Hence, it had been rather challenging to fulfil sustainability-related learning outcomes within two contact hours every two weeks. Moreover, the time to introduce, commonly discuss and reflect on key concepts of sustainability was rather limited in a topic-focused lecture series.</p> <p>Hence, I chose an Inverted (Online) Classroom Model to combine the need for self-directed learning (according to individual schedule, pre-knowledge, interests) with the desire for common discussion and critical reflection during contact hours. As a basis, I developed three main modules introducing students to key interdisciplinary concepts, findings and perspectives (topics/contents see above). To provide a clear self-study structure, the learning platform material was categorized into "basic/required" and "optional/advanced" and guided by 3-4 key questions to prepare each live session. I expanded the self-study material with self-recorded power point presentations, thematically aligned guest lectures, additional video and literature recommendations. During the live sessions, I typically used the key questions to guide the discussion – first in breakout groups to foster student interaction, then in the plenary to discuss group results and open questions.</p> <p>I tried to measure students' understanding and reflection of key concepts with regular polls, e.g. anonymous associative word clouds and open questions about their key learnings, surprises and remaining unclarities. After the third "concept-based" module, I integrated a co-creative element by letting students choose between three thematic options for the remaining 1-2 sessions (there are 7-8 sessions in total depending on the summer/winter semester). They usually opted for a live guest lecture and discussion with an expert to dive deeper into a certain issue (e.g. Green Growth - Degrowth) and a session on professional orientation in the sustainability field (the course being part of Freie Universität Berlin's "General Professional Skills" Area).</p> <p>Unfortunately, it is rather challenging to provide definite results on the lecture series' learning outcomes due to its sheer size and elective nature. However, we can draw some tentative conclusions from attendance rates, course evaluations (incl. closed and open questions) and my personal teaching experience. Compared to the previous offline lecture, attendance during online-meetings increased more than threefold (from ~50 to ~150). Active participation in the plenary was much lower, but breakout sessions have created an opportunity for a "safe space" for mutual student exchange that would not be equally possible in a typical lecture hall. Moreover, several</p>

	<p>student emails and evaluation responses suggest that much more learning occurs “invisibly” now, e.g. reporting that they found the material very interesting and engaging and are grateful for such a self-study opportunity. This suggests that expected advantages from an Inverted Online Classroom Model materialized, as asynchronous learning can be better reconciled with students’ heterogeneous pre-competences, schedules and interests. In particular, students with parenthood, job or other parallel life responsibilities seem to be grateful for such an opportunity, supporting the argument that diversity and inclusion goals may be better realized through online teaching.</p> <p>In this context, I would also like to point to some challenges and limits. Our course evaluations simultaneously suggest that many students also struggle with “only” online teaching, missing the necessary guidance and structure provided by personal contact teaching. Due to our learning platform Blackboard’s very limited and user-unfriendly functions to interact with students during the asynchronous phase (e.g. by giving them regular tasks, quizzes, interacting through chats or fora), it is very difficult to accompany them and evaluate their learning progress during the asynchronous phase. Hence, our main mode of contact are the live-sessions every two weeks, where active visible participation is still tied to those who come prepared and “dare to speak”. Besides, participation may be hampered by several factors such as a bad internet connection (WebEx is usually more instable than zoom), distracting household noise or the feeling of anonymity. Overall, online teaching seems to provide both opportunities and challenges to active, inclusive participation and a fruitful, engaging discussion atmosphere.</p> <p>Finally, I would like to mention some challenges in realizing the above-mentioned learning objectives and competences. Firstly, I think we often underestimate the challenge of connecting social, natural and technical science approaches to sustainability transformations and teaching a mutual and critical understanding of these perspectives. For instance, in our course evaluations, natural science students most often criticize the vagueness of conceptual discussions and lack of clear factual input, while political science students tend to love power-critical discussions about sustainability and degrowth. Depending on their disciplinary socialization, students thus have very different expectations about an “introduction to sustainability”. Hence, it needs quite some time, patience and partly uncomfortable confrontation with the complex, ambiguous, inter- and transdisciplinary nature of sustainability questions. To realize these aims, a voluntary lecture series worth 1 European Credit Transfer and Accumulation System (ECTS) point (1 semester hour per week contact hour) may not be the best format, but rather a 5 ECTS points seminar with more frequent contact hours and space for group work.</p>
--	---

4.1.5 “Waste prevention: structural challenges and local solutions” (*Pettibone, L.*)

Title of the course	Waste prevention: structural challenges and local solutions
Lecturer’s name	Dr. Lisa Pettibone
Development context (course of study); location (university) and previous course frequency	International online seminar, BA Politikwissenschaft-Verwaltungswissenschaft-Soziologie, FernUniversität in Hagen

Topic and contents	group case study analysis of innovative local waste prevention strategies and comparison across three countries
Learning objectives and competencies to be imparted	<ul style="list-style-type: none"> ■ Identification of key policy instruments for waste management and prevention ■ Analysis of local case studies in international context ■ Active and passive English comprehension (reading, writing, speaking, and listening), including competence with academic English ■ Increased intercultural competences through teamwork in international groups
Required competencies/resources of students	English B2/C1
Required technical infrastructure at the university	Open Moodle (for availability at partner universities), video recording studio, English proofreading service
Application of which digital tools	Open Moodle, Zoom
Forms of examination	group project and presentation with optional written component for international partners
Qualitative individual/collective experience report/description of “lessons learned” from teaching...	<ul style="list-style-type: none"> ■ Didactic course is developed with colleagues at FernUniversität in Hagen and international partners. It will be interesting to see how challenging it is to get partners interested in concept and develop a course that meets requirements at different universities. ■ Biggest challenge is institutional: making sure that course requirements for different programs/universities are met; also developing partnership agreements across universities. ■ When developing an international course, it is useful to select a topic that will spark interest with potential partners, where multiple universities have developed expertise, and where the course will fit into different degree programs. ■ One change I hope to see is at the FernUniversität in Hagen itself. Right now, these online seminars are required for the degree, but do not provide course credit. This means that students are not expected to do much work within the course, a difficult context to start with when bringing in international partners whose students likely will need course credit. More generally, it makes the standardization happening across the European Union something I welcome, as it will hopefully make collaborations like this easier.

4.2 Planning and simulation games

4.2.1 “Conservation conflicts in coastal areas – a planning game” (Hein, J.)

Title of the course	Conservation conflicts in coastal areas – a planning game
Lecturer’s name	Dr. Jonas Hein
Development context (course of study); location (university) and previous course frequency	Original title in German “Umweltkonflikte in Küstenregionen – ein Rollenspiel”, in the study program “Geography” (BA) and “Socio-environmental conflicts” in the study program “Sustainability, Society and the Environment” (MA)

	<p>The planning game has been developed in a project seminar for BA students in Geography at Kiel University. Initially it was planned to develop a game for a regular class room setting. Because of the Covid-19 pandemic the project seminar took place online and we developed a planning game that can be played both online (using a number of applications) and in a class room setting.</p> <p>The project seminar had two main objectives: first, the development of a planning game simulating a fictitious environmental planning conflict in a coastal area and second, to introduce students to gamification and its potential for didactics and knowledge transfer.</p> <p>The developed game replaced an earlier version focusing on terrestrial environmental conflicts (“The Bungku Forest”) that I played with students of the module “Socio-environmental conflicts” in the study program “Sustainability, Society and the Environment”. A beta version of the conservation game was first used in the “Socio-environmental conflicts” during the winter term 2020/2021.</p> <p>The game material and rules of the game can be downloaded here: https://einfachgutelehre.uni-kiel.de/methodenset/conservation-game/</p>
<p>Topic and contents</p>	<p>The socio-environmental conflict module takes up current issues and examples of socio-environmental conflicts in coastal and marine areas. Conceptually the module builds on political ecology. The planning game as the core of the module facilitates the promotion of complex interdisciplinary knowledge in a didactically appealing and practical way. It helps to identify synergies and trade-offs among development and conservation objectives and associated power relations among involved actors in a playful way.</p> <p>The planning game simulates a multi actor planning conflict in a fictitious tropical coastal area (involving among others a port company, fisher community, indigenous coastal dwellers, tourism operators). Each actor will be played by a group of two to four students.</p> <p>The module is structured as follows:</p> <ul style="list-style-type: none"> ■ Joint reading and discussion of key articles on conservation conflicts, green and blue grabbing and political ecology. ■ Student presentations of topics related to the role they play in the planning game (e.g. marine protected area management, political ecology, port development, commodification of nature, indigenous rights movement). ■ Preparatory meetings to prepare the game, the roles and the role's positions in the conflict. ■ Full day session to play the Conservation Game ■ 2-hour session to reflect on the outcome of the game ■ 2-hour session on conflict mediation and solution ■ 2-hour closing session
<p>Learning objectives and competencies to be imparted</p>	<p>The class and the planning game seek to gain awareness for the complexity of socio-environmental conflicts, to understand trade-offs and synergies among development and conservation policies and to get familiar with the role that power and knowledge asymmetries play in socio-environmental conflicts. The planning game provides the opportunity to experience conflicts instead of just talking about them. The class helps to learn about the different interests of actors. Moreover, the class helps to familiarize with planning games, a method increasingly used in environmental and spatial planning.</p>

Required competencies/ resources of students	<p>No specific disciplinary background or competencies required, seminar benefits from an interdisciplinary group, class is most interest for students in human geography, environmental management/ studies, conservation science, coastal ecology.</p> <p>Students need the following technical resources: Students need a broadband internet connection, a discord account and a webcam. In addition, the collaboration tool Conceptboard and a video conference tool (e.g. Discord) are required.</p>
Required technical infrastructure at the university	Internet connection, large screen (+55 inches) or projector and video conference tools such as discord or Alfa View and a digital whiteboard (e.g. Conceptboard) to display the game board and to allow players to edit the game board.
Application of which digital tools	White board (e.g. Conceptboard), communication tools (e.g. Discord, Alfa View).
Forms of examination	Planning game report and student paper.
Qualitative individual/ collective experience report/ description of “lessons learned” from teaching...	<p><i>How has the didactic concept of the course been developed (e.g. exchange with colleagues, inclusion of students, own didactic training)?</i> The game has been developed by students of the above-mentioned project seminar and myself in a dialog with the didactics support unit PERLE at Kiel University and was supported by Jörn Schmidt (Center for Ocean and Society, Kiel University, Einhard Schmidt-Kallert (TU Dortmund University) and Yvonne Kunz (Royal Netherlands Institute of Southeast Asian and Caribbean Studies). Further feedback was provided by students of the “Socio-environmental conflicts” module.</p> <p><i>What has to be considered during practical implementation of the course (e.g. technical, institutional or other obstacles)?</i> For playing the game online, a digital communication tool is required that allows video conferencing and that allows users to create virtual rooms. These virtual rooms are used for internal discussions and users should be able to visit other virtual rooms to negotiate with other actors without requesting the permission of session host. Discord and Alfa View provide this option.</p> <p><i>What can other lecturers learn from the experiences made so far in the course (tips, tricks, warnings)?</i> Planning games in a virtual setting are a great opportunity to make online teaching more interactive. However, in contrast to a regular class room setting the players are usually less emotional and need more time to familiarize themselves with the game setting, the tools and their role.</p> <p><i>What needs to be changed in the future to further support the realization of digital sustainability education against the background of your own teaching experiences?</i></p> <ul style="list-style-type: none"> ■ Teaching obligation regulations have to be more flexible. ■ Additional investments in digital infrastructure needed, in particular for hybrid teaching.

4.2.2 “*bioSIMin* – explorando la biodiversidad por medio de simulación” (Gerner, M.)

Title of the course	<i>bioSIMin</i> – explorando la biodiversidad por medio de simulación
Lecturer’s name	Loreto Aceitón Perea (Universidad Tecnológica Metropolitana, Chile); Karl Bohmer Muñoz (Universidad Tecnológica Metropolitana, Chile); Dr. Martin Gerner (Technische Universität Dresden) et al. martin.gerner@tu-dresden.de
Development context (course of study); location (university) and previous course frequency	<p>Translation: <i>bioSIMin</i> – exploring biodiversity by means of simulation games</p> <p><i>bioSIMin</i> represents the international edition of <i>bioSim</i>, the simulation-game-based learning assignment that focuses on biodiversity contexts. It has been developed from scratch for a fully-fledged, virtual-digital learning environment in order to address presumed characteristics, including interdisciplinary, inter-institutional, collaborative, tandem-teaching, and transformational, sustainability-related.</p> <p><i>bioSIMin</i> has already attracted roughly 20 participants from Chile and Germany pursuing study courses in international relations, forestry and engineering. Spanish serves as <i>lingua franca</i>. It has been declared UN-Day-2020 project, thus, generously supported by the United Nations Association of Germany, and promoted as globally oriented, cross-cultural learning assignment of the Center for International Studies of Technische Universität Dresden and the sustainability program of the Universidad Tecnológica Metropolitana, Chile.</p>
Topic and contents	<p><i>bioSIMin</i> – explorando la biodiversidad por medio de simulación: los desafíos de una plataforma internacional y de multiples actores al monitoreo de la biodiversidad</p> <p><i>bioSIMin</i> – exploring biodiversity by means of simulation games: challenges of establishing a global, multi-stakeholder platform for biodiversity monitoring.</p>
Learning objectives and competencies to be imparted	<ol style="list-style-type: none"> 1. Participants are acquainted with the simulation-game format. 2. Participants are aware of the importance biodiversity provides as green infrastructure for nature and mankind. 3. Participants are able to explore the spatiotemporal variations of green infrastructure. 4. Participants develop a keen sense for the complexity of valorizing green infrastructure as ecosystem service beyond mere financial assets. 5. Participants obtain informed insights into both methodology and application of monitoring biodiversity. 6. Participants are enabled to apply their gained expertise in specific, virtual and interactive contexts. 7. Participants are able to communicate the importance of green infrastructure by designing the specifications of an app for monitoring biodiversity.
Required competencies/ resources of students	<ul style="list-style-type: none"> ■ Designing role profiles based on expertise ■ Conducting targeted research and content analysis ■ Developing positions in a process-oriented, strategy-driven way of thinking and reasoning ■ Carrying on negotiations in all phases of planning, deciding and arguing ■ Experiencing and tolerating interdisciplinary and interpersonal ambiguity ■ Witnessing agility and spontaneity
Required technical infrastructure at the university	globally accessible, manageable online learning platform (OPAL) unrestricted, ready-to-use conferencing tool (BigBlueButton)

Application of which digital tools	Mentimeter, breakout rooms, chat lounges
Forms of examination	<p>The assessment is formative based on predefined and announced criteria (constructive alignment); it comprises the quadruple e-portfolio consisting of:</p> <ul style="list-style-type: none"> ■ policy paper, including role profile, ■ strategy paper, ■ account of proceedings, and ■ reflection paper. <p>Learning in simulation games is essentially based on the reflection of the experiences gained throughout the interactive process. An appropriate methodology is required in order to be able to organize, systematize and evaluate results and knowledge. The digital portfolio work lives up to this requirement, because it docks flexibly with the individual and scenario-related needs. To make such an e-portfolio easily manageable and reusable in a variety of ways, the digital version of the portfolio was considered. Portfolios are folders of documenting so-called pieces of evidence; they represent the collection of work results, related documents, visualizations and various types of presentations up to audio-visual documentation or pieces of art; they are compiled independently and reflected in a suitable manner.</p>
Qualitative individual/ collective experience report/ description of “lessons learned” from teaching...	<p><i>How has the didactic concept of the course been developed (e.g. exchange with colleagues, inclusion of students, own didactic training)?</i></p> <p><i>bioSIMin</i> has been designed in an exploratory way...</p> <ol style="list-style-type: none"> a) based on recognized patterns for simulation-game design (Klabbers et al. 1989; Duke 2016); b) grounded on multiple years of didactic experience and continuing training as simulation-game developer; c) driven by well-explored learning experiences of multiple cohorts of participants as scientific analyst (Gerner 2018); and d) adapted through tandem-teaching exchange with colleagues of different disciplinary backgrounds. <p><i>What has to be considered during practical implementation of the course (e.g. technical, institutional or other obstacles)?</i></p> <p><i>bioSIMin</i> represents a research-based/exploratory format that provides purposefully designed degrees of freedom. Thus, there are only few institutionalized occasions to test performances in the course of the simulation game. This requires certain tolerance in terms of ambiguity, patience, trial-and-error-loops, processes and (non-)interaction, from both participants and facilitators for not intervening. In many cases, participants are not used to deal with this vagueness and uncertainty. Facilitators of simulation games, however, are well advised to limit their involving commitment to e-tutoring and coaching only! In practical terms, time shifts, intercultural sensitivity and general readiness for alternative modes of learning need to be considered, accordingly, and to be anticipated in/for gaming contexts with cross-cultural participation, in particular.</p> <p><i>What can other lecturers learn from the experiences made so far in the course (tips, tricks, warnings)?</i></p> <p>The essential message taken from <i>bioSIMin</i> is just kick-off! And to continue with lessons learned! Indeed, there are challenges to be dealt with in the course of this exploratory process: learning cultures, for example, differ considerably in terms of grasping the decided notion of simulation game, showing commitment, and feeling encouraged to act in a self-determined,</p>

exploring way. At the same time, the binding character of scheduled steps and deadlines or documented work packages turned out to be a veritable sticking point of intercultural communication. In the end bargaining failed due to the fact that stakeholders organized and committed themselves too little. Failure is – like in the flesh – in the realm of possibility of an exploratory learning assignment. It is due to the professional distancing for the sake of the didactic arrangement not to intervene. In the case of *bioSIMin* this was hard to accept since creative solutions were at hand; only a few participants recognized and realized this window of opportunity. However, the concept of encouraging participants to perform in roles based on scenario-grounded motivations is fascinating since it enables various, often unpredictable learning outcomes. For instance, as result *bioSIMin* provides unanimously agreed upon specifications for an app that monitors biodiversity, even though positions and strategies of contesting stakeholders have varied considerably!

What needs to be changed in the future to further support the realization of digital sustainability education against the background of your own teaching experiences?

Lessons learned comprise the following aspects:

- *international*: global contextualization provides additional dimensions of experience for participants; depending on the perspective, they may be regarded conducive or hampering;
- *value-adding*: conditions of success should be discussed among collaborating teaching teams in advance, including individual and institutional benefits, while considering an increased workload scaling up to double or three times for e-tutoring, e-assessment and platform-based learning;
- *globally-relevant*: globally-relevant issues embedded with institutional affiliations do not necessarily lead to more acceptance or enhanced attractiveness of the learning assignment per se;
- *collaborative*: tandem teaching is recommended as basic rule, since it raises awareness among both facilitators and participants; at the same time, it aligns with individual professionalizing purposes, such as experiencing novel, asynchronous, exploratory learning with novel, revisited paradigms;
- *inter-institutional*: establishing networks of co-operation requires much more coordinating efforts in contexts of team teaching and intercultural involvement; thus, it is recommended to discuss, agree upon and allocate work load in predefined packages in advance;
- *cross-cultural*: roles should consequently be assigned in a culturally heterogeneous manner for taking advantage of immanent changes of perspectives, both attributed with cross-cultural learning and communication;
- *virtual*: making a virtue out of necessity means to grasp provided opportunities whenever promising for realizing and evolving learning assignment in a virtual/digital way; hybrid (both digital and in person) and/or blended (digital and in person alternating) arrangements may represent silver bullets for future considerations;
- *inter-disciplinary*: heterogeneous expertise and diverse professional backgrounds do enrich the functioning of the role-profile-based project teams considerably; due to the didactically established format and exploring nature of a simulation game methodological differences can be well bridged.

4.3 Online degree programs

4.3.1 “M.Sc. Sustainable Transition” (Kiesler, N.; Teuber, R.)

Title of the studies program	M.Sc. Sustainable Transition
Lecturer’s name	Prof. Dr. Ramona Teuber (Head of Study Program), Natalie Kiesler (Instructional Designer)
Development context (course of study); location (university) and previous course frequency	Justus Liebig University Giessen; Faculty 09 - Agricultural Sciences, Nutritional Sciences, and Environmental Management Development Phase; First Time offered: Winter Term 2021/22.
Topic and contents	<p>The faculty 09 at JLU is a highly interdisciplinary faculty comprising professors and teaching staff from a large variety of disciplines such as among others agricultural and food economics, sociology, environmental science and management, nutritional science, and medicine. This interdisciplinarity is also needed for studying sustainability, especially to analyze and evaluate potential pathways to a more sustainable society and finally to take appropriate actions. Hence, the newly developed master program Sustainable Transition will benefit from a long-established tradition at the FB 09 offering interdisciplinary study programs. More specifically, the study program consists of eleven mandatory modules (core modules), five optional modules (profile modules), and the master thesis.</p> <p>Core Modules (Mandatory Courses)</p> <ul style="list-style-type: none"> ■ Applied Statistics (6 CP) ■ Theory and Practice of Economic Development (6 CP) ■ Global Food Markets (6 CP) ■ Sustainable Food Systems (6 CP) ■ International Economics (6 CP) ■ Climate Change and Development (6 CP) ■ Resource Economics, Sustainability & Environmental Management (6 CP) ■ Renewable Energy Transition (6 CP) ■ Natural Resources and Ecosystem Services (6 CP) ■ Food Politics (6 CP) ■ Scientific Working and Writing (6 CP) <p>Having completed the core modules, the students are well equipped with a solid scientific education and ready to broaden their knowledge in specific research areas. By individually choosing their profile modules from a diverse range of study areas students shape their individual competence profile. Profile modules will be offered in fields such as Python for Environmental Scientists or Land Governance for Sustainable Land Use in Africa</p> <p>Further information: https://www.uni-giessen.de/study/courses/master/sustainable-transition?set_language=en</p>
Learning objectives and competencies to be imparted	<p>Students obtaining the degree have acquired the following skills/competencies:</p> <ul style="list-style-type: none"> ■ Being able to analyze and understand the concept of sustainability and the involved trade-offs through the lens of different disciplines; ■ Comprehend the various areas of transition, including economic, legal, political, social, agricultural, and environmental aspects and their interlinkages with sustainability;

	<ul style="list-style-type: none"> ■ Possess knowledge as well as analytical competences in methods and strategies to enhance the transition processes towards a more sustainable economy; ■ Be skilled in evaluating transition processes from a sustainability perspective and developing solutions for sustainable transitions applicable to the private and public sector.
<p>Required competencies/ resources of students</p>	<p>Applicants must hold a bachelor's degree with at least 180 ECTS points and the grade good or very good in one of the following scientific fields: Agriculture, Nutrition, Natural or Environmental Sciences, Economics, Political Sciences. Proof of sufficient knowledge in economics, and/or the social sciences, i.e., at least 60 ECTS points in at least one of these subjects. The application includes a letter of motivation outlining the candidate's personal motivation and his or her subject-specific knowledge.</p> <p>As the entire degree course is taught in English, applicants must provide proof of sufficient knowledge of written and spoken English (i.e., TOEFL test etc.).</p> <p>As students have to work with learning management systems, elaborate knowledge and submit several different written tasks, the following technical requirements are expected: a reliable internet connection, a computer with sufficient screen size (about 15 inches), camera and headset, whereas several different devices and combinations are possible (i.e., laptop with integrated camera or web cam plus headset and possibly an additional screen). Students should be careful about their choice of tablets, as statistic programs, for instance, do not run on every device. We therefore recommend using a laptop or a classic workstation computer. We advise students to refrain from studying with only a smartphone.</p> <p>In addition, students should be able to study autonomously and in a self-regulated manner. Students will have to manage their time and resources responsibly. As courses and material will be realized online, we also expect digital literacy and a competent use of digital tools and today's learning management systems.</p>
<p>Required technical infrastructure at the university</p>	<p>The study program requires a technical infrastructure with educational technologies and the respective know-how or training offers to use them. Thus, the program depends on learning management systems (in our case ILIAS and Stud.IP), exam tools and their alignment with local data protection regulations, the higher education law and even state regulations regarding, for instance, e-exams, as well as e-teaching and e-assessment in general.</p> <p>The technical infrastructure for synchronous online teaching and learning also requires hardware and software components for educators. Webcams, headsets and licenses for video conferencing software (i.e., Cisco WebEx, MS Teams) are among them. Moreover, screencasting software (OBS studio, Camtasia Studio, etc.) helps support the recording of asynchronous e-lectures.</p> <p>In the context of future hybrid learning and teaching scenarios, a mobile conferencing system (Logitech MeetUp/Group system + TV screen on wheels) will help stream synchronous in-class meetings. The IT Service Centre also offers support by means of a camera team for recording or streaming (e-)lectures, by offering a self-recording studio, a glass white board and other technical equipment for video production. The support structures for the use of the technical infrastructure via the IT Service Centre is crucial. The (media) didactic support is assured through an instructional designer position and several consultants with didactic expertise.</p>

<p>Application of digital tools</p>	<p>Uni-assist and JLU's online application portal processes and administrates international and national applications for the study program. Once matriculated, students receive a university e-mail address and a student user ID including a password, which constitutes the basis for using all further services listed below.</p> <p>Stud.IP and ILIAS are used as <i>Learning Management Systems</i> (LMS) and the registration for courses (i.e., for communication, providing study material, e-lectures, exercises, for organizing study groups, peer-reviews, office hours, etc.). The LMS thus constitute the baseline of our online classes as links to live meetings and further material can be clustered and saved.</p> <p>FlexNow helps administrate the exam registrations. Additional services comprise, for instance, the JLUbox/Hessenbox as an alternative to Dropbox. Electronic media and resources from JLU's library system can be used via the EZ-Proxy Server. Furthermore, Cisco WebEx and Microsoft Teams are used for facilitating synchronous courses, live meetings and asynchronous group work, chats, etc. respectively. Lecturers may however choose further tools, technologies and applications.</p>
<p>Forms of examination</p>	<p>Up to three of the following forms of examinations per module can be selected: Assignments, presentation, written examination, project work, seminar paper and the respective combinations of these forms (i.e., presentation and project work).</p>
<p>Qualitative individual/ collective experience report/ description of "lessons learned" from teaching...</p>	<p><i>How has the didactic concept of the course been developed (e.g. exchange with colleagues, inclusion of students, own didactic training)?</i></p> <ul style="list-style-type: none"> ■ Experience and exchange with colleagues with regard to the other English-language programs of the faculty. ■ Support via an instructional designer position and academic research assistants as part of a project funding by the German Academic Exchange Service. <p><i>What has to be considered during practical implementation of the course (e.g. technical, institutional or other obstacles)?</i></p> <ul style="list-style-type: none"> ■ Intercultural aspects of teaching and learning along with the resulting technological obstacles, such as using WebEx in Iran, students' equipment and internet connection, group work and instruction covering various time zones, etc. ■ Supporting lecturers with regard to the use of digital tools and the IT infrastructure. ■ Assuring sufficient interaction among students, as well as between students and lecturers. ■ Offering all of the relevant information regarding the student life cycle (application, enrolment, exam registration, re-registration) in English. ■ Offering counselling for students prior and during the program. ■ Preventing high retention rates via information, transparency, counselling options, social events, and fostering a connection to the institution and the academic community. ■ Continual review of institutional policies and their alignment with the special requirements of digital programs (exam policies, higher education laws, data protection regulations, etc.) and, if possible, assure the according revision. <p><i>What can other lecturers learn from the experiences made so far in the course (tips, tricks, warnings)?</i></p>

	<ul style="list-style-type: none"> ■ Fully virtual study programs require the institution's and faculty's support (top-down) and intense collaboration with other stakeholders within your institution (IT service department, the entire administration apparatus, legal department, public relations, etc.). Do not try it alone. It will be painful. ■ Prepare for many questions from (prospective) students and freshmen during the study entry phase and offer information packages related to the university, forms of instruction and assessment, the IT infrastructure, etc. ■ Funding and support structures for lecturers are recommendable, as technical equipment, (media) didactic support, further trainings and more human resources (academic staff, lecturers, study coordinator, teaching assistants, etc.) are required, especially if educators have few prior experiences in and resources for online teaching and assessment. ■ Core modules should be facilitated by permanent faculty members in order to ensure continuity, as well as high-quality courses and material. ■ Always test new tools and technologies before using them in courses with students. ■ Invest in a reliable IT-infrastructure (above all your LMS and video conferencing system) as a backbone for your study program. ■ Engage interaction between students by using didactic methods and tools in both synchronous and asynchronous classes, as learning communities improve student success. ■ Provide alternative forms of instruction and assessment throughout the study program. <p><i>What needs to be changed in the future to further support the realization of digital sustainability education against the background of your own teaching experiences?</i></p> <ul style="list-style-type: none"> ■ Continuous funding for state-of-the-art hardware and software, teaching or research assistants, as well as permanent (media) didactic support structures. ■ Continuity and a reliable framework with regard to higher education laws and other legal aspects, teaching loads, data protection regulations, the approval of educational technologies such as video conferencing tools etc. ■ Establish sustainable support structures to ensure, for instance, counselling throughout the student life cycle even beyond an initial funding phase.
--	--

4.4 Toolbox and methods

(Breitmeier, H.; Hickmann, T.; Lederer, M.; Marquardt, J.; Schwindenhammer, S.; Strobehn, K.; Weiland, S.)

The following section provides a summary of the presented digital tools and didactical methods which can be applied in DSE and online teaching in general. The list is not exhausted and the terms of usage as well as pricing of the listed software and tools might be subject to changes in the future, therefore, the description must be read as a current snapshot as of August 2021. With regard to current legal and data protection framework conditions, the usage of specific software, particularly conference and meeting programs or cloud storages, should be clarified prior to the purchase as e.g. the server location, encryption or data storage policies might not be compatible with a country's data protection legislation.

Tools for digital (sustainability) education

Topic	Description
Conference and meeting tools	
Adobe Connect	<p>Adobe Connect is a video conference and communication tool which comes with multiple functions, amongst others, breakout rooms, polling, whiteboards etc.</p> <ul style="list-style-type: none"> Costs and registration: Registration required; there is a free 30 days trial available. Link: https://www.adobe.com/de/products/adobeconnect.html
Alfa View	<p>Alfa View is a communication tool and video conference program which includes several functions as e.g., screen sharing, polling etc.</p> <ul style="list-style-type: none"> Costs and registration: Registration required; there is a free version for private persons and university license available. Link: https://alfaview.com/en/
BigBlueButton	<p>BigBlueButton is a video conference and communication program which enables screen sharing, breakout rooms, polling, multi-user whiteboards etc.</p> <ul style="list-style-type: none"> Costs and registration: Open source license. Link: https://bigbluebutton.org/
Cisco WebEx	<p>Cisco WebEx can be used for implementing video conferences and provides multiple tools, as e.g. whiteboards, polling function, recording etc.</p> <ul style="list-style-type: none"> Costs and registration: Registration required; limited free version available. Link: https://www.webex.com/de/index.html
Discord	<p>With Discord, a video conference and communication tool, new chats and channels can be created to facilitate online communication.</p> <ul style="list-style-type: none"> Costs and registration: Registration required; freeware. Link: https://discord.com/
Jitsi Meet	<p>Jitsi Meet is a video conference tool with a chat, live streaming, screensharing function. It does not provide a whiteboard or polling function.</p> <ul style="list-style-type: none"> Costs and registration: Free open source; no registration or download needed but possible Link: https://jitsi.org/jitsi-meet/
Microsoft Teams	<p>Microsoft Teams is a video conference and collaboration software. On Microsoft Teams, specific channels, sub-channels and private chats can be created. In these chats and channels, users can upload files in the chat and work simultaneously together, using Microsoft Office (desktop) apps.</p> <ul style="list-style-type: none"> Costs and registration: Registration required; there are several MS Teams versions, amongst others a freeware version, an education and a business license. More: https://www.microsoft.com/en-us/microsoft-teams/group-chat-software
Zoom	<p>Zoom is a video conference and communication program which provides multiple tools, amongst others, breakout rooms, polling, whiteboards etc.</p> <ul style="list-style-type: none"> Costs and registration: Registration required; free version with limited functions available Link: https://zoom.us/

E-learning platforms	
E-learning platforms (mainly provided by universities)	<ul style="list-style-type: none"> ■ University information systems (e.g. LSF) ■ Learning management systems (e.g. Moodle, ILIAS, Stud.IP, Blackboard) ■ Examination systems (e.g. FlexNow) ■ Online storage systems (e.g. Hessenbox, JLUBox)
Collaboration tools, whiteboards and mind mapping tools	
Conceptboard	<p>Conceptboard is an online whiteboard and collaboration tool which can be used for simultaneous group work and brainstorming. It provides also a video conference, commenting as well as cloud storage function and allows the upload of external files.</p> <ul style="list-style-type: none"> ■ Costs and registration: Registration required; free limited license and free 30 days trial available ■ Link: https://conceptboard.com/
CryptPad	<p>CryptPad offers the possibility to simultaneously (and anonymously, if desired) work on documents etc. online and store them on the CryptDrive. It also provides a whiteboard function.</p> <ul style="list-style-type: none"> ■ Costs and registration: Registration not required but possible to use more functions; free license available ■ Link: https://cryptpad.fr/
Etherpad	<p>Etherpad is a collaborative, real-time online text editor.</p> <ul style="list-style-type: none"> ■ Costs and registration: Open source; online access without download and registration possible via alternative providers, e.g. with Yopad. ■ Link: https://etherpad.org/
h5p	<p>With the h5p plugin, various interactive tools, such as quizzes, games, videos, can be created and, amongst others, be integrated in learning management systems.</p> <ul style="list-style-type: none"> ■ Costs and registration: There is a free trial (30 days) available which does not require a separate hosting website. Free plugin versions are only available for selected learning management systems, e.g. for Moodle. ■ More: https://h5p.org/
Miro	<p>Miro is an online whiteboard on which people can simultaneously work and brainstorm together. It simulates real whiteboard experiences with providing various tools, amongst others digital post-its.</p> <ul style="list-style-type: none"> ■ Costs and registration: Free educator license available; registration required ■ More: https://miro.com/
Padlet	<p>Padlet provides virtual pin boards/ white boards which can be edited simultaneously by different users.</p> <ul style="list-style-type: none"> ■ Costs and registration: Free limited license available; registration required. ■ Link: https://de.padlet.com/
Yopad	<p>Yopad/ EtherPad Lite is a collaborative online text editor.</p> <ul style="list-style-type: none"> ■ Costs and registration: Free version ■ More: https://yopad.eu/
Xmind	<p>Xmind is a mind mapping tool.</p> <ul style="list-style-type: none"> ■ Costs and registration:

	<p>Free trial available; special education licenses</p> <ul style="list-style-type: none"> ■ More: https://www.xmind.net/
Survey tools	
Mentimeter	<p>Mentimeter is a polling tool which can be used for live polling events. Several polling templates as e.g. rating, word clouds, multiple choice, are available. During the polling process, the results can be shared simultaneously with the participants.</p> <ul style="list-style-type: none"> ■ Costs and registration: Limited freeware version available; registration required ■ More: https://www.mentimeter.com/
Sli.do	<p>Sli.do is a polling tool which can be used for live polling events. Several polling templates as e.g. rating, word clouds, multiple choice, are available. During the polling process, the results can be shared simultaneously with the participants.</p> <ul style="list-style-type: none"> ■ Costs and registration: Limited freeware version available; registration required ■ More: https://www.sli.do/de
Screencasting and video softwares/ platforms	
Camtasia Studio	<p>Camtasia Studio is a video editing and recording program.</p> <ul style="list-style-type: none"> ■ Costs and registration: No registration but download required; free 15 days trial available ■ More: https://www.techsmith.de/camtasia.html
OBS studio	<p>With the Open Broadcaster Software (OBS) studio, videos can be recorded and livestreams produced.</p> <ul style="list-style-type: none"> ■ Costs and registration: Freeware; download required ■ More: https://obsproject.com/
PowerPoint	<p>PowerPoint is a software for creating presentations which also includes a recording function. Thereby, it is a practical tool for producing videos for asynchronous teaching.</p> <ul style="list-style-type: none"> ■ Costs and registration: There are several versions but no freeware version. The software can be bought separately or in combination with other Microsoft programs (e.g. Word, Excel). The Microsoft Office 365 program bundle can be tested for free for one month. ■ More: https://www.microsoft.com/en-us/microsoft-365/powerpoint
Shotcut	<p>Shotcut is a software for editing and cutting videos.</p> <ul style="list-style-type: none"> ■ Costs and registration: Freeware; download required ■ More: https://shotcut.org/
Youtube	<p>Youtube is a video platform on which you can upload, organize and share your videos publicly or privately with a selected audience. It also includes a livestreaming and commenting function.</p> <ul style="list-style-type: none"> ■ Costs and registration: Online freeware version available; registration required ■ More: https://www.youtube.com/

Didactical methods for digital (sustainability) education	
Topic	Description
Ideas for asynchronous digital teaching	
General conceptual and structural hints	<ul style="list-style-type: none"> ■ Recording short videos or podcasts (e.g. welcoming videos to explain the course structure or usage of digital tools; introduction and explanation of specific topics; etc.) ■ Application of inverted (online) classroom model (e.g., refer to the example delivered by Nora Große, pp. 16-18)
Single works	<p>Online teaching modules which can comprise:</p> <ul style="list-style-type: none"> ■ Watching/ creating (short) videos ■ Listening/ creating podcasts ■ Poster creation ■ Quizzes ■ Text work (case study analyses; writing essays, summaries, abstracts; question guided analyses; etc.)
Group works	<ul style="list-style-type: none"> ■ Chat and commenting function to allow asynchronous discussions and answer questions ■ Creation of a wiki glossaries
Ideas for synchronous digital teaching	
Group works	<ul style="list-style-type: none"> ■ Flashlight rounds ■ Breakout rooms for separate discussions and the preparation of tasks (breakout rooms are a feature of some meeting software) ■ Drafting papers (e.g., briefings, strategies, press releases, policy evaluation plans, laws etc.)
Interactive group works	<ul style="list-style-type: none"> ■ Online planning games (e.g., "Conservation conflicts in coastal areas – a planning game" by Jonas Hein, pp. 19-21) ■ Online simulation games (e.g., refer to the example delivered by Martin Gerner, pp. 22-24) ■ simulated virtual science conference (e.g. "Research-oriented online seminar with case study – political processes in bioeconomy policy" by Katrin Beer, pp. 9-11)

5. Conclusion

(Breitmeier, H.; Hickmann, T.; Lederer, M.; Marquardt, J.; Schwindenhammer, S.; Strobehn, K.; Weiland, S.)

DSE has huge potential to increase access equality to sustainability knowledge, lifelong learning and inclusion to ensure that no one is left behind both now and in the future. To ensure DSE in the post-pandemic world, presence-based teaching universities need to further open up the model of face-to-face education to blended learning teaching practices. As the good practice DSE teaching examples introduced in section 4 show, hybrid teaching models can not only foster students' participation through the application of innovative (technical and didactic) methods but also encourage self-learning and independent exchange among students. The combination of asynchronous and synchronous teaching elements can thereby help to keep students interested and engaged beyond the seminar's context and

time. However, as discussed before, the creation of an appropriate online learning environment and atmosphere is crucial to maintain the personal connection between students and lecturers. In addition, both lecturers and students are not yet digital natives, therefore, the introduction and application of “new” software and tools should be done proportionally and be guided by respective explanations. Moreover, governments will need to make greater effort and investments to create conducive conditions for DSE learning and teaching for students and lecturers, e.g. constant internet access (Leal Filho et al. 2021: 11272). There is also a need to enhance technological resources and lecturers teaching skills as well as to facilitate and support (home) working with appropriate hardware, software and systems access (Leal Filho et al. 2021: 11272). Lecturers as well as students need to receive the professional teaching experience, learning skills and institutional infrastructure and support required for good DSE practices. We are optimistic, that the lessons learned and good practice teaching examples and tools shared in this working paper contribute to the further development of such good DSE practices.

References

- Arbeitskreis Hochschullehre der DVPW (n.d.). Toolbox Hochschullehre Politikwissenschaft. In: Deutsche Vereinigung für Politikwissenschaft. Retrieved 20 July 2021 from: https://www.dvpw.de/fileadmin/docs/Lehre/DVPW_Toolbox_2020-12-14.pdf
- Barth, M.; Godemann, J.; Rieckmann, M.; Stoltenberg, U. (2007). Developing key competencies for sustainable development in higher education. *International Journal of Sustainability in Higher Education* 8(4), 416-430.
- Brudermann, T.; Aschemann, R.; Füllsack, M.; Posch, A. (2019). Education for Sustainable Development 4.0: Lessons learned from the University of Graz, Austria. *Sustainability* 11(8), 2347.
- Cebrián, G.; Junyent, M. (2015). Competencies in Education for Sustainable Development: Exploring the student teachers' views. *Sustainability* 7(3), 2768-2786.
- Coman, C.; Tîru, L. G.; Mesesan-Schmitz, L.; Stanciu, C.; Bularca, M. C. (2020). Online teaching and learning in higher education during the coronavirus pandemic: Students' perspective. *Sustainability* 12(24), 10367.
- Cusanus (2021). 'Über diesen Blog', #coronaverstehen. Retrieved 12 July 2021 from: <https://www.coronaverstehen.de/über-diesen-blog>
- de Haan, G. (2008). Gestaltungskompetenz als Kompetenzkonzept der Bildung für nachhaltige Entwicklung. In: Bormann, I.; de Haan, G. (Eds.): Kompetenzen der Bildung für nachhaltige Entwicklung. Wiesbaden: VS Verlag für Sozialwissenschaften, 23-43.
- Duke, R. D. (2016). A Paradigm for Game Design. *Simulation & Games* 11 (3), 364-377.
- Freise, M. (2021). Politikwissenschaftliche Leseübungen in der Online-Lehre. In: Lambach, D. (ed.): Bausteine digitaler Hochschullehre in der Politikwissenschaft. Frankfurt a. M.: Wochenschau Verlag, 53-62.
- Gerner, M. (2018). Snapshots on simulation games in academic contexts. *HDS.Journal*, 1+2. Leipzig (1+2), 83-87. Retrieved 13 May 2019 from: <http://ul.qucosa.de/api/qucosa%3A33234/attachment/ATT-0/>
- Gerner, M.; Pause, M. (2020). Advancing Learning Assignments in Remote Sensing of the Environment Through Simulation Games. *Remote Sensing* 12(4), 735.
- Gherheş, V.; Şimon, S.; Para, I. (2021). Analysing students' reasons for keeping their webcams on or off during online classes. *Sustainability* 13(6), 3203.
- Ginzky, H., Löwe, C. & Neßhöver, C. (2020). Lehren aus der Corona-Krise: Neue Leitmotive für die Umwelt- und Nachhaltigkeitspolitik erforderlich? - ein Diskussionsbeitrag. Umweltbundesamt: Dessau-Roßlau.
- Grund, J.; Brock, A. (2018). Bildung für nachhaltige Entwicklung in Lehr-Lernsettings – Quantitative Studie des nationalen Monitorings – Befragung junger Menschen, Berlin: Freie Universität Berlin/Institut Futur.
- Hawlitsek, A.; Merkt, M. (2018). Die Relevanz der Integration von Präsenz- und Onlinephasen für den Lernerfolg in Blended-Learning-Szenarien. In: Getto, B.; Hintze, P.; Kerres, M. (eds.): Digitalisierung und Hochschulentwicklung. Proceedings zur 26. Tagung der Gesellschaft für Medien in der Wissenschaft e.V. Münster; New York: Waxmann, 188-199.
- Howlett, C.; Ferreira, J.-A.; Blomfield, J. (2016). Teaching sustainable development in higher education: Building critical, reflective thinkers through an interdisciplinary approach. *International Journal of Sustainability in Higher Education* 17(3), 305-321.
- Klabbers, J. H. G.; Scheper, W. J.; Takkenberg, C. A. TH.; Crookall, D. (eds.) (1989). Simulation-Gaming. On the Improvement of Competence in Dealing with Complexity, Uncertainty and Value Conflicts. Department of Gamma-Informatics, Utrecht University, The Netherlands 16-19 August 1988. International Simulation and Gaming Association (ISAGA). 1st ed. Oxford, New York: Pergamon Press

- (Proceedings of the International Simulation and Gaming Association's 19th International Conference). Retrieved 22 August 2020 from: <https://b-ok.cc/dl/2367183/d93dea>
- Konrad, P. (2021a). Feedback über Tweedback. In: Lambach, D. (ed.): Bausteine digitaler Hochschullehre in der Politikwissenschaft. Frankfurt a.M.: Wochenschau Verlag, 102-103.
- Konrad, P. (2021b). Gemeinsam erstellt: Wikis für Lehrveranstaltungen. In: Lambach, D. (ed.): Bausteine digitaler Hochschullehre in der Politikwissenschaft. Frankfurt a.M.: Wochenschau Verlag, 104-105.
- Lambach, D.; Kärger, C. (2021). Asynchrone und synchrone Lehre verzahnen: Der Online-only Flipped Classroom. In: Lambach, D. (Ed.): Bausteine digitaler Hochschullehre in der Politikwissenschaft. Frankfurt a.M.: Wochenschau Verlag, 20-29.
- Leal Filho, W.; Price, E.; Wall, T. *et al.* (2021). COVID-19: the impact of a global crisis on sustainable development teaching. *Environment, Development and Sustainability* 23, 11257-11278.
- Muthu, S. S. (ed.) (2021). *The Water-Energy-Food Nexus: Concept and Assessments*. Singapore: Springer.
- Messner, D.; Fromhold-Eisebith, M.; Grote, U.; Matthies, E.; Pittel, K.; Schellhuber, H. J.; Schieferdecker, I.; Schlacke, S.; Schneidewind, U. (2019). Digital Momentum for the UN Sustainability Agenda in the 21st Century. Berlin: WBGU. Retrieved 20 July 2021 from: https://www.wbgu.de/fileadmin/user_upload/wbgu/publikationen/politikpapiere/pp10_2019/pdf/WBGU_PP10_DT.pdf
- Napal, M.; Mendióroz-Lacambra, A. M.; Peñalva, A. (2020). Sustainability teaching tools in the digital age. *Sustainability* 12(8), 3366.
- Oxenfarth, A. (ed.) (2020). Die Coronakrise: Stimulanz für die Große Transformation? *politische Ökologie*, 04-2020 (163), Oekom-Verlag, München.
- UNCED (1992). Agenda 21, Rio Declaration, Forest Principles. New York: United Nations.
- UNESCO (2014). Shaping the future we want: UN Decade of Education for Sustainable Development (2005-2014). Final Report. Paris: UNESCO. Retrieved 19 July 2021 from: <https://unesdoc.unesco.org/ark:/48223/pf0000230171>
- UNESCO (2015). Rethinking education. Towards a global common good? Paris: UNESCO. Retrieved 18 July 2021 from: <http://unesdoc.unesco.org/images/0023/002325/232555e.pdf>
- UNESCO (2017). Education for Sustainable Development Goals. Learning objectives. Paris UNESCO. Retrieved 18 July 2021 from: https://www.unesco.de/sites/default/files/2018-08/unesco_education_for_sustainable_development_goals.pdf
- UNESCO (2020). Education for sustainable development. A roadmap. Paris: UNESCO. Retrieved 18 July 2021 from: <https://www.gcedclearinghouse.org/sites/default/files/resources/200782eng.pdf>
- UNGA (2015). Transforming our world: The 2030 Agenda for Sustainable Development. Resolution adopted by the General Assembly on 25 September 2015. A/RES/70/1. New York: United Nations.
- Rosner-Merker, T. (2021a). Lektürepodcast. In: Lambach, D. (ed.): Bausteine digitaler Hochschullehre in der Politikwissenschaft. Frankfurt a.M.: Wochenschau Verlag, 106-107.
- Rosner-Merker, T. (2021b). Zielscheibenabfrage. In: Lambach, D. (ed.): Bausteine digitaler Hochschullehre in der Politikwissenschaft. Frankfurt a.M.: Wochenschau Verlag, 108-109.
- Rosner-Merker, T. (2021c). Placemat. In: Lambach, D. (ed.): Bausteine digitaler Hochschullehre in der Politikwissenschaft. Frankfurt a.M.: Wochenschau Verlag, 110-111.
- Samuel, S. (2020). Our environmental practices make pandemics like the coronavirus more likely. Vox, Retrieved 12 July 2021 from: <https://www.vox.com/future-perfect/2020/3/31/21199917/coronavirus-covid-19-animals-pandemic-environment-climate-biodiversity>

Wals, A. E. J.; Corcoran, P. B. (2006). Sustainability as an outcome of transformative learning, in: Holmberg, John, Samuelsson, Bo. E. (eds.): Drivers and barriers for implementing sustainable development in higher education. Paris: UNESCO, 103-108. Retrieved 20 July 2021 from: <https://unesdoc.unesco.org/ark:/48223/pf0000148466>

Winde, M., Werner, S.D., Gumbmann, B. & Hieronimus, S. (2020). Hochschulen, Corona und jetzt? Future Skills Diskussionspapier 4. Essen: Stifterverband für die Deutsche Wissenschaft.

About the editors

Prof. Dr. Helmut Breitmeier is Professor of International Relations at Justus Liebig University Giessen since 2013 and member of the board at the ZEU. Between 2008 and 2013 he has been Professor of International Relations at the Open University in Hagen (Germany). He is one of the four principal investigators of JLU's SDGnexus Network which is part of the DAAD "Higher Education Excellence in Development Cooperation – exceed" program. The network aims to strengthen higher education for enabling effective and innovative contributions to the Sustainable Development Goals (SDGs) of the United Nations. His research interests focus on the analysis of politics in international and transnational institutions (global governance), on effectiveness of governance, sustainability policy as well as on normative questions of democratic legitimacy and distributive justice.

Dr. Thomas Hickmann is a researcher at the Copernicus Institute of Sustainable Development at the University of Utrecht in the Netherlands. There, he studies the governance effects of the Sustainable Development Goals on politics and society on the one hand, and on the other hand, he deals with new approaches to climate and sustainability policy. Prior to his current appointment, he was a PhD student and postdoctoral researcher at the University of Potsdam, where he successfully defended his dissertation in the topic area of global climate policy in 2014. He studied political science and public law at the Universities of Copenhagen and Potsdam. Thomas is one of the spokespersons of the working group "Environmental Policy and Global Change" of the German Political Science Association. His most recent books are: "The Anthropocene Debate and Political Science" (London: Routledge, 2019, ed. with L. Partzsch, P. Pattberg, S. Weiland) and "The Sustainable Development Goals as a Transformative Force?" (Cambridge: Cambridge University Press, 2022, ed. with F. Biermann, C.-A. S nit).

Prof. Dr. Markus Lederer is Professor of International Relations at TU Darmstadt since 2016. Previous academic stations included University of M nster, the University of Potsdam, and the University of Bremen. His research focuses on global environmental, climate and development policy. Current projects focus on the political aspects of decarbonization processes, especially in countries of the global South. He also studies the role of administrations and public institutions in climate and energy policy. Questions of the geopolitics of renewable energy, climate engineering, green new deals, or populism and climate change were also explored in smaller papers. Markus is one of the spokespersons of the working group "Environmental Policy and Global Change" of the German Political Science Association. He has published his work in various international journals, most recently in *Regulation & Governance*, *Environmental Politics*, *Cambridge Review of International Affairs*, *Geopolitics*, *Global Environmental Politics*, and the *Journal of Environment and Development*.

Dr. Jens Marquardt is a research associate at the Institute of Political Science at TU Darmstadt. There, he is primarily researching how climate protection measures can be successfully institutionalized in the global South within the framework of a DFG research project. Jens received his PhD from Freie Universit t Berlin in 2015 and subsequently researched and taught at Harvard University and Stockholm University, among others. His research interests include issues of power, social conflict, and visions of the future in relation to environmental and climate policy. Jens is one of the spokespersons of the working group "Environmental Policy and Global Change" of the German Political Science Association. His publications include "How Power Shapes Energy Transitions in Southeast Asia" (London: Routledge, 2017) and "Governing Climate Change in Southeast Asia" (London: Routledge, 2021, ed. with L. Delina, M. Smits).

Dr. Sandra Schwindenhammer is deputy coordinator and project leader of the BMBF collaborative research project "SUSKULT: Development of a Sustainable Cultivation System for Food of Resilient Metropolitan Regions, Subproject F" (2019-2022, FKZ: 031B0728F) at Justus Liebig University Giessen.

She received her PhD in political science with a focus on international relations from the Technical University of Darmstadt (2011). Sandra is one of the spokespersons of the working group “Environmental Policy and Global Change” of the German Political Science Association and member of the ZEU. Her research interests include theories and conflicts of global norms (Sustainable Development Goals), political authority of private agents of change, and (urban) sustainability transformation. Sandra has published her work in various international journals, e.g. in *Global Environmental Politics*, *Journal of European Public Policy*, *Journal of Comparative Policy Analysis* and *Journal of Environmental Policy & Planning*.

Katrin Strobehn is research assistant at the ZEU at the Justus Liebig University Giessen and is currently doing her PhD in political science with a focus on international relations. Before, she studied European Studies and Transition Management at the universities of Magdeburg and Giessen. Katrin’s research focuses particularly on the water-energy-food nexus in international development cooperation, environmental and global governance as well as on critical norm research.

Prof. Dr. Sabine Weiland is Associate Professor at the Université Catholique de Lille and director of the ESPOL-LAB Research Centre for European and International Politics. She works on environmental policy, food policy, sustainability governance and transformation as well as on knowledge in policy processes. Previous research experience includes the Helmholtz Centre for Environmental Research - UFZ in Leipzig, Freie Universität Berlin, Université Catholique Louvain, Belgium, and Sciences Po Paris, France. Sabine is one of the spokespersons of the working group “Environmental Policy and Global Change” of the German Political Science Association.



This publication is licensed for use under a [Creative Commons Attribution 4.0 International License \(CC BY 4.0\)](https://creativecommons.org/licenses/by/4.0/). Subject to attribution, you are free to share (copy and redistribute the material in any medium or format), adapt (remix, transform, and build upon the material) for any purpose, even commercially.

Editors: Sandra Schwindenhammer, Katrin Strobehn, Helmut Breitmeier, Thomas Hickmann, Markus Lederer, Jens Marquardt and Sabine Weiland

With contributions from: Katrin Beer, Katja Biedenkopf, Helmut Breitmeier, Martin Gerner, Nora Große, Tobias Gumbert, Jonas Hein, Thomas Hickmann, Natalie Kiesler, Markus Lederer, Jens Marquardt, Lisa Pettibone, Sandra Schwindenhammer, Katrin Strobehn, Ramona Teuber and Sabine Weiland

Recommended citation: Schwindenhammer, S.; Strobehn, K.; Breitmeier, H.; Hickmann, T.; Lederer, M.; Marquardt, J.; Weiland, S. (eds.) (2021). Digital Sustainability Education – Potential, Development Trends and Good Practices, SDGnexus Network Working Paper 03-2021. Center for international Development and Environmental Research (ZEU), Justus Liebig University Giessen. DOI: <http://dx.doi.org/10.22029/jlupub-99>

Front cover photo: Johannes Damster

SDG^{nexus} Network

Centre for International Development
and Environmental Research (ZEU)
Justus Liebig University Giessen
Senckenbergstrasse 3
35390 Giessen, Germany

+49 641 99-12701
sdgnexus@zeu.jlug.de
@SDGnexusNET
www.sdgnexus.net

German Academic Exchange Service (DAAD) grant number 57526248,
programme "exceed - Hochschulexzellenz in der Entwicklungszusammenarbeit".

