Learning for Sustainable Development in Higher Education and Beyond: Finding and Shaping Transformative Spaces

Inaugural dissertation
of the Faculty of Science,
University of Bern

presented by

Lilian Julia Trechsel
from Winterthur ZH

Supervisor of the doctoral thesis:
Prof. Dr. Thomas Breu
Centre for Development and Environment (CDE), University of Bern

source: https://doi.org/10.48549/4572 | downloaded: 14.7.2025

Learning for Sustainable Development in Higher Education and Beyond: Finding and Shaping Transformative Spaces

Inaugural dissertation
of the Faculty of Science,
University of Bern

presented by

Lilian Julia Trechsel
from Winterthur ZH

Supervisor of the doctoral thesis:
Prof. Dr. Thomas Breu
Centre for Development and Environment (CDE), University of Bern

Accepted by the Faculty of Science.

Bern, 2 Dec. 2021

The Dean
Prof. Dr. Zoltan Balogh

creative commons

This work is licensed under a Creative Commons Attribution 4.0 International (CC BY 4.0) Licence. See http://creativecommons.org/licenses/by/4.0/ to view a copy of the licence.

Abstract

What role can higher education institutions (HEIs) play in tackling the urgent sustainability challenges we currently face locally and globally? Education is at the heart of the 2030 Agenda, key to the success of all the Sustainable Development Goals (SDGs), and seen as a crucial lever for transformation. From the perspective of the 2030 Agenda, it is essential to ensure that universities provide conditions for teaching and learning that make education for sustainable development (ESD) possible. HEIs are increasingly committing to sustainable development (SD) as part of their overall mission. However, they often approach SD sectorally and fail to establish a mutual dialogue with important policy actors.

Using a mixed-methods approach focused on in-depth qualitative interview data and the quantitative results of a tracer study, this dissertation investigates how HEIs can redefine their education mission and learn from the experiences of students and HEI staff in order to contribute to societal transformation towards SD. Approaching the topic from a theory-of-change perspective, the research includes an impact chain of SD integration in HEIs, which provides the conceptual framework for the dissertation.

First, the dissertation begins by presenting the results of an analysis of the University of Bern's strategy to mainstream SD. Here, it highlights the importance of rethinking institutional structures in order to motivate lecturers to engage with SD and to provide them with opportunities to find links between their discipline and SD.
Second, it analyses a tracer study of international PhD alumni, many of whom went on to work in academia following graduation. In analysing the students' experiences, the study sheds light on the inequalities of tertiary education and unequal career trajectories more broadly, which tend to marginalize the global South while strengthening Northern (Western) universities. It calls for interdisciplinary and transdisciplinary educational programmes that facilitate safe and innovative learning spaces in which students from all parts of the world are brought together, exchange and capacity development are supported, and opportunities for trainers and network building are provided. The study proposes to enhance academic metrics that emphasize experience, research quality, and societal contributions over journal impact factors.
Third, the dissertation explores the experience of Swiss students who build bridges between science and society in the context of student-led projects. Here, the research examines settings and spaces where formal and non-formal learning meet, listening to the voices of students who act as "boundary agents" between science and society, learning from their personal experiences, and relating the results to current debates on ESD, transformative learning, and the SD strategies of HEIs.

The research contained in this dissertation calls on HEIs to expand and reflect on their understanding of education and learning in order to overcome detrimental gaps between science and society. The corresponding studies encourage HEIs to increase their awareness and reflect on

their own policies and structures, respond to students' wishes regarding SD, acknowledge the opportunities opened up by students' learning paths, and rethink research settings and career pathways by confronting global power issues. To this end, HEIs should provide safe spaces for learning and conceive of their education mission in a (more) holistic way – in line with a "whole institution approach" – enabling all actors involved to view themselves as learners who must consider changing their mindset and engaging with the challenges of societal transformation.

Acknowledgement

Why not be disruptive myself? I would like to switch the order of acknowledgements normally found in doctoral dissertations and begin with the people who provided me with the safe family/private space that allowed me to work on this PhD. They may not occupy my academic environment per se, but they are the most significant individuals in my life. Without them, my dissertation simply would not have been possible.
Without further ado, I want to express my deepest gratitude to four magical creatures and two little fairies who share with me this PhD:

- To **Daniel Schmid**, my partner, who took on the lion's share of household work and parenting to give me room for my research and supported me with all his love no matter what mood I was in.
- To my little fairies **Mateo and Laya**, who often had to accept deprivation and were patient when time was limited.
- To my mother, **Brigitte Trechsel**, and my mother-in-law, **Ursula Schmid**, who kept my back free by taking care of the kids for many days and weeks and provided me with moral support.
- To my supervisor, coach, former boss, and friend **Dr. Anne Zimmermann**, who accompanied me over the years. She has taken it upon herself to stand up for women's promotion and gave me and many others room and time to develop careers, as well as professional support in the publishing world.

Finally, a big "thank you" goes to:

- My main supervisor **Prof. Dr. Thomas Breu**, director of CDE, for letting me combine my work position and my research topic, and for his support and constructive feedback during my PhD which enabled me to grow as a research scientist.
- My supervisor **Prof. Dr. Susan Thieme,** Unit Leader of Critical Sustainability Studies, for sharing knowledge and providing scientific advice in an enriching way while publishing together.
- The **co-authors** I published with, and for the inspiring moments and teamwork we experienced while working intensively together on an article.
- My father **Martin Trechsel** and siblings **Rahel and Jonas Trechsel** for their support and encouragement throughout my life.
- My neighbour **Karin Lüthi** who took care of the kids when there was need.
- My friend **Martina Schell** who provided her home to me for writing. **Emmily Mugasia, Käthi Kägi**, and **Nadine Müller** for offering support from near and far. Our friendships mean so much.
- My colleagues **Camilla Steinböck** and **Laurenzia Karrer** who supported me with EndNotes and data management on many publications. And to **Tamara da Silva** for being a good office (and online) friend during my PhD journey.

- My “impact area” colleague **Dr. Christoph Bader** for taking over key tasks when I needed to focus on my PhD and writing retreats.
- My friend **Dr. Christine Bigler** who critically reviewed my doctoral dissertation with her scientific experience.
- My “chief editor” **Anu Lannen** for his language editing and proofreading, including his ability to find the right words for my ideas.
- And to all **my friends** and extended family who supported me during my PhD, and to my godchildren **Camille** and **Ezra** who never complained when time was short.

Contents

1 Setting the scene

1.1 Overview of publications

No.	Title	Authors	Journal	Current status
1*	Mainstreaming Education for Sustainable Development at a Swiss University: Navigating the Traps of Institutionalization	Lilian Julia Trechsel, Anne Barbara Zimmermann, David Graf, Karl Herweg, Lara Lundsgaard-Hansen, Lydia Rufer, Thomas Tribelhorn and Doris Wastl-Walter	Higher Education Policy, 2018, 31, (471–490), available here *(peer-reviewed)*	Published November 2018
2*	Safe Spaces for Disruptive Learning in a North–South Research Partnership Context: International Mobility of Doctoral Students	Lilian Julia Trechsel, Anne Barbara Zimmermann, Camilla Steinböck, Thomas Breu, Karl Herweg, Susan Thieme	Sustainability, 2021, 13, 2413 (1-21), available here *(peer-reviewed)*	Published February 2021
3*	Students between Science and Society: Why Students' Learning Experiences in Transformative Spaces are Vital to Higher Education Institutions	Lilian Julia Trechsel, Clara Léonie Diebold, Anne Barbara Zimmermann, Manuel Fischer	International Journal of Sustainability in Higher Education, available here *(peer-reviewed)*	Published January 2023
4**	Unlocking Knowledge for Sustainable Development: Partnership-based Research and Education	Lilian Julia Trechsel, Sarah Ayeri Ogalleh, Anne Barbara Zimmermann, Karl Herweg, Thomas Breu, Anu Lannen	CDE Policy Brief, No. 17, available here	Published December 2020
5	Experiences of PhD Graduates Researching and Learning for Sustainable Development in an Inter- and Transdisciplinary Setting	Lilian Julia Trechsel	ETH Learning and Teaching Journal, Vol 2, No 2, 2020 (137-140) available here	Published December 2020
6	Brennpunkt Nachhaltigkeit – Beitrag einer digitalen Lernplattform zu transformativem Lernen und Transformation in Richtung Nachhaltiger Entwicklung	Lilian Julia Trechsel, Rolf Peter Tanner	Progress in Science Education, Vol 3, No. 2, (29-36), available here *(peer-reviewed)*	Published September 2020
* counting towards and included in PhD thesis ** included topic-wise in PhD thesis				

1.2 Points of reference of scientific debate

In our current age – the Anthropocene – humanity confronts never-before-seen ecological and social crises (Zalasiewicz et al., 2021) and dysfunctional systems that appear incapable of handling them (Biester and Mehlmann, 2020, Sterling, 2021, Wals, 2020, Macintyre et al., 2020). At the global level, the 2030 Agenda (United Nations, 2015) seeks to respond to the current crises with 17 Sustainable Development Goals (SDGs) that provide a foundation for efforts towards sustainable development (SD). Meanwhile, the window of time available to achieve the SDGs is closing rapidly, as emphasized by the recent Global Sustainable Development Report (United Nations, 2019). In the words of the United Nations Educational, Scientific and Cultural Organization (UNESCO 2021, p. 4): "The time to learn and act for our planet is now".

Education is recognized as at the heart of the 2030 Agenda, crucial to the success of all SDGs (UNESCO, 2015), and fundamental to transformation (UNESCO, 2021). Higher education institutions (HEIs) can respond to today's pressing challenges and support the changes required to achieve the SDGs. Indeed, HEIs are ideally positioned to enable both student and staff learning on behalf of urgently needed societal transformation. However, given our limited time and resources, the question arises: *How can HEIs best redefine education and learning to contribute to SD in a meaningful way?*

The present dissertation approaches this main question from the perspective of geography. The field of geography is well-suited to address SD issues. It is very open to interdisciplinarity – borrowing from disciplines in the natural sciences, social sciences, and humanities – and brings together a variety of conceptual and methodological approaches. It readily incorporates sustainability topics and societal transformation debates and explores social processes such as the transformation knowledge of students (Thieme and Fry, in press). Indeed, as a discipline, geography got involved very early on in the sustainability discourse for a variety of reasons (including some that might be seen as self-serving). For example, geography lends itself to combining different perspectives and establishing innovative relationships between the natural and social sciences and the humanities. At the same time, engagement in sustainability debates helped to integrate major cornerstones of physical and human geography. It also supported examination of contextuality according to natural, cultural, and social features and introduced integrative elements that were attractive for geographers (Wiesmann and Messerli, 2007). In geography and other disciplines, HEIs have played and continue to play a crucial role in driving transformation through science (Messerli et al., 2019), education (UNESCO, 2021), and a "third mission" (Compagnucci and Spigarelli, 2020). This dissertation focuses on the latter two, in particular the link between education and HEIs' third mission via a "whole institution approach" (Sterling, 2003). In the following sections, I will introduce several key strands of the debate within which the thrust of my dissertation argument is embedded.

1.2.1 Education: from commodified education to education as key enabler

In the current neoliberal understanding of education and prosperity that dominates globally, students are viewed as consumers of knowledge who themselves must be made fit for the market, and success is mainly equated with profit (Sterling, 2021). According to Biberhofer (2019), this narrow, commodified understanding of education leads to simplification of knowledge, skills, and competencies, and engenders passive attitudes in students that hinder deeper social learning. Indeed, a number of scholars have criticized today's dominant market-driven education system (Jickling, 2017, Gutiérrez, 2016, Sterling, 2021), describing an instrumentalized understanding of the educational setting that mainly provides knowledge (and skills) to students so that they can be successful players in the labour market (Biberhofer, 2019). At the same time, observers point to a glaring global North–South imbalance in knowledge production that concentrates knowledge in wealthy Western countries (Wals and Benavot, 2017, Trechsel et al., 2021) and continually reproduces postcolonial structures (Baumann et al., 2017). Especially in the context of research and education for SD, this inequality in knowledge production and access must be addressed as rapidly as possible. Lange (2015) approaches such inequality through the concept of relationality. She places the idea of the relational self at the centre, building on and expanding beyond social constructionism and postmodernist insights by incorporating feminist, postcolonial, ecological, and aboriginal theories and epistemologies. According to her: "Relationality is transformative by definition, in both challenging the dominant Western paradigm and providing life-affirming processes and patterns for a regenerative future" (Lange, 2021, p. 27). The 2030 Agenda also seeks to address knowledge inequalities and has opened up new debates on the corresponding role of education. On the one hand, education is defined more holistically in SDG 4, which further calls on the global community to "ensure inclusive and equitable quality education and promote lifelong learning opportunities for all" (United Nations, 2015). On the other, the ESD for 2030 Roadmap describes education as a key enabler of all SDGs to empower learners and educators "with the knowledge, skills, values and attitudes needed for the transition to sustainability [and thereby] recognize young people as key actors in addressing sustainability challenges and the associated decision-making processes" (UNESCO, 2020, p. 3). In this way, it is important to understand education both as a goal and as a key enabler or driver of change on behalf of transformation towards SD.

Against this background, the education for sustainable development (ESD) movement within HEIs has gradually evolved from an initial focus on teaching about the environment towards a much more holistic and self-reflective focus (UNESCO, 2021, Biester and Mehlmann, 2020). Its global foundations were laid with the UN decade for ESD (2004–2013). As early as 2005, the United Nations Economic Commission for Europe (UNECE) stressed the need to reorient our understanding of knowledge provision, away from one-sided transmitter–recipient concepts of teaching and learning.
Thanks to the SDGs and the efforts of numerous ESD practitioners and scholars, understanding of educational tasks has become much more holistic, and this expanded

view is increasingly supported at the primary and secondary school level in particular (SDSN, 2020). At the tertiary level, more time and significant effort appears necessary to encourage HEIs to respond to the urgent call for improved ESD (Sterling, 2021).

1.2.2 Learning: different forms of learning for sustainability

In May 2021, fresh wind entered the ESD debate as a result of the Berlin Declaration on ESD promoted by UNESCO (UNESCO, 2021). The declaration advocates for sustainable and transformative economies and calls for a holistic understanding of education reinforced with a whole institution approach.[1] It further recommends empowering young people as change agents and views ESD as a means to equip learners with important cognitive skills as well as non-cognitive skills (e.g. critical thinking, cooperation, resilience). In this regard, the need for increased efforts towards informal, non-formal, and formal[2] learning is emphasized. Finally, the declaration highlights the urgency of learning and acting in our current moment, and recommends transformative learning and fostering of "cognitive skills, social and emotional learning, and action competences for the individual and societal dimensions of transformation, promoting individual behavioural change for sustainable development" (UNESCO, 2021) as the way forward.

For nearly three decades already, scholars of higher education for SD (HESD) have emphasized the weakness or artificiality of drawing precise distinctions between formal, informal, and non-formal learning. While highlighting the importance of recognizing different forms of learning[3], they have recommended increased efforts to cross the real and imagined boundaries between them (Wals, 2012, Barth and Michelsen, 2013, Lotz-Sisitka et al., 2015, Sterling, 2021), as opposed to the continual reification of formal learning in narrowly conceived education systems across the world (Sterling, 2021). Among the numerous and incomplete list of different forms of learning for sustainability explored are transformative learning (Rodríguez Aboytes and Barth, 2020), transgressive learning (Lotz-Sisitka et al., 2015, Wals, 2021), global learning (Scheunpflug, 2021), lifelong learning (Wals and Benavot, 2017), service learning (Reinders, 2016, Barth et al., 2014), experiential

[1] In the current ESD debate, it is also often called the "whole school approach". In this dissertation, I have chosen to use the term "whole institution approach", as it is more likely to be recognized and adopted by representatives of HEIs.

[2] UNECE (2005) makes the following distinction in its glossary:
• **Formal learning** takes place in education and training institutions, leading to recognized diplomas and qualifications.
• **Non-formal learning** takes place outside and sometimes parallel with mainstream systems of education and training and does not typically lead to formal certificates. Non-formal learning may be provided at the workplace and through the activities of civil society, organizations, and groups (such as youth organizations, trade unions, and political parties). It can also be provided through organizations or services that have been set up to complement formal systems (such as arts, music, and sport classes or private tutoring to prepare for examinations).
• **Informal learning** is a natural accompaniment to everyday life. Unlike formal and non-formal learning, informal learning is not necessarily intentional learning, and as such may not even be recognized by individuals themselves as contributing to their knowledge and skills.

[3] According to the Oxford Dictionary, *learning* is the acquisition of knowledge or skills through study, experience, or being taught (https://www.lexico.com/definition/learning).

learning (Illeris, 2007), social learning (Wals and Van der Leij, 2009), and transdisciplinary learning (Khoo et al., 2018, Pearce et al., 2018). The nuances conceptualized and illustrated in the work of scholars of learning are many. Several of the learning forms listed overlap in their approaches.

The focus of the present dissertation is on transformative learning (hereinafter TL). TL and its associated approaches can serve as an urgently necessary "driver of transformation" that enables up-and-coming generations to learn to tackle global challenges. Drawing on educational practice, TL is a theory that deals explicitly and purposefully with radical transformation. It represents a well-established approach developed by renowned thinkers and critical pedagogues and, at the same time, aligns with current understandings of learning presented in the Berlin Declaration (UNESCO, 2021).

While there are several different definitions of TL, most of them go back to Mezirows' principles described in his 1990s analysis of adult learners' (radical) learning processes (Mezirow, 1997). However, one definition of TL that is increasingly cited in the context of ESD comes from Morrell and O'Connor (2002). Central to the present dissertation, this definition states (Morrell and O'Connor, 2002, p. xvii):

> *transformative learning involves a deep structural shift in the basic premises of thought, feelings and actions. It is a shift of consciousness that dramatically and permanently alters our way of being in the world. Such a shift involves our understanding of ourselves and our self-location: our relationships with other humans and with the natural world. It also involves our understanding of power relations in interlocking structures of class, race and gender, our body awareness, our visions of alternative approaches to living, and our sense of possibilities for social justice, peace and personal joy.*

Of particular relevance to the present research is the "shift of consciousness" described in the above definition. Triggered by TL experiences, this shift can challenge students and teachers to approach learning in more active, participatory, and unconventional ways, as discussed in Paper 1 and Paper 2 of the present dissertation. Further, the above definition of TL emphasizes the importance of power relations, as discussed in Paper 2. Finally, it highlights the importance of self-reflection as well as taking action, two key pillars of TL that are taken up in Paper 3.

A recent systematic literature review of TL (1999–2019) by Rodríguez Aboytes and Barth (2020) concludes that it is an attractive theory in the field of sustainability, can both help to formulate learning outcomes and represent a learning outcome on its own, shares common elements with experiential and social learning, and can provide a foundational meta-theory for use in developing (E)SD-competencies.

1.2.3 ESD pedagogies, competences, and values

Consideration of the need to make HE compatible with SD has led scholars to criticize teaching practices that are oriented solely or primarily towards "transmission" of knowledge and methodological skills. Instead, several HESD scholars have called for integration of a variety of distinct competences in teaching. Wiek et al. (2011) created a now well-known categorization of competences for SD required in HE teaching. Brundiers and 13 other international experts in sustainability education (2020) assessed and verified Wieks categories, enhancing them with two additional competences. Overall, to enable transformative university teaching, a number of specific didactic approaches, methods, and tools are needed, in addition to more outputs from the educational sciences based on empirical research (e.g., Thieme and Fry, in press, Herweg et al., 2021).

Engaged pedagogies of ESD that promote ESD competences and different kinds of learning typically have a clear focus on empowerment, assigning learners an active stake in co-creating knowledge and shaping their future (Biester & Mehlmann, 2020). According to Lotz-Sisitka et al. (2015, p. 78):

> *The transformative, transgressive forms of learning described all require engaged forms of pedagogy that involve multi-voiced engagement with multiple actors. […] Such forms of pedagogy and learning are only beginning to emerge in higher education, mainly under the banner of engaged research, transdisciplinarity and/or transgressive decolonising pedagogies.*

Aside from knowledge and competences, ESD also calls for helping students cultivate relevant mind-sets (Herweg et al., 2017) as well as the ability and willingness to address human values in scholarly work (Barth, 2015). As a result, accusations of ideology or indoctrination sometimes arise. In response, Wals (2020, p. 66) clearly states:

> *Sustainability also emphasizes values of solidarity, sharing, sensitivity, empathy, and compassion and intergenerational, intergender, interethnic, and interspecies equity, among others. […Thus, t]he counterargument is that education is always normative because it will always (re)produce particular values willingly (e.g. human rights) or unwillingly (e.g. consumerist mindsets) and that we, therefore, need to be transparent, aware, and critical about the values that are centred and the ones that are forgotten or left out intentionally or unintentionally.*

After investigating the complex terrain of ESD competences and corresponding hermeneutic inquiry, Shephard et al. (2018) conclude that the terms "competences" and "capabilities" have been complicated by misunderstandings and miscommunication, especially across languages and pedagogical cultures. Nevertheless, addressing related discussions of academic freedom, they express agreement with other scholars (Sterling, 2008, Sterling and Maxey, 2013, Kläy et al., 2015) who observe that values are part and parcel of SD development and any science conducted in its service, such that "neutrality" is an illusory aim.

The present dissertation specifically addresses questions of SD competences, empowerment, and values. In Paper 1, it discusses ways of supporting university teachers in integrating SD competences in their teaching. In Paper 2, it investigates an interdisciplinary doctoral programme in which students developed skills, methods, and attitudes needed to address global challenges in a team-oriented manner. In Paper 3, it analyses students' learning experiences in connection with their own values and the empowerment elements of learning.

1.2.4 Learners and institutions as agents of change

In general, ESD approaches that recommend modifying curricula and diversifying ways of teaching aim at shaping the learning process of participants so as to expand what they are "willing to do or to be, [in contrast to] processes designed to change what learners know or what learners can do, if they choose to" (Shephard et al., 2018, p. 13). This idea of learning processes directly contributing to societal transformation for SD in an interlinked and organic system is also promoted by Wals (2020), who describes a "sustainability-oriented ecology of learning". In his conception, this ecology "comprises a vital coalition of multiple stakeholders engaged in addressing a common challenge and/or realizing a common vision, using a blend of learning processes in order to bring about a real, meaningful, and responsible change" (Wals, 2020, p. 64). Further, according to Wals (2020), the relevant learning processes span five dimensions of learning (*to know, to do, to care, to be, to transform*). This, in turn, leads Wals to include "change agency" (*learning to transform*) as a competence – also encompassing our relationships with nature and other people – that can be achieved through holistic learning. Such an understanding of learning obviously requires a more expanded view of what a student is or can be when compared with more "conventional" perspectives. It also implies a rethinking of standard understandings of education within HEIs. Paper 3 takes up Wals' expansion of the learning paradigm as a means of analysing data on students' learning experiences collected for the present research. The aim of Paper 3 is to focus on change that can be triggered in and through student initiatives.

Originally rooted in the change theory of Lewin (1947), more recent notions of change agency often refer to the organizational management ideas of Caldwell (2003), who shaped the discourse by formulating models of change agency and highlighted the complexity of change agent roles in organizations. It is striking how frequently change agency is used in the context of sustainability research, with practical aspects often given emphasis. Further, change agency has been researched at the individual and community/group level (Van Poeck et al., 2017, Visser and Crane, 2010, Heiskanen et al., 2016), with several scholars identifying students as possible change agents (Mohamad et al., 2021, Drupp et al., 2012, Hesselbarth and Schaltegger, 2014) and underscoring their creative potential.

In Paper 2 and Paper 3 of the present dissertation, the concept of change agents plays a crucial role in the corresponding research on two groups: doctoral programme graduates and active students. In Paper 3, students are also recognized as "boundary agents" between science and society.

The concept of "boundary agency" comes from Star and Griesemer (1989), who describe the varying relationships different stakeholders have with objects placed in museums, so-called "boundary objects". They describe the "creation and management of boundary objects [as] a key process in developing and maintaining coherence across intersecting social worlds" (Star and Griesemer, 1989, p. 393). Such "boundary objects" help link (scientific) knowledge and possible action (in society) – including in the context of sustainability research. The term "boundary agent" is sometimes also used to refer to members of a "boundary organization", who represent members of different worlds (McNie et al., 2008). Overall, the concept of "boundary objects" is instrumental in overcoming what could be called the "silo syndrome" persisting between science and society. Discussed in Paper 3 of this dissertation (on students' learning experiences in student-led initiatives), the notion of "boundary agents" highlights the need to go beyond focusing solely on HEIs, and instead to link to societal actors around them as well, i.e. in their immediate local context. While this has been required of research for SD for several decades already – and extensively theorized in debates on transdisciplinary research (and more recently education) – expansion of the idea to encompass the full duration of students' learning experience and HEIs as a whole has only been expressed in the last few years in HESD scholarship, albeit with growing frequency.

HEIs are increasingly committing to SD as part of their overall mission. However, they often understand this task sectorally, whether from the perspective of campus operations (Amaral et al., 2020), as something that needs to be taken up in a specific curriculum (Lozano et al., 2017), or as a scientific activity demanding institutional consolidation (Bammer, 2013). Yet according to experts, "[t]he challenge is whole-system transformation, which needs to take place in a co-evolutionary way in tandem with changes in wider society" (Sterling and Maxey, 2013, p. 311). Considered in this way, promoting a whole institution approach is central to transforming HEIs in the direction of SD. The whole institution approach has been proposed by a number of scholars (Tilbury, 2013, Sterling and Maxey, 2013, Wals and Benavot, 2017, Sterling, 2003, Mogren et al., 2018, Hargreaves, 2008, Henderson and Tilbury, 2004). The aim is to support HEIs on a holistic change journey with SD placed as high as possible on the agenda. This includes treating SD as a commitment, redesigning corresponding curricula, promoting pedagogies that enable deeper learning, encouraging SD issues in all disciplines, and steering the institution in a direction where it "is open to change and is responsive, creative, solution-focused and dynamic in every sphere" (Sterling and Maxey, 2013, p. 313). HEIs that adopt a whole institution approach understand themselves as learning institutions. To date, the vast majority of HEIs have yet to implement an SD-relevant whole institution approach. Against

this backdrop, it can be useful to group existing HEIs according to Sterlings' categories of institutional sustainability commitment, namely: "(1) no response, (2) accommodation, (3) reform, and (4) transformation" (Sterling, 2021, p. 3). According to Sterling, most institutions remain in category 1 or category 2. As a result, transformation of most existing educational institutions – as understood by Sterling and other scholars (Wals, 2020, Lotz-Sisitka et al., 2015, Tilbury, 2016, Weiss et al., 2021, Barth et al., 2020) – would demand a radical redesign, with a special focus on curricula changes as well as completely different, adapted understandings of teaching and learning processes.

.

2 Concern and research questions

Discussion of various key aspects of the scientific debate (above, Chapter 1) suggests that the core function of education has been agreed upon at the global level and set in line with SDG 4. Nevertheless, most HEIs appear to remain stuck in rigid, historically determined structures (Trechsel et al., 2021) characterized by educational paradigms that are insufficiently (critically) reflexive, perpetuate outdated norms in teaching and learning policies and practices (Sterling, 2011), and fail to adequately support ESD approaches. Nonetheless, the Berlin declaration (UNESCO, 2021) has finally put ESD front and centre, seeking to advance a more holistic understanding of education and learning. In the current debate emerging from the ESD community, learning is understood as being much more than a mere "transmission process". So-called participatory learning with diverse actors beyond HEIs and concepts such as the whole institution approach and "learning organizations" (Sterling, 2021, Tikly et al., 2020, Wals and Benavot, 2017) are increasingly discussed, even though the current realities of most HEIs look quite different.

Overall, ESD experts understand that the transformation towards SD means that we must radically rethink and redesign our institutions – and we have numerous descriptions of what this implies in theory. Unfortunately, we have only a few scientifically framed examples of this being done in concrete ways and specific settings. As a result, it is urgent to explore how HEIs can support transformation in practice. At the same time, some practice-based examples already exist that simply need to be analysed and systematized. This is where the present dissertation enters the picture. I seek to address this theory–practice gap by working and researching in the field of ESD, in particular by examining HEIs' potential to contribute to societal transformation towards SD that addresses global challenges in a sustainable, inclusive, and equitable manner. To this end, I conducted research along a concrete impact chain, seeking to give voice to the persons concerned – including students and teachers – and capturing their interactions with societal actors beyond and outside the relevant HEIs (see framework in Figure 1, chapter 3, p. 13). The main question that guided me through my dissertation is:

> ***How can HEIs redefine education and learning to contribute to societal transformation towards SD?***

To this end, it is initially important to analyse an HEI itself to understand its structure, strategies, and mission (Paper 1). Secondly, it is vital to explore the experience of stakeholders who passed through an SD programme, namely PhD alumni, and analyse their reflections (Paper 2). Thirdly, it is highly valuable to speak to active students who shape their HEIs and interact with other societal actors (Paper 3). (See the location of the three Papers in Figure 1 in the framework on page 13).

This leads me to the following three specific research questions:

- What strategies can HEIs use to ensure that their overall educational mission responds to the societal need for competences that go beyond disciplinary knowledge and skills?
- What conditions do HEIs need to offer to doctoral students to enable them to conduct research for SD taking into account global inequalities in international education?
- How can HEIs offer students opportunities to act as boundary agents between science and society and simultaneously benefit from this in an effort to advance towards a whole-institution approach?

3 Approach and methodology

3.1 Conceptual approach

The present dissertation primarily focuses on transformation and implementation of change within HEIs. Its conceptual approach is rooted in theories of change (ToCs) which can be used for sustainability science, as proposed by Oberlack et al. (2019). Overall, ToCs: (1) require a continuous and critical reflection process; (2) allow for non-linearity and unintended effects; (3) acknowledge and name unknowns; and (4) can facilitate cumulative learning at an organizational level (Oberlack et al., 2019). ToCs do not seek to present the robustness of a theory per se, but rather provide a narrative of the implementation of a particular theory and can help to understand the related process and its consequences. A ToC can illustrate the rationale behind an approach and can help to structure data collection, analysis, and further reflection – including stakeholders' different perspectives on an approach. This in turn requires openness among participants to reflective learning (Mason and Barnes, 2007). The history of ToCs goes back to the mid-20th century, but they were especially promoted in the field of evaluation in the 1990s, mostly involving analyses of organizations' hypotheses about how to trigger change with specific strategies and activities (Dhillon and Vaca, 2018). ToCs were initially criticized for their emphasis on linearity when seeking to understand interactions between activities, outputs, outcomes and impacts, as well for their overly optimistic view of particular scenarios. To address these possible shortcomings, critical reflection is needed as well as consideration of different feedback systems (Oberlack et al., 2019).

Inspired by the ToC approach, the ESD team at the Centre for Development and Environment, University of Bern developed an impact chain (designed by Karl Herweg, see Trechsel et al., 2018) that constitutes the overall framework for the present dissertation; the three main scientific papers and a policy brief are situated in the impact chain, as illustrated below in Figure 1. Based on the monitoring theory of Bickmann (1987), the impact chain illustrates what elements support the *desired impact* according to an impact hypothesis – similar to a ToC. The impact chain formulates *desired outcomes* and postulates *outputs* of planned *activities* (Trechsel et al. 2018), while remaining aware of the "attribution gap" that exists between outcomes and activities (Herweg and Steiner, 2002).

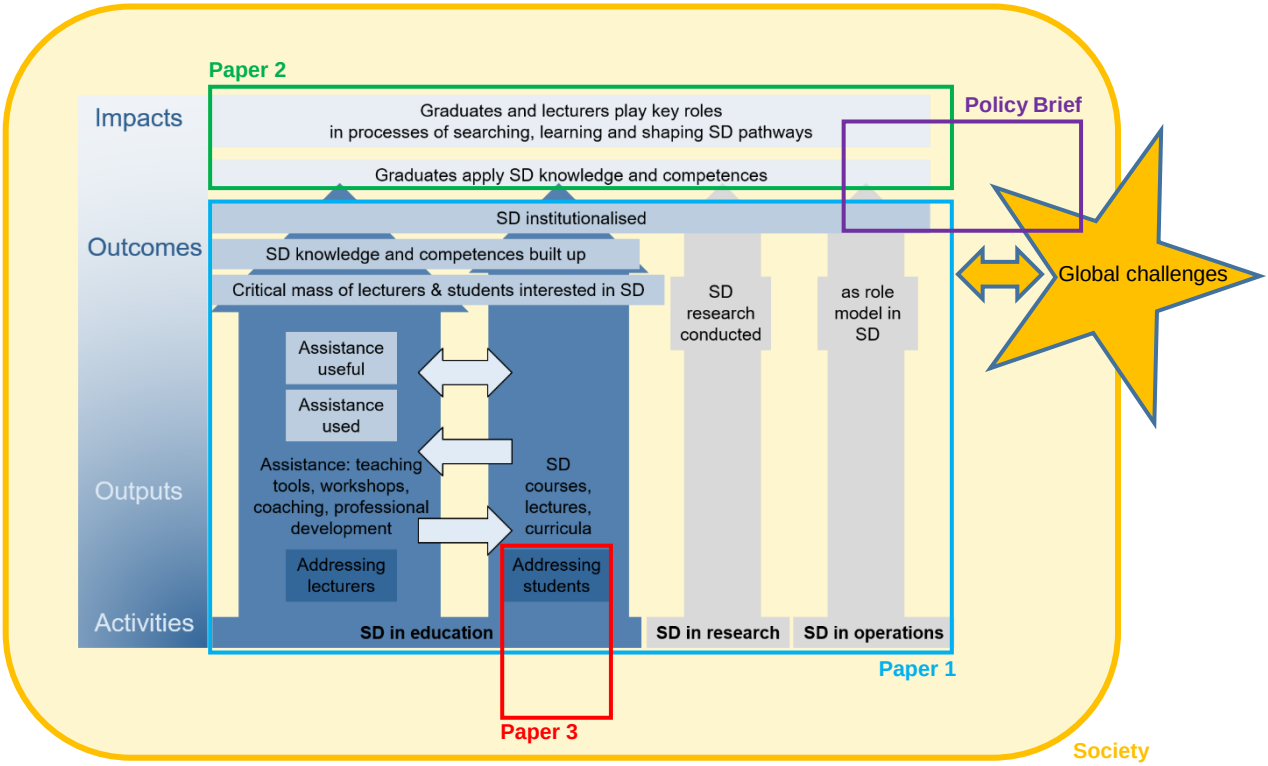

Figure 1: Positioning of the three papers and a policy brief, comprising the present dissertation, according to an impact chain of SD integration at a university. Designed by Karl Herweg, adapted from Trechsel et al. 2018.

The impact chain created by the ESD team guided me in identifying foci for my research, in particular by inspiring me, firstly, to analyse the university as a system (Paper 1); secondly, to focus on the experiences and career pathways of doctoral graduates who constitute a new generation of experts in research for SD (Paper 2); and, thirdly, to explore the concrete activities of student-led projects (Paper 3) and to summarize key results and recommendations for policymakers (CDE Policy Brief; see also the key insights of publications in Chapter 4 and, more comprehensively, in Chapter 5).

3.2 Methods and data

The following section summarizes the methods employed for each paper and the data that were included.

Paper 1 (see Figure 1, blue), takes the University of Bern as a case study and analyses its ESD strategy vis-à-vis a review of the relevant literature. Against the background of this literature review, the paper focuses on the combined top-down and bottom-up approach developed at the University of Bern and analyses potential pitfalls of mainstreaming SD in higher education. It describes and discusses the ESD policy, means, and tools developed at the university within the context of institutional change management literature, ESD theory, and pedagogical practice and theory. The paper explores policies, involved university members, and support structures for teachers and reflects on participants' experiences in the light of the international literature in the field.

Paper 2 (see Figure 1, green) investigates a tracer study using a mixed-methods approach comprising a quantitative survey (78 alumni) and seven qualitative in-depth interviews. Embedded in a conceptual framework encompassing international student mobility studies, education inequalities, studies on the role of science for SD, and pedagogical reflections on spaces for transformative learning, the paper analyses the pathways and experiences of doctoral students/graduates of an integrated global research, development, and training programme, known as the Swiss National Centre of Competence (NCCR) North-South. The paper explores how students in the global South and North benefitted from the opportunities provided by the programme, how they dealt with its challenges, and how this influenced their careers as researchers engaging with SD.

Paper 3 (see Figure 1, red) uses a qualitative approach to analyse 13 in-depth semi-structured interviews and discusses transformative spaces created by students at different HEIs in Switzerland who benefitted from funding linked to their HEIs but could use it to engage and interact with many actors from wider society. The paper discusses these students' learnings in their initiatives to create opportunities for SD, and considers how their interests contribute and add value to HEI sustainability agendas. The analytical perspective used in this paper is influenced by the concept of "ecologies of learning" developed by Wals (2020). Finally, the paper focuses in particular on different dimensions of learning as transition levers to reach action.

The **Policy Brief** (see Figure 1, violet) summarizes the North–South partnership-based SD research and education approach developed at the Centre for Development and Environment (CDE), University of Bern, and highlights the results of a tracer study on corresponding PhD alumni (see Paper 2). Further, it outlines the process of SD integration throughout the University of Bern (see Paper 1). In addition, it discusses the ethical dimension of research and teaching for SD as well as issues of knowledge privatization, global power structures, and inequality in science and higher education. In simple, concise language aimed at policymakers, it emphasizes the potential for expanded partnership-based research and holistic institution-wide SD approaches to tackle today's urgent global challenges.

4 Key insights and main foci of research papers

The results of this thesis are presented in three peer-reviewed research papers, two already published and one under review in a peer-reviewed journal. Whereas the first paper (p. 19) analyses the University of Bern's ESD strategy to revise its overall education mission and address societal learning needs that go beyond disciplinary knowledge and skills, the second paper (p. 40) expands the focus to examine global student mobility and the experience of international alumni of a doctoral programme incorporating inter- and transdisciplinary research on SD. The third paper (p. 62) analyses students' learning experiences in student-led initiatives developed outside formal curricula. The three papers are complemented by a CDE Policy Brief (p. 79) that highlights the crucial role of partnership-based research and education for sustainability in tackling today's urgent global crises.

Paper 1
Mainstreaming Education for Sustainable Development at a Swiss University: Navigating the Traps of Institutionalization
As a practice-oriented contribution, Paper 1 discusses an ESD-mainstreaming strategy applied to teaching in all bachelor's programmes offered at a Swiss university. Increasingly, HEI policies call for integration of SD in research, operations, and education. This paper examines such efforts based on the understanding that education is key to societal transformation. It begins by observing, in line with organizational management theory, that HEIs have evolved somewhat rigid structures based on historical circumstances. These structures have provided HEIs with increasing institutional power, while still affording them some flexibility to adapt to socio-economic change. Under these conditions, it remains a challenge to integrate SD, which is inherently normative, and to make the sweeping institutional changes that are truly necessary. This paper highlights how the University of Bern has addressed this challenge: Thanks to an enabling political climate and a supportive change-focused funding environment, the university prioritized a precise target group, clearly systemized interactions with them, and developed tools to support lecturers willing to adapt their teaching – packaged as an opportunity for professional development. It recommends a combined bottom-up/top-down approach, relying on early adopters of ESD within the institution (bottom-up) coupled with certain mandatory requirements on behalf of integrating SD in university activities (top-down). The paper contributes to the debate by rethinking the role of education in HEIs from the perspective of SD and by highlighting key entry points for change. It also emphasizes the need to foster value-oriented change and to create an enabling environment for such change. The discussion provides space for deeper reflection on HEI structures and identifies traps when institutionalizing integration of SD in teaching. It also describes what groups at an HEI are most likely to support integration of SD, i.e. potential change agents such as students, recent graduates, and teachers who are intrinsically motivated by SD. The paper helps to increase the awareness of policies and structures addressing SD within and beyond HEIs, while embedding the discussion in an

organizational change approach. It highlights the important tasks for HEIs to respond to societal needs and fulfil their third mission.

Paper 2

Safe Spaces for Disruptive Learning in a North–South Research Partnership Context: International Mobility of Doctoral Students

Paper 2 focuses on the growing mobile education landscape, characterized by increasing numbers of international students as well as steered commodification of mobility, research, and education. The paper discusses the evidence of competition and inequality in science and education, frequently to the detriment of global South countries based on power asymmetries. The study at the heart of the paper looks at an SD research and education programme, drawing on the results of a tracer study of international doctoral alumni. It gives voice to doctoral students, who represent future scientists and key players for SD, to better understand their experience of mobility, their career pathways, and their learning in inter- and transdisciplinary research networks. The study shows that "brain circulation" was more dominant than "brain drain" and that alternative pathways in higher education can reduce science inequality. Further, it sheds light on the dynamics of career advancement and the empowering safe space for learning and transformation experienced by students, in particular based on the opportunities provided them to confront uncertainties and different epistemologies as well as to address relationality. This highlights the value of spaces where cultural meanings are dynamically negotiated, as well as the importance of postcolonial debates that underscore how the dichotomy of "self" and "other" impedes transformation towards more sustainable interactions between people and institutions. In addition, the paper advances debates about the "hoarding" of knowledge in Western countries, highlights corresponding power asymmetries, and underscores the global responsibility of HEIs, ultimately calling on Western universities to lay down their privileges in an effort to reduce global inequality in education and research. The paper further contributes to the visibility of transdisciplinary education and research programmes, and advocates for the flexibility needed from HEIs to enable students to experience disruptive moments in "safe spaces" and make transformative learning possible. This can lead to epistemological insights and transformed mindsets in the context of multidisciplinary, multicultural, and multi-institutional settings.

Paper 3

Students at the Science–Society Nexus: Why Students' Learning Experiences in Transformative Spaces are Vital to Higher Education Institutions

Paper 3 focuses on HEI-supported student-led projects implemented in non-formal settings, emphasizing the importance of HEI commitments to societal change towards SD based on transformative learning. It shows that students experience valuable learning in self-defined, self-designed initiatives mainly occurring beyond classroom walls, and that students should not be considered the only learners. Further, the paper calls for new understandings of the teaching mission at HEIs, in particular to enable students to address

human attitudes and values, in addition acquiring core knowledge and skills. The study focuses on the learning experience of students, emphasizing the conditions, processes, and outcomes of their projects and the transformative spaces they create, and highlighting the potential for HEIs to include students' learnings in their transformation processes towards SD. It describes the value of rethinking HEIs' education mission and contributing to science–policy dialogue (third mission) through student-led projects in which students can act as "boundary agents". Students can assume this role while occupying two worlds (e.g. academia and society) and learning how to mediate between them, as well as becoming familiar with how priorities are set and what consequences this has for resulting actions. Against this backdrop, the whole institution approach appears to be ideally suited to enable the necessary critical commitment to SD and student engagement at HEIs.

Policy Brief

Unlocking Knowledge for Sustainability: Partnership-based Research and Education

This CDE Policy Brief integrates the results of the tracer study of PhD graduates (Paper 2) and the experiences of the ESD team at the Centre for Development and Environment (inter alia Paper 1) in support of the efforts of the rectorate of the University of Bern to integrate SD topics into the curricula of all faculties. It identifies universities as key sites where the next generation of experts and decision-makers, seen as change agents, are educated. The policy brief highlights some of the ethical dimensions of science and teaching, especially the highly unequal global distribution of scientific resources and capacities (see Paper 2). It also critiques the quasi-commodification of education, whereby students are often understood merely as consumers. It formulates policy implications to invest in studies and teaching on and for SD. In particular, it places a special focus on shaping knowledge and improving academic metrics that emphasize real-world experience, research quality, and social contributions, and stresses the importance of creating spaces and time for transformative learning and lifelong learning opportunities for students and teachers.

5 Research papers

Peer-reviewed papers

1. Trechsel LJ, Zimmermann AB, Graf D, Herweg K, Lundsgaard-Hansen LM, Rufer L, Tribelhorn T, Wastl-Walter D. (2018). Mainstreaming Education for Sustainable Development at a Swiss University: Navigating the Traps of Institutionalization. *Higher Education Policy*, 31(4), pp. 471-490. https://doi.org/10.1057/s41307-018-0102-z
   pp. 19–39

2. Trechsel LJ, Zimmermann AB, Steinböck C, Breu T, Herweg K, Thieme S (2021). Safe Spaces for Disruptive Learning in a North–South Research Partnership Context: International Mobility of Doctoral Students. *Sustainability*, 13, 2413. https://doi.org/10.3390/su13042413
   pp. 40–61

3. Trechsel, LJ, Diebold, CL, Zimmermann, AB, Fischer, M (2021). Students at the Science–Society Nexus: Why Students' Learning Experiences in Transformative Spaces are Vital to Higher Education Institutions. *International Journal of Sustainability in Higher Education* (under review)
   pp. 62–78

Policy Brief

4. Trechsel LJ, Steinböck C, Ayeri Ogalleh S, Zimmermann AB, Herweg K, Breu T, Lannen A. (2020). *Unlocking Knowledge for Sustainability: Partnership-based Research and Education*. CDE Policy Brief, No. 17. Bern: Centre for Development and Environment (CDE), University of Bern, with Bern Open Publishing (BOP).
   pp. 79–85

5.1 Paper 1: Mainstreaming Education for Sustainable Development at a Swiss University: Navigating the Traps of Institutionalization

—HIGHER—
EDUCATION
—POLICY—

Higher Education Policy, **2018**, **31**, (471–490)
© 2018 International Association of Universities 0952-8733/18
www.palgrave.com/journals

Original Article

Mainstreaming Education for Sustainable Development at a Swiss University: Navigating the Traps of Institutionalization

Lilian J. Trechsel[a], Anne B. Zimmermann[a], David Graf[b], Karl Herweg[a], Lara Lundsgaard-Hansen[a], Lydia Rufer[b], Thomas Tribelhorn[b] and Doris Wastl-Walter[c]

[a]Centre for Development and Environment (CDE), University of Bern, Mittelstrasse 43, 3012 Bern, Switzerland.

E-mail: lilian.trechsel@cde.unibe.ch

[b]Educational Development Unit, Centre for University Continuing Education, University of Bern, Schanzeneckstrasse 1, 3001 Bern, Switzerland.

[c]Vice-Rectorate Quality, University of Bern, Hochschulstrasse 4, 3012 Bern, Switzerland.

How far have higher education institutions progressed towards integrating sustainable development at an institutional level and are they responding to the societal need for transformation? Can the pace of transformation be accelerated, given the urgency of the issues our world is facing? As a practice-oriented contribution to this broader debate — still open despite progress achieved during the Decade of Education for Sustainable Development (2005–2014) — this article discusses a mainstreaming strategy applied to teaching at a higher education institution in Switzerland, the University of Bern. We analyse the traps of institutionalizing sustainable development (SD) in a higher education institution and clarify the policies and approach to change management needed to navigate these traps, based on an analysis of our experience as an education for sustainable development team. We propose (1) using a combined top-down and bottom-up policy to increase motivation, (2) prioritizing and sequencing target groups and helping them to find the link between their discipline and SD, and (3) offering tools, support, and professional development to help lecturers to move towards a more competence-oriented form of teaching. Concrete support needs to take place at four levels: the level of formulating competences for SD; the level of shifting towards a learner-centred approach; the level of designing their learning environments; and the level of becoming a community of practice. An impact chain explains the logic from concrete activities (tools, courses, workshops, etc.) to the desired impact of helping lecturers and graduates to become agents of change capable of playing a key role in society and helping to shape our future.
Higher Education Policy (2018) **31,** 471–490. https://doi.org/10.1057/s41307-018-0102-z; published online 1 November 2018

Keywords: mainstreaming sustainable development; transformation; learner-centred teaching; higher education institutions; institutional change; higher education policy

Introduction

Sustainable development (SD) requires a value-conscious, pan-societal process of transformation (WBGU, 2011), implying, among others, that individuals are willing to change and have appropriate knowledge and skills for participating in or leading change (Corcoran *et al.*, 2002; Luna *et al.*, 2012). Education plays a significant role in supporting this process of transformation, since the role of education can be to prepare the new generation to be "change agents" (WBGU, 2012). The key role of education in pursuing more *sustainable* development has long been acknowledged by the global community, for example in Chapter 36 of Agenda 21 (UN, 1992), the Decade of Education for Sustainable Development (2005–2014) and subsequent plan of action (UNGA, 2017), and Goal 4 of the Sustainable Development Goals (UN, 2015). A key means of achieving this goal is to advance policy — "a foundational activity for education for sustainable development and the one in which the greatest number of key partners are engaged. Education systems are increasingly informed by education for sustainable development strategies, guidelines and frameworks" (UNGA, 2017, 9). But although policy has advanced, adaptation of curricula to integrate SD has been slow, especially in higher education institutions (Sule and Greig, 2017).

How do higher education institutions (HEIs), in particular universities, serve society through education and are they in a position to help to transform our world towards SD? This is a major institutional challenge for HEIs (Tilbury, 2013), which have to transform themselves if they want to contribute to transformation (COPERNICUS Alliance, 2012). Universities have institutional structures that do not readily allow for change of the kind needed for transformation. To quote a recent essay on transformation, "it should be discussed in what sense these governance structures are part of the problem" (Brand, 2016, 25). This is what Trowler *et al.* (2013) examine from the perspective of organizational change. They look at what hinders change at universities and mention very slow internal structures, difficult decision-making processes because they take place at numerous and uncoordinated levels, and problems in implementing new practices. But they also underline that from a historical perspective, these structures have enabled universities to survive, sometimes across many centuries, and point out that universities are therefore also "adept at adapting" (273) rather than being just "change averse" (272). Universities adapt to some changes while maintaining and constantly supporting historically developed structures, so the picture is not so bleak. But do universities respond to societal needs or are they ivory towers?

Research on organizational change in HEIs has explored what enables them to adapt to societal needs. In their extensive review of articles discussing the nature of organizational change studies within HEIs, Fumasoli and Stensaker (2013) argue that structures, processes, and organizational cultures(s) reflect complex dynamics and interactions between internal and external factors. While it is important to see

how HEIs handle external influences, it is also important to understand internal dynamics. The authors note that power relations have been well researched in this context, but that the organizational influence on the content and practices of teaching (and research) is less known. This is regrettable, given the importance teaching must have in the vision of universities contributing to the transformation towards SD (Kläy, 2012). Indeed, assuming that only a minority of university students will work in research after graduation, the question arises how HE can best prepare the majority of students who could become key players for SD in numerous other workplaces. Of course, ensuring that the minority who will continue working as academics are able to adapt to new forms of research is just as important and requires action as well. From the perspective of Agenda 2030 (UN, 2015), it is essential to ensure that universities offer conditions for teaching and learning that make education for sustainable development (ESD) possible (Verhulst and Lambrechts, 2015).

Although teaching is a key priority for universities, assessments and rankings tend to privilege research, with a focus on publication and citation activity (Fadeeva and Mochizuki, 2010; Wals, 2014); moreover, professional development in tertiary teaching is seldom a requirement when appointing new professors, at least in Switzerland. This makes it difficult to create better conditions for ESD at most universities. An additional barrier needs to be tackled once the conditions for teaching have been improved: the dominant understanding of teaching in HEIs is that the aim of teaching is to transmit scientific knowledge and skills rather than to enable students to develop competences (Sterling and Thomas, 2006). This is remarkable given the fact that European universities should meanwhile be implementing the Dublin descriptors, which focus not only on knowledge but also on various other skills and competences (swissuniversities, 2017). The focus on knowledge transmission alone has long been shown to work against the aims of ESD (Ison, 1990).

Thus, if we want universities to contribute to transformation towards more SD, we need them to be responsive to this societal need. This responsiveness will depend on their management's ability to rethink the role of education and to create a favourable environment for learning for change. The nature of and conditions for teaching need to be reconsidered in order for teaching to be able to support the development of competences for SD. In this article, we explore how a Swiss university used the momentum provided by the national and regional political context on the one hand (Kläy, 2012), and by a federal programme to support better integration of SD at universities on the other (scnat, 2017), to try and mainstream SD in teaching in all its faculties.

Our aim is to discuss what is necessary for a successful integration and mainstreaming of SD into education at university, in particular:

- What policies are needed?

- Which university members should be involved when?
- And how can these members be supported?

Based on a conceptual framework illustrating our own theory of change, we analyse the example of the University of Bern's approach to mainstreaming SD in teaching, discuss it in the context of the international literature, and draw conclusions regarding how the traps of institutionalizing SD in a university can be navigated through a combined top-down and bottom-up policy, with specific attention paid to prioritizing of target groups and sequencing of interaction with them, and the development of a set of tools and support approaches.

Conceptual Framework

Designing an impact chain for mainstreaming SD in teaching

Our conceptual framework for analysing the experience of the University of Bern is based on monitoring theory (Bickmann, 1987). Its basic premise is to develop a "theory of change" that starts from a formulation of *desired impacts* (Ebrahim and Rangan, 2014, 124). From there, it is possible to derive *impact hypotheses* and formulate an *impact chain.* The impact chain is an application of the theory of change to a very concrete context. The impact chain consists of *desired outcomes*, which are postulated as the expected broader effects of the *outputs* of planned activities. While outputs can be planned, their use and usefulness depends on stakeholders involved and can only be verified years after implementation of planned activities (Fig. 1): they are subject to an "attribution gap". In addition to reflecting on outputs, outcomes, and impacts, it is important to think about *who* will be involved in change and *what context and factors* will help to make change more likely (Herweg and Steiner, 2002). It is also worthwhile differentiating between desirable and undesirable impacts and outcomes, and being aware of factors that could influence outcomes in unexpected ways.

In the case of designing how a university can contribute to SD, the *first step* is thus to define the desired impact — a university that contributes to "transformation". Based on Stoltenberg and Burandt (2014), we define transformation towards SD as a continuous global, societal, and democratic search and learning process aimed at shaping alternative pathways. SD is a moving target in a world with fast changing needs and dwindling natural resources. To be able to move towards SD, we need change agents capable of generating knowledge to understand the world, and able to help to define the (moving) target and negotiate the ways in which we can reach it (Proclim/CASS, 1997). What are the expected outcomes that need to be achieved within the context of university teaching, given the fact that the desired impact consists of a moving target on the one hand, and on the other, of individuals capable of helping society at large to reach it?

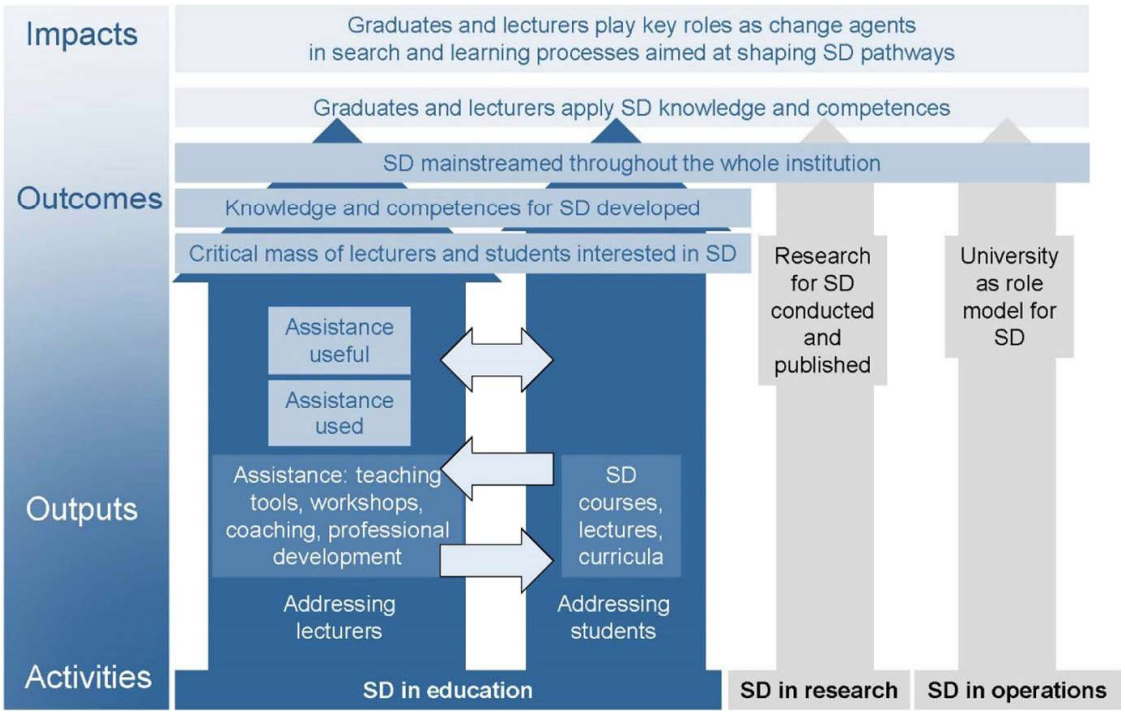

Fig. 1. Model of an impact chain as a conceptual framework for imagining how a university can start integrating sustainable development (SD). Design by Karl Herweg.

Before we can define what the desired outcomes are, in a *second step* we need to better understand who will be the change agents. In a larger societal context, anybody who wants to contribute to transformation can become a change agent (Schubiger, 2013); within the context of tertiary education, the potential change agents will be university graduates and the lecturers who teach them. The problem is that such an understanding of students and teachers in HE runs counter to the conventional understanding of teaching at a university; but as Wals and Jickling (2002) argue, "higher education has first and foremost something to do with creating possibilities, not defining or prescribing the future for our students" (130). Part of creating these possibilities is to enable students to become change agents, and enable teachers to help them to achieve this. An important question to reflect on when doing this is how intensively HE should involve students in transformative learning (Singer-Brodowski, 2016): should it "only" enable students to think critically and reflexively, or can it go further and require more, in view of the urgency of SD and a generally weak link between knowledge and action? The decision is an ethical one.

A *third step* is to work out how much resistance can be expected from the university and how we can reach lecturers and students to support transformation towards SD — in other words we need to grasp the context. As an institutional body, a university system will attempt to be "sustainable" by sustaining its

structures; paradoxically, this leads to inertia and lack of responsiveness to societal needs. But at the same time, it is necessary for the university to offer reliable working conditions to its staff. Therefore, it is essential to understand a university's structures and work with them rather than against them, and to identify where there are possibilities of introducing change and making existing structures support change (Verhulst and Lambrechts, 2015).

This leads us to the *fourth step*, describing desired outcomes. The first outcome would logically be to reach as many students and teachers as possible, and ensure that they acquire the knowledge and competences to understand SD and link this knowledge to action. Offering university lecturers guidance in their attempt to take SD into account in their teaching is a way of doing this (Barth and Rieckmann, 2012), along with providing support for students willing to engage for SD (Sterling and Witham, 2008). Another important outcome would be an institutionalization of this reorientation and enrichment of teaching, for which professional development and a change in assessment criteria are essential (Mader, 2014); moreover, it is essential to enable teachers to become multipliers (Barth and Rieckmann, 2012).

The *fifth and final step* is to conceive outputs and activities that can lead to these outcomes. A number of researchers and practitioners have reached agreement on the need, ultimately, for transformative learning (Singer-Brodowski, 2016; Sterling, 2011), but have also pointed out that such learning is difficult to stage at a university (e.g. Moore, 2005). Therefore, being aware of options to integrate SD into teaching in stages rather than revolutionizing the entire tertiary education system has been recommended as the way to go (Sterling and Thomas, 2006). This requires delving deeper into what kind of teaching is needed to enable our students to become change agents.

Moving towards competence-oriented and learner-centred teaching

Learning scenarios must be designed in a way that enables students to develop the competences that are needed for SD (UNECE, 2011). Competences have generally been defined as the "proven ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations" to perform a specific task (EC, 2009, 14). Several suggestions have been made to define SD-specific competences (e.g. de Haan's, 2010, model of competences for ESD; the skills significant for ESD identified by Dawe *et al.*, 2005; the sets of values, knowledge, understanding, and abilities developed at RMIT University, described in Holdsworth *et al.*, 2006; the analysis of sustainability competences specifically needed in the academic context, see Wiek *et al.*, 2011). According to Sterling and Thomas (2006), these suggestions have two things in common: first, they should be viewed as a guide and must be modified by teachers to suit their own discipline and teaching needs. Second, they "require the introduction of a much more critical and interactive pedagogy than usually found in universities" (352). Tilbury (2011) also

Table 1 Major shifts in higher education required to integrate sustainable development (SD)

Integration of sustainability within higher education implies shifts:	
From	*To*
Transmissive learning	Learning through discovery
Teacher-centred approach	Learner-centred approach
Individual learning	Collaborative learning
Learning dominated by theory	Praxis-oriented learning linking theory and experience
Focus on accumulating knowledge and a content orientation	Focus on self-regulative learning and a real issues orientation
Emphasis on cognitive objectives only	Cognitive, affective, and skills-related objectives
Institutional, staff-based teaching/learning	Learning with and from outsiders
Low-level cognitive learning	Higher-level cognitive learning

Table reproduced from Sterling (2004, 58, Table 4.3, courtesy of the author)

calls for more active and participatory learning, and Herweg and Moser (2017) suggest the need for self-directed and problem-based learning in interdisciplinary teams. We must therefore challenge the widely used conventional teaching style and change our ways of teaching. Sterling (2004) summarizes this in a table showing major shifts (Table 1).

One of the core claims made by Sterling (2004) is the shift towards a learner-centred approach, where universities exist not just to provide information but to induce learning. Barr and Tagg (1995) named this the "Learning Paradigm", where a university's purpose is to "create environments and experiences that bring students to discover and construct knowledge for themselves, to make students members of communities of learners that make discoveries and solve problems" (15). According to Hattie (2009), who conducted an analysis of 800 meta-analytical studies of learning impact (covering over 50,000 studies), this shift from teaching to learning and most of the other claims (e.g. the focus on self-regulative learning, learning with and from others) not only enable integration of sustainability within HE, but also increase the sense of empowerment that students experience through their proven increase in achievement. Hence, herein lies the possibility not only to strengthen ESD, but also to improve the learning outcomes of every student.

These shifts are crucial suggestions, but one should not try to initiate them all at the same time. This would make changes in curricula too complex for most teachers and would probably also lead to structural resistance within the institution, which needs to ensure that degrees are comparable among universities (EC, 2009). Table 1 provides teachers with ideas and directions about how and how extensively they might begin to change their teaching. To provide a more in-depth analysis of different possibilities of shifting towards ESD, Sterling (2011) describes three *orders of learning*. What characterizes the move from the first to the third order of

learning is an increasing focus on the process of learning rather than on the content of what is learned. Third-order learning is also called transformative learning. One of the purposes of transformative learning is to change the way we see ourselves and the world we live in Mezirow (2003). Transformative learning relies on a constructivist view of knowledge and learning, in which learning is conceived as an active rather than passive process: learners have an active role in constructing knowledge and meaning based on their experiences (Narayan *et al.*, 2013).

The *first level of learning* includes learning within existing disciplinary boundaries and is therefore *conformative*. Students learn to do things better, to be more effective and efficient. *Second-order learning* focuses on an active confrontation of values and assumptions. It involves the learner in critical examination, and if necessary in changing beliefs, values, and assumptions (Sterling, 2011). *Third-order learning* is a dramatic change. It deals with the "experience of seeing our worldview rather than seeing with our worldview" (Sterling, 2011, 22). It implies a "deep structural shift in the basic premises of thought, feelings and actions. It is a shift of consciousness that dramatically and permanently alters our way of being in the world" (Morrell and O'Connor, 2002, xvii).

Second-order learning and third-order learning are particularly important for ESD. At the same time, they are challenging — not only for students, because they involve reflecting and/or restructuring of basic assumptions and ultimately linking knowledge to action, but also for teachers, as it is difficult to design learning experiences that enable such learning (Sterling, 2011). This implies that teachers at universities willing to introduce SD into their teaching need support…

1. … when they formulate the competences for SD that students should acquire in their course;
2. … when shifting their teaching towards a more learner-centred approach; and
3. … when designing the specific learning environments that enable students to develop the desired competences.

Corresponding tools and methods have started to emerge at various universities and experience can be shared thanks to networks and publications. But only a minority of university teachers will know how to implement ESD. If a university applies a mainstreaming approach, it will also be necessary to provide professional development in addition to tools. According to a recent study conducted in over 33 countries (Mulà *et al.*, 2017), there is still a lack of capacity to integrate ESD in professional development and a lack of professional development in this field.

Despite numerous achievements during the Decade of Education for Sustainable Development, it remains a great challenge to provide teaching staff at HEIs with appropriate teaching practices and innovative learning scenarios. Research conducted by Holdsworth *et al.* (2008) and Tilbury (2016), the latter in connection

with the European programme "University Educators for Sustainable Development" (UE4SD), has revealed that it is still unclear what are the best forms of integrating SD into teaching and learning frameworks, and what are desired changes in professional development in HEIs. The UE4SD programme promotes a set of competences that help teachers to hone their focus on ESD. The authors also emphasize that a long-term perspective is needed to integrate this into professional development at universities (Mulà *et al.*, 2017).

The example of the University of Bern

The University of Bern's Strategy 2021 formulates a vision of a whole-university approach by including SD in teaching, research, and operations (Universität Bern, 2013). Implementation of this vision is relatively young and will require a number of years to permeate all areas of the university's activities. In this paper, we focus on how lecturers are being addressed (see Fig. 1, large pillar on the left) and how learning scenarios are leading to greater interaction with engaged students. As recommended by Chalkley and Sterling (2011), ideally each scientific discipline should be perceived as contributing to the societal goal of SD, as formulated in the "discipline leads" idea. This is the approach taken by the authors of the present article — an ESD team that is supporting the Rectorate in its efforts to mainstream SD in teaching. In the following section, we report on how we have been navigating the traps of institutionalizing SD and analyse our experience in the light of the literature.

How We Navigate Three Traps

What policies are needed?

Universities are historically grown institutions characterized by clear and powerful hierarchies; from this, one could deduce that a top-down approach to integrating SD into operations, research, and teaching is the right solution. At the same time, universities defend academic and teaching freedom, and are a key source of innovation. So is a top-down approach a trap? And how does one deal with it? The following analysis of the University of Bern's experience illustrates the issues involved in this question.

In a way that is exemplary for Switzerland, SD has been included in the University of Bern's performance mandates since 2010. This led the Rectorate of the University to integrate SD in its Strategy 2021, based also on an internal report of the University's Committee for SD, who was asked to conduct a survey in 2010 to see where SD was anchored and what still needed to be done. The Strategy 2021 paved the way for implementing integration of SD on a larger and deeper scale, as it provided the necessary policy conditions for introducing a new focus and a value

orientation that is sometimes reflected sceptically by academics (Kläy *et al.*, 2015). But this did not guarantee success of integration efforts, as the eight highly diverse Faculties have an institutionally enshrined freedom in the fields of research and teaching that had to be respected. Meanwhile, however, the Rectorate of the University had also decided to create interdisciplinary Centres covering five focal points of relevance to society, one of which was sustainability. The Centres receive four-year mandates from the University Rectorate and collaborate with institutes at various Faculties, following the principle of interdisciplinarity. This makes the Centres accountable to the Rectorate, but leads them to build alliances with the Faculties. The Centres thus have a rather special position in the University that makes them good candidates for negotiating the difficult interface between accountability to the overall strategy (and ultimately to society), freedom in research and teaching, and excellence in research. The Rectorate conducts annual "strategy and quality control discussions" with the nine Centres and eight Faculties, who then report to their institutes and departments. The former have the responsibility of adapting their planning to take into account the Rectorate's recommendations. Integration of SD is only a small part of these discussions, and it is difficult to ensure that the response in terms of concrete initiatives to make changes to existing structures will be fruitful: the impact of the top-down strategy tends to peter out when it reaches this level.

While a top-down policy is needed and can be essential in helping universities wherever there is a tendency towards institutional "change averseness" (Trowler *et al.*, 2013, 272) against SD, a bottom-up approach is just as essential. Indeed, integration of SD at universities requires both institutional change and personal commitment (Jones *et al.*, 2008; Lozano, 2006). Personal commitment is a challenge that is different from freedom of research and teaching; but one can argue that it is related if we understand freedom in the Enlightenment sense, as is often done in relation to SD. At the University of Bern, we are applying a strategy combining top-down and bottom-up efforts to integrate SD into teaching. On the one hand, the University Rectorate is requiring the integration of SD into all curricula through a top-down approach, based on the overall mandate from the regional government (which has derived the mandate from Switzerland's constitution). On the other hand, with the help of the ESD team (i.e. the authors of the present article) affiliated with one of its Centres and the University's Educational Unit, it is offering support to those willing to spearhead change. Moreover, the Rectorate is supporting bottom-up initiatives proposed by students and individual lecturers. But this comes with another kind of challenge, as pointed out by Thomas (2004): it "makes it difficult for top management to direct change, since guiding a group of academics who prize their individuality, analytical skills and creativity is not unlike 'herding a mob of cats'" (40).

Nevertheless, some change is taking place. This corresponds to what Fumasoli and Stensaker (2013) have observed from the perspective of organizational studies:

they see the university as an open system in a dynamic interrelation with its environment, which can be captured better while focusing on a bottom-up perspective. So do Trowler *et al.* (2013): in their view a university needs to be considered as a complex system that is not only steered by top-down approaches, but also by all individuals from the bottom-up. Interaction, a multi-level dialogue, and an iterative process are essential. While disciplinary independence is crucial and necessary for researchers' specialization, at the same time it can be a barrier to integrating SD.

In addition to the combined top-down and bottom-up approach, what other policy elements are needed to achieve the integration of SD within a university? Trowler *et al.* (2013) focus on institutional change towards a Sustainability Agenda and emphasize the need for change management within universities. The danger of creating bubbles of social practices that are not accessible to others must be avoided by having adaptable and flexible frameworks, different strategies to foster change, and long-term time frames to implement SD. This is often challenged by limited funding. The Rectorate of the University of Bern is providing a long-term perspective: it has been offering support and competitive funding since 2013. It has encouraged many projects and is providing the ESD team with a long-term time frame bound to the Strategy 2021. This has enabled the ESD team to develop guidelines and tools (see below, "How can they be supported?") to reach as many university staff as possible (see below, "Which university members should be involved when?"). The University also engages in a dialogue with faculty members at all levels, as well as with a national and international ESD network and with society. Broader interaction is achieved, for example, on the occasion of the annual Sustainability Day, the purpose of which is to promote dialogue within the University of Bern, as well as with other Bernese HEIs and society. Students and university staff are encouraged to present their visions of SD in concrete projects, where they act as a part of society; they transfer their knowledge and visions of SD into their daily lives — a key part of a strategy towards the whole-institution approach (Sterling and Thomas, 2006).

Which university members should be involved when?

Thinking carefully about how to increase the impact of efforts to reach teaching staff (and students) at the University of Bern is crucial. We strongly believe that everyone needs to do something to contribute to SD and that the job should not be delegated. So we could argue that "everyone must be involved in SD". This, however, will not work at a university — it contradicts the very principle of freedom and responsibility. This trap can be avoided by changing the verb "must" to "can" and offering teachers the help they need to integrate SD into their teaching.

If we want to reach all students, we need to put particular effort into assisting lecturers to integrate SD within their discipline. However, it is also very important

to consider that most university staff, trained mainly to do research and employed as researchers and teachers, are facing increasingly time-consuming tasks related to publishing, personnel and financial administration, quality management, dealing with important topics such as gender, etc. Thus, any additional task such as including SD into their work comes as an overload; it is crucial to find ways of overcoming this barrier. As different academic staff (the proverbially un-herdable "cats") have different knowledge and motivations, we divided them into four categories (Fig. 2) and set priorities regarding when and how to approach them. The four categories correspond to different barriers that must be tackled.

1. The group that is already "on board" needs to be acknowledged and supported by giving them the opportunity to share their knowledge, skills, insights, and questions. We made this happen by organizing an Early Adopter workshop and offering an electronic platform for exchange. We also invited early adopters to contribute to a volume of good practices (Fischer *et al.*, 2016).
2. The group that has to "establish thematic-methodological links" needs to be identified through a targeted communication strategy. After screening all courses on offer at the University, we invited selected university lecturers to attend a "find the link" workshop series, in which the ESD team helped teachers to establish links between their discipline and SD.

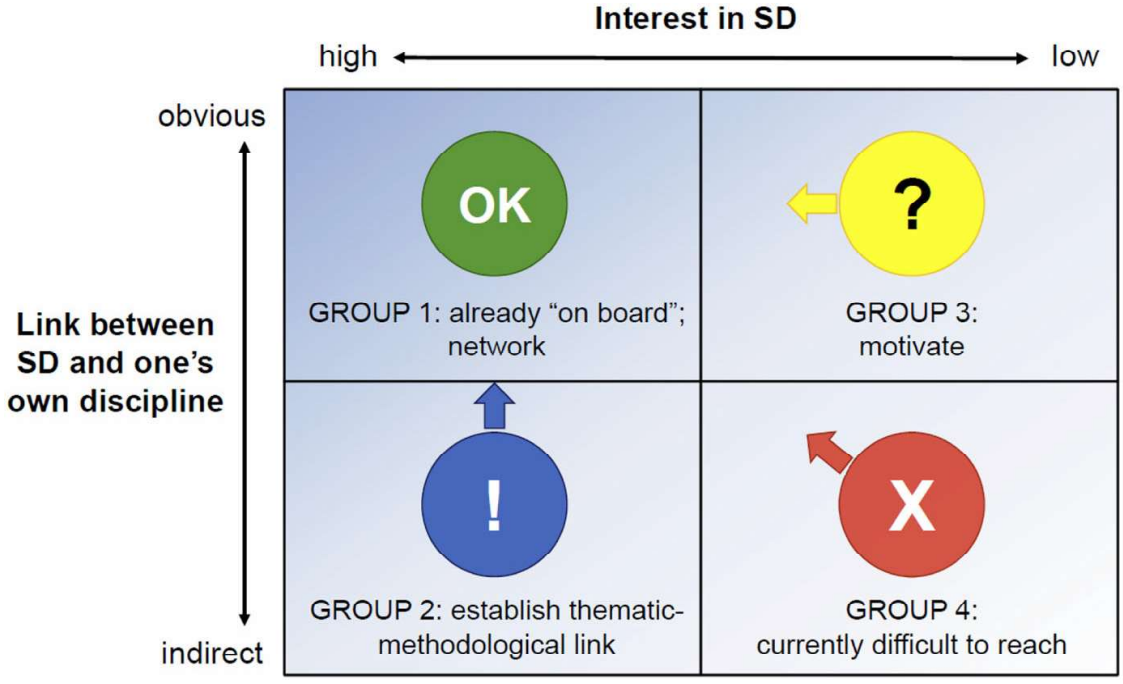

Fig. 2. Integrating sustainable development (SD) into university teaching: setting priorities.

3. By actively involving many academic staff in sustainability events such as the annual Sustainability Day, the team is trying to motivate lecturers and other University members by stimulating their interest in the field of SD.
4. We must be realistic about the group of people "currently difficult to reach": in the short term, we cannot convince lecturers who are not interested in SD or believe this does not concern them as researchers and teachers. They may eventually be reached by colleagues ("multipliers") capable of showing that integrating SD in their work can be a source of innovation.

Thus, the strategy of our team is to focus on gradually building a critical mass of motivated persons who are willing to take on the challenge of integrating SD into their teaching (groups 1 and 2). Sustainability events have begun to attract members in group 3. The Rectorate has a new policy, requiring that all newly appointed professors explicitly state what they intend to do to take SD into account when they start working in their new position. This might help to reach group 4 as well.

We found that lecturers' motivation to integrate SD was more important than their thematic closeness to SD. But motivated lecturers often did not know how to connect their discipline with SD and how to create corresponding learning scenarios. Offering them concrete tools (see next section) to either reflect on what their discipline can inherently contribute to SD (in terms of knowledge, methods, and reflexive tools) or to broaden their teaching methods was a good way of getting them on board for mainstreaming SD in curricula.

How can these members be supported?

The most direct way of promoting SD would be to tell teachers how to do it. But imposing a new paradigm of teaching is a further trap to avoid. Rather than dictating an understanding of SD and a way of integrating it into teaching, the authors of this article prefer to discuss with teachers what didactics would be appropriate to achieve their teaching goal, to offer them tools that can help integrate SD, and to provide insights into processes that help develop competences for SD.

From a pedagogic and professional development perspective, if we want teachers to integrate SD into their courses we must support them at four different levels:

1. The level of formulating competences for SD;
2. The level of shifting towards a learner-centred approach;
3. The level of designing their learning environments;
4. The level of becoming a community of practice.

In order to reach as many teachers as possible, we decided to create some larger support options; but we also invested in developing smaller stones as parts of a bigger mosaic (towards a transformation). The numbers in the parentheses indicate the levels of support mentioned above.

Guidelines for ESD (1–3)
We first produced a set of guidelines with different goals (Herweg *et al.*, 2017). The guidelines' *Foundations* clarify the university's understanding of SD and ESD and its role in the whole process. Furthermore, this part introduces the need for a new teaching paradigm and offers ideas about how to find the link between SD and one's own discipline. The guidelines' *In-depth Module 1* shows ways of formulating adequate competences for SD and designing appropriate learning environments. It introduces different teaching methods for large and small audiences. In the *In-depth Module 2* (Fischer *et al.*, 2016), seven University teachers from various disciplines (from sports to politics, geography, and information systems) show through case studies how they incorporated ESD into their teaching. Among others, they describe the learning outcomes and the learning scenario they designed. This second in-depth module also works as a platform portraying the seven teachers and is a possibility of appreciating the effort they made. Two further *In-depth Modules* offer supplementary supporting material for University of Bern teachers and educational materials that teachers can adapt to their own needs.

Learning material (3)
We also produced different types of learning materials (e.g. interactive learning videos, quizzes, slide sets with comments) for teachers creating their own learning environment. This material can be used primarily to acquire a common understanding of what SD is, or to start a discussion about SD. The material is available on a website (www.esd.unibe.ch).

Continuing support and coaching (1–3)
In addition to the above materials and information, we designed courses and began offering individually tailored support or coaching for both thematic (SD and ESD) and pedagogical issues. Given the heterogeneity of faculties and the great diversity of lecturers, the production of general material such as guidelines and tools is only a first step. We realized that understanding of SD among teaching staff was often limited ("I thought SD meant environmental protection") and this made it difficult for them to establish a link to SD. There is no blueprint solution for this problem. Thus, coaching of individuals and groups will remain a permanent offer in the next few years. Since SD requires more than knowledge, thematic support must be combined with didactic-methodological advice to ensure that ESD competences are also developed. Here, we are still at the beginning, but successful first specimen

lectures integrating SD into highly diverse topics from theatre science to geology suggest that it is possible to identify links, even if they seem quite hidden for some subjects. The strategy here is not to overwhelm colleagues with standard procedures, but to initiate a dialogue that allows them to formulate their individual needs and discover new options, leaving space to include already existing knowledge of SD.

Networking (4)
As it requires quite some time for SD to be integrated in university research, education, and operations, we are focussing at this initial stage on building a critical mass of lecturers and students who are convinced of the importance of SD. Networking within and outside the university is essential to create alliances. To build a community of practice and enhance exchange between interested teachers, researchers, and students, an online collaboration and exchange platform has been set up.

Professional development course (1–4)
In a cooperation involving the Educational Development Unit and the Centre for Development and Environment, a two-day course entitled "Think global, teach local: Integrating Education for Sustainable Development into my own course" was developed. The course is and will continue to be offered as part of a professional development certificate. It addresses all four levels of support mentioned above. The main goal of the course is to enable participants to create their own innovative course with a clear SD component, and to join a community of professional practice.

Apart from helping participants to identify their disciplinary link to SD, we introduced several general competences for ESD (e.g. de Haan's, 2010, model of competence for ESD). We began translating competences into specific, achievable, and measurable learning outcomes, following Kennedy's (2006) recommendations (for a distinction between competences and learning outcomes, see the ECTS Users' Guide, EC, 2009, 13–14). Introducing and considering the idea of constructive alignment (Biggs and Tang, 2011), we then addressed teaching and later assessment methods. Our emphasis was on student-oriented and collaborative teaching methods with high levels of engagement.

Concluding Considerations

The authors of this article believe that universities cannot do their work as knowledge institutions and brokers without having clear and stable structures; at the same time, these structures need to remain flexible enough to adapt to changes required at the forefront of knowledge production as well as to demands coming

from society. While disciplines are necessary, as they allow research communities to go into greater heuristic depth when dealing with specific issues, they can also be barriers for a systemic understanding of such a broad issue as SD, especially if they act as "silos" (Pearson *et al.*, 2005). On the other hand, disciplines are also the source of a great variety of knowledge and scientific practices, as well as of innovatory ideas. In itself this is positive, but the sheer variety also makes it impossible to offer a "one-size-fits-all" version of integration of SD. A further issue to be considered is that SD should not be delegated to one new discipline, e.g. sustainability science. Here again: specialization is necessary, but the new discipline cannot be asked to work towards transformation vicariously for all the others. Everyone must be involved in transformation in one way or another. In addition to the epistemological limitation resulting from disciplinary approaches, an institutional limitation related to disciplinary structures needs to be tackled: the different disciplines will tend to compete rather than collaborate for funding, making it difficult to develop the interdisciplinary options that are needed for a focus on SD. Thus, mainstreaming SD throughout the disciplines represented at a university seems to be a good option, as it inevitably raises awareness of the need to collaborate beyond disciplinary borders. Indeed, this is essential if we want to better grasp the complexity of SD issues. At the same time, it invites all members of the institution to be part of the transformation process.

To conclude with a practice-oriented perspective: what the experience reported and analysed in this article reveals is the following. The ESD team realized that a number of lecturers find it very challenging to integrate SD into their discipline. We see three major levels where intervention is possible, based on a theory of change inspired by project management theory. *First*, it is important to motivate lecturers to engage with SD and provide them with opportunities to do so. Here, some top-down pressure can help. At the same time, bottom-up approaches relying on early adopters who have already pioneered ways of integrating SD into their teaching are of vital importance. Prioritizing target groups properly should eventually lead to a multiplier effect. Indeed, early adopters will motivate their colleagues on the one hand and spread the idea of SD into the student community on the other. This will eventually help build a critical mass. Furthermore, students will also carry SD knowledge, motivation, and competences out into society. At a *second* level, lecturers need assistance to find the link between SD and their discipline; this requires coaching and tools. *Third*, support for developing concrete learning scenarios is essential, as high-level and innovative teaching skills are needed to account for the shift towards more learner-centred teaching. This requires professional development in didactics. While integrating SD into teaching is a necessity for ESD, it is also an opportunity for a university as an institution to improve the effectiveness of its curricula. As a result of support at these three levels, students become change agents who engage in the search and learning process aimed at shaping SD pathways. If a university starts with such small steps

to integrate SD and allocates resources for a sufficiently long-term perspective, change will start happening within the organization and beyond, oriented by the desired transformation towards sustainable development.

References

Barr, R.B. and Tagg, J. (1995) 'From teaching to learning. A new paradigm for undergraduate education', *Change* 27(6): 12–26.

Barth, M. and Rieckmann, M. (2012) 'Academic staff development as a catalyst for curriculum change towards education for sustainable development: An output perspective', *Journal of Cleaner Production* 26(2012): 28–36.

Bickmann, L. (1987) 'The Functions of Program Theory', in L. Bickmann (ed.) *Using Program Theory in Evaluation*, San Francisco, London: Jossey-Bass, pp. 5–18.

Biggs, J. and Tang, C. (2011) *'Teaching for Quality Learning at University'*, 3rd edition, Buckingham: Open University Press.

Brand, U. (2016) '"Transformation" as a new critical orthodoxy: The strategic use of the term "Transformation" does not prevent multiple crises', *GAIA-Ecological Perspectives for Science and Society* 25(1): 23–27.

Chalkley, B. and Sterling, S. (2011) 'Hard times in higher education: the closure of subject centres and the implications for education for sustainable development (ESD)', *Sustainability* 3(4): 66–77.

COPERNICUS Alliance (2012) *Rio + 20 Treaty On Higher Education-People's Sustainability Treaty On Higher Education*, https://www.copernicus-alliance.org/images/Documents/treaty_rio.pdf, accessed 15 September 2017.

Corcoran, P.B., Calder, W. and Clugston, R.M. (2002) 'Introduction: Higher education for sustainable development', *Higher Education Policy* 15(2): 99–103.

Dawe, G., Jucker, R. and Martin, S. (2005) 'Sustainable Development in Higher Education: Current Practice and Future Developments. A report for The Higher Education Academy', Heslington: Higher Education Academy.

de Haan, G. (2010) 'The development of ESD-related competencies in supportive institutional frameworks', *International Review of Education* 56(2): 315–328.

Ebrahim, A. and Rangan, V.K. (2014) 'What impact? A framework for measuring the scale and scope of social performance', *California Management Review* 56(3): 118–141.

EC (European Commission) (2009) '*ECTS Users' Guide',* Luxembourg: Office for Official Publications of the European Communities.

Fadeeva, Z. and Mochizuki, Y. (2010) 'Higher education for today and tomorrow: University appraisal for diversity, innovation and change towards sustainable development', *Sustainability Science* 5(2): 249–256.

Fischer, M., Thurnheer, K., Herweg, K., Hammer, T., Moesch, C., Wyttenbach, S. et al. (2016) *Nachhaltige Entwicklung in die Hochschullehre integrieren-Ein Leitfaden mit Vertiefungen für die Universität Bern. Vertiefung 2: Fallbeispiele.* Bern: University of Bern and Bern Open Publishing (BOP).

Fumasoli, T. and Stensaker, B. (2013) 'Organizational studies in higher education: A reflection on historical themes and prospective trends', *Higher Education Policy* 26(4): 479–496.

Hattie, J.A.C. (2009) *Visible Learning: A Synthesis of 800 Met-Analysis on Achievement*, London: Routledge.

Herweg, K. and Moser, S. (2017) 'Vom Homo sapiens zum Homo faber. Die Menschheit steht vor der grössten Herausforderung ihrer Geschichte-dem Aufbau einer nachhaltigen Gesellschaft', *Umweltpsychologie* 3: 14–17.

Herweg, K. and Steiner, K. (2002) *Impact Monitoring & Assessment. Instruments for Use in Rural Development Projects with a Focus on Sustainable Land Management*. Bern, Switzerland: Centre for Development and Environment. Volume 1.

Herweg K., Zimmermann, A.B., Lundsgaard Hansen, L., Tribelhorn, T., Hammer, T., Tanner, R.P., Trechsel, L.J. et al. (2017) *Integrating Sustainable Development into Higher Education-Guidelines with In-depth Modules for the University of Bern. Foundations*. Bern: University of Bern and Bern Open Publishing (BOP).

Holdsworth, S., Wyborn, C., Bekessy, S., Mnguni, P., Hayles, C. and Thomas, I. (2006) 'Beyond Leather Patches Project for Sustainability Education at RMIT', in W.L. Filho and D. Carpenter (eds.) *University Sustainability in the Australasian University Context*, Frankfurt: Peter Lang Scientific Publishers, pp. 107–128.

Holdsworth, S., Wyborn, C., Bekessy, S. and Thomas, I. (2008) 'Professional development for education for sustainability: How advanced are Australian universities?', *International Journal of Sustainability in Higher Education* 9(2): 131–146.

Ison, R.L. (1990) *Teaching Threatens Sustainable Agriculture,* London: International Institute for Environment and Development (IIED).

Jones, P., Trier, C.J. and Richards, J.P. (2008) 'Embedding education for sustainable development in higher education: A case study examining common challenges and opportunities for undergraduate programmes', *International Journal of Educational Research* 47(6): 341–350.

Kennedy, D. (2006) *Writing and Using Learning Outcomes: a Practical Guide*, Cork: University College Cork.

Kläy, A. (2012) 'Nachhaltige Entwicklung an Schweizer Hochschulen: Zeit für Tritt- statt Stolpersteine', *GAIA - Ecological Perspectives for Science and Society* 21(4): 321–323.

Kläy, A., Zimmermann, A.B. and Schneider, F. (2015) 'Rethinking science for sustainable development: Reflexive interaction for a paradigm transformation' *Futures* 65(2015): 72–85.

Lozano, R. (2006) 'Incorporation and institutionalization of SD into universities: breaking through barriers to change', *Journal of Cleaner Production* 14(9–11): 787–796.

Luna, H., Martin, S., Scott, W., Kemp, S. and Robertson, A. (2012) *Universities and the Green Economy: Graduates for the Future. Higher Education Academy policy think tank report,* Heslington: The Higher Education Academy.

Mader, C. (2014) 'The Role of Assessment and Quality Management in Transformations Towards Sustainable Development: The Nexus Between Higher Education, Society and Policy', in Z. Fadeeva, L. Galkute and C. Mader (eds.) *Sustainable Development and Quality Assurance in Higher Education: Transformation of Learning and Society*, Basingstoke: Palgrave Macmillan, pp. 66–83.

Mezirow, J. (2003) 'Transformative learning as discourse', *Journal of Transformative Education* 1(1): 58–63.

Moore, J. (2005) 'Is higher education ready for transformative learning? A question explored in the study of sustainability', *Journal of Transformative Education* 3(1): 76–91.

Morrell, A. and O'Connor, M. (2002) 'Introduction', in E. O'Sullivan, A. Morrell and M. O'Connor (eds.) *Expanding the Boundaries of Transformative Learning: Essays on Theory and Praxis*, New York: Palgrave Macmillan, pp. xv–xx.

Mulà, I., Cheltenham, G., Tilbury, D., Ryan, A., Mader, M., Dlouhá, J. et al. (2017) 'Catalysing change in higher education for sustainable development', *International Journal of Sustainability in Higher Education* 18(5): 798–820.

Narayan, R., Rodriguez, C., Araujo, J., Shaqlaih, A. and Moss, G. (2013) 'Constructivism-Constructivist Learning Theory', in B.J. Irby, G. Brown, R. Larea-Alecio and S. Jackson (eds.) *The Handbook of Educational Theories*, Charlotte, NC: Information Age Publishing, pp. 169–183.

Pearson, S., Honeywood, S. and O'Toole, M. (2005) 'Not yet learning for sustainability: The challenge of environmental education in a university', *International Research in Geographical and Environmental Education* 14(3): 173–186.

Proclim/CASS (Forum for Climate and Global Change/Conference of the Swiss Scientific Academies) (1997), 'Visions by Swiss Researchers: Research on Sustainability and Global Change-Visions in Science Policy by Swiss Researchers', Bern: ProClim.

Schubiger, A. (2013) *Lehren und Lernen,* Bern: hep.

scnat (Schweizerische Akademien der Wissenschaften) (2017) *Sustainable Development at Universities Programme: Abschlussbericht,* Bern, Switzerland: Swiss Academies Communications. 12(1).

Singer-Brodowski, M. (2016) 'Transformative Bildung durch transformatives Lernen. Zur Notwendigkeit der erziehungswissenschaftlichen Fundierung einer neuen Idee', *Zeitschrift für Internationale Bildungsforschung und Entwicklungspädagogik* 39(1): 13–17.

Sterling, S. (2004) 'An Analysis of the Development of Sustainability Education Internationally: Evolution, Interpretation and Transformative Potential', in J. Blewitt and C. Cullingford (eds.) *The Sustainability Curriculum: The Challenge for Higher Education*, London: Earthscan, pp. 43–62.

Sterling, S. (2011) 'Transformative learning and sustainability: sketching the conceptual ground', *Learning and Teaching in Higher Education* 5: 17–33.

Sterling, S. and Thomas, I. (2006) 'Education for sustainability: the role of capabilities in guiding university curricula', *International Journal of Innovation and Sustainable Development* 1(4): 349–370.

Sterling, S. and Witham, H. (2008) 'Pushing the boundaries: the work of the Higher Education Academy's ESD Project 1', *Environmental Education Research* 14(4): 399–412.

Stoltenberg, U. and Burandt, S. (2014) 'Bildung für eine nachhaltige Entwicklung', in H. Heinrichs and G. Michelsen (eds.) *Nachhaltigkeitswissenschaften*, Berlin: Spektrum, pp. 567–594.

Sule, O.F. and Greig, A. (2017) 'Embedding Education for Sustainable Development (ESD) Within the Curriculum of UK Higher Educational Institutions (HEIs): Strategic Priorities', in W.L. Filho (ed.) *Sustainable Development Research at Universities in the United Kingdom: Approaches, Methods and Projects*, Cham: Springer International Publishing, pp. 91–107.

swissuniversities (2017) *Dublin Descriptors*, https://www.swissuniversities.ch/en/higher-education-area/qualifications-framework-nqfch-hs/dublin-descriptors/, accessed 9 March 2017.

Thomas, I. (2004) 'Sustainability in tertiary curricula: what is stopping it happening?', *International Journal of Sustainability in Higher Education* 5(1): 33–47.

Tilbury, D. (2011) *Education for Sustainable Development: An Expert Review of Processes and Learning,* Paris: UNESCO.

Tilbury, D. (2013) 'Another World is Desirable. A Global Rebooting of Higher Education for Sustainable Development', in S. Sterling, L. Maxey and H. Luna (eds.) *The Sustainable University: Progress and Prospects,* Abingdon: Earthscan Routledge, pp. 71–85.

Tilbury, D. (2016) 'Student Engagement and Leadership in Higher Education for Sustainability', in M. Barth, G. Michelsen, M. Rieckmann and I. Thomas (eds.) *Routledge Handbook of Higher Education for Sustainable Development*, London: Routledge, pp. 273–286.

Trowler, P., Hopkinson, P. and Comerford Boyes, L. (2013) 'Institutional change towards a sustainability agenda: How far can theory assist?', *Tertiary Education and Management* 19(3): 267–279.

UNECE (United Nations Economic Commission for Europe) (2011) *Learning for the Future: Competences in Education for Sustainable Development*. Geneva: UNECE.

UNGA (United Nations General Assembly) (2017) *Report of the Director General of the United Nations Educational, Scientific and Cultural Organization on the implementation of education for sustainable development. A/72/130.* New York: United Nations.

UN (United Nations) (1992) *United Nations Conference on Environment & Development, Rio de Janerio, Brazil, 3 to 14 June 1992, AGENDA 21*. New York: UN.

UN (United Nations) (2015) *Transforming our World: The 2030 Agenda for Sustainable Development. A/RES/70/1*. New York: UN.

Universität Bern (2013) *Strategie 2021, Stratégie 2021, Strategy 2021*, Bern: University of Bern.

Verhulst, E. and Lambrechts, W. (2015) 'Fostering the incorporation of sustainable development in higher education. Lessons learned from a change management perspective', *Journal of Cleaner Production* 106(2013): 189–204.

Wals, A.E.J. (2014) 'Sustainability in higher education in the context of the UN DESD: a review of learning and institutionalization processes', *Journal of Cleaner Production* 62(2014): 8–15.

Wals, A.E.J. and Jickling, B. (2002) '"Sustainability" in higher education: From doublethink and newspeak to critical thinking and meaningful learning', *International Journal of Sustainability in Higher Education* 3(3): 221–232.

WBGU (German Advisory Council on Global Change) (2011) *World in Transition - A Social Contract for Sustainability,* Berlin: WGBU.

WBGU (2012) *Research and Education: Drivers of Transformation*. Factsheet 5, February 2012, http://www.wbgu.de/en/factsheets/factsheet-5/, accessed 15 September 2017.

Wiek, A., Withycombe, L. and Redman, C.L. (2011) 'Key competencies in sustainability: a reference framework for academic program development', *Sustainability Science* 6(2): 203–218.

5.2 **Paper 2:** Safe Spaces for Disruptive Learning in a North–South Research Partnership Context: International Mobility of Doctoral Students

sustainability

MDPI

Article

Safe Spaces for Disruptive Learning in a North–South Research Partnership Context: International Mobility of Doctoral Students

Lilian Julia Trechsel [1,*], Anne Barbara Zimmermann [1], Camilla Steinböck [1], Thomas Breu [1], Karl Herweg [1] and Susan Thieme [2]

[1] Centre for Development and Environment (CDE), University of Bern, 3012 Bern, Switzerland; anne.zimmermann@unibe.ch (A.B.Z.); camilla.steinboeck@unibe.ch (C.S.); thomas.breu@unibe.ch (T.B.); karl.herweg@unibe.ch (K.H.)

[2] Institute of Geography, University of Bern, 3012 Bern, Switzerland; susan.thieme@giub.unibe.ch

* Correspondence: lilian.trechsel@unibe.ch; Tel.: +41-631-52-71

Abstract: This article spans issues of international student mobility, inequalities in higher education, and spaces for transformative learning for sustainable development. We tracked PhD alumni of an international Swiss research program in 2012 and 2017 and found that students from the global South experienced a significant, immediate career boost; most graduates decided to remain in or return to their country of origin after graduation (brain circulation). Career advancement among global North students took longer to develop. In-depth interviews with selected graduates gave students a voice: they felt empowered by networks, new friendships, and working relationships across disciplinary boundaries. The "safe spaces" or "Third Spaces" created in the program—encompassing inter- and transdisciplinary approaches, institutional and cultural diversity, and a real-world focus—were key for transformative learning, supported by an unconventional teaching and research strategy. To support disruptive learning leading to changes in mindsets and to reduce inequality in higher education, Western universities must question their own privileged position.

Keywords: education for sustainable development; interdisciplinary approach; international student mobility; alumni; North–South; Third Space

check for updates

Citation: Trechsel, L.J.; Zimmermann, A.B.; Steinböck, C.; Breu, T.; Herweg, K.; Thieme, S. Safe Spaces for Disruptive Learning in a North–South Research Partnership Context: International Mobility of Doctoral Students. *Sustainability* **2021**, *13*, 2413. https://doi.org/10.3390/su13042413

Academic Editor: Eila Jeronen

Received: 31 December 2020
Accepted: 15 February 2021
Published: 23 February 2021

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Copyright: © 2021 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (https://creativecommons.org/licenses/by/4.0/).

1. Introduction

As key sites of learning for students in increasingly mobile education landscapes, universities and similar higher education institutions have a complex role. They are hubs where knowledge is produced, transmitted, and stored according to historically developed, somewhat rigid epistemological and physical structures, corresponding with separate disciplines. However, they must also remain flexible to accommodate evolving fields of inquiry and societal needs [1]. As brick-and-mortar institutions, higher education institutions are still very much place-based, with certain geographic areas developing reputations for "excellence" that are deployed to attract mobile students in line with current "commodified" understandings of higher education.

Educational research, for its part, has gradually moved away from its initial place-based bias—reflected in studies of classrooms or campuses—to embrace wider spatial concepts and issues of mobility, enabling analysis of education and learning according to broader, decentered understandings [2,3]. In this new scholarly debate, authors emphasize the interconnectedness and spatial relations of mobile knowledge. Higher education institutions are seen as interconnected via mobile norms, values, curricula, educational policies, and especially students—evidenced particularly by international students visiting and travelling from one institution to the next [4].

International student mobility (ISM) has increased markedly in recent decades. According to UNESCO, nearly all countries have recorded a rise—some even experiencing a

doubling or tripling of international students in the last decade [5,6]. Most ISM research fails to give students themselves a voice or an opportunity for self-reflection [7–9], with a few notable exceptions (e.g., see [10–12]). This is a missed opportunity: ISM is worth exploring not only because of its contribution to the reputations of higher education institutions and professional programs, but also because of how it is shaping knowledge systems through the experiences and career decisions of individual students [13].

By listening to the voices of mobile students, the present article addresses this first gap to better understand what PhD graduates' experience of mobility entails beyond career implications and whether they are being sufficiently equipped to respond to changing societal needs locally and globally. For example, how do programs address the urgent, internationally negotiated goals of the 2030 Agenda for Sustainable Development, which require scientists to engage more strongly and assume responsibilities beyond generating data [14]? How do they respond to the call for research that does more than conduct ostensibly "value-free" studies [15]? Such questions are particularly relevant when focusing on doctoral (PhD) degree programs, as students who complete them typically face major decisions about continuing in academia or seeking senior positions elsewhere.

Higher education institutions can no longer afford narrow assumptions about employability or requisite skills. Today's global challenges [16] such as climate change or inequality require long-term, globally oriented programs that train PhD candidates and future leaders to address global challenges with a critical mind. These programs must also help to build evidence-informed consensus and develop solution-oriented approaches, particularly by cooperating closely with stakeholders from outside academia [17–20]. Proponents of education for sustainable development (ESD) increasingly emphasize the need for tertiary education focused on development of specific competences including skills in systems thinking, anticipatory methods, normative issues, strategic approaches, and interpersonally [21] as well as the application of sustainability knowledge in future job settings [22]. Aside from knowledge and competences, ESD also requires helping students develop relevant attitudes [23] and the ability to incorporate values in scholarly work [24]. To develop attitudes and values enabling them to address real-world sustainability issues, students need a "safe space" where they can experience the emotional learning edge that triggers transformative learning moments [25,26] through disruptive learning [27,28].

However, the dominant understandings of science largely remain structured along disciplinary lines, despite increasing numbers of inter- and transdisciplinary research centers. Academic disciplines strive to obtain or defend their own privileged position in the research landscape, often trapping themselves in "silo thinking" [29]. Prevailing teaching formats and curricula largely reproduce this disciplinary approach. In academia, especially at the PhD level or above, disciplinary specialization is emphasized and "outputs" like peer-reviewed articles enable individual scientists to advance their careers, while enabling their "home" institutions to improve their international rankings.

Overall, attitudes of competition (e.g., between researchers, disciplines, and institutions) continue to dominate knowledge-production processes in science. One especially unfortunate consequence of this is the reproduction of global inequalities between countries of the global North and South [30,31]. Historical divides between former colonial powers and occupied countries, for example, now arguably show up as resource divides—not least of all in their scientific capacities. In particular, the distribution of researchers across the world is highly uneven: according to recent figures, low-income countries average only 66 researchers per million inhabitants, 50 times fewer than OECD (Organisation for Economic Co-operation and Development) countries [6]; and all low-income countries combined account for as little as 0.3% of global research spending [14]. This low researcher density, combined with limited scientific tradition and inadequate access to established research communities and journals, seriously hampers low-income countries in their academic development and continues to drive many talented young students from the global South to study abroad.

Although Switzerland is a globally connected country in terms of student mobility and higher education, it has only recently become the focus of ISM research [32,33]. Against this background, the present article addresses the second gap of disciplinary thinking and marketized higher education impeding proper sustainability orientation of universities and ISM by examining a unique survey of PhD alumni from around the globe who participated in a 12-year North–South research partnership program funded by Swiss donors, known as the National Centre of Competence in Research (NCCR) North–South. Participants were trained in an intercultural, interdisciplinary setting with a focus on science for sustainable development [34]. The program sought to reduce North–South science inequality while advancing research to tackle societal problems according to a combined disciplinary, interdisciplinary, and transdisciplinary approach. Participants pursued a disciplinary PhD but also received a supplementary degree in recognition of their research focus on sustainable development. Altogether, 222 PhD candidates from around the world received training through the program, also giving rise to a unique student population sample for this research. Most of the students from the global South and North were officially enrolled at a home-country university, but had the chance to meet and collaborate with fellow PhD candidates from other countries and disciplines during program fieldwork, training, and conferences. In the present article, we take a particular look at the program's annual "summer school", which enabled PhD students to discuss and interact beyond their disciplinary boundaries in challenging real-world contexts.

This article seeks to analyze how the NCCR North–South program enabled PhD researchers to advance their academic careers and simultaneously afforded them innovative learning opportunities on behalf of sustainable development. It draws on two alumni tracking surveys and follow-up interviews designed to access the students' individual mobility experience, trace their career pathways, and understand how alumni perceived their ability to tackle sustainability issues in their research. We focused on the following two questions:

- How did students perceive the training setting of the program, and did it support them in their desire to address today's global challenges?
- How did the alumni benefit from an inter- and transdisciplinary North–South research network in terms of their career path and future work?

Specifically, the present research examined the career pathways of 78 PhD alumni according to a mixed-methods approach, with a view to determining where these PhD alumni stood at the time of the survey. The qualitative research portion used semi-structured interviews to give the PhD alumni a voice; it particularly investigated how students experienced learning spaces designed to disrupt disciplinary expectations during their PhD training. The literature review that follows in the next section places the present study in a framework combining several spheres of interest: ISM studies, inquiries into education inequalities, studies on the role of science for sustainable development, and reflections on spaces for transformative learning. This review was conducted by the authors individually, in their specific areas of expertise, and results were shared in several writing workshops to consolidate the analytical framework for this paper.

2. Academic Mobility—Cementing Global Inequalities?

2.1. International Students with Transnational Networks

In 2017, UNESCO counted over 5.3 million international students, that is, students pursuing all or part of their tertiary education in a country other than their home country. Indeed, the number of international students more than doubled in less than two decades, from 2 million in 2000 [35]. Numerically, international student mobility (ISM) is driven mainly by non-Western countries, especially China, India, and South Korea. Students from Africa are less mobile and their enrolment rate in tertiary education is significantly lower. Looking ahead, the role of these countries—especially in Africa—will only grow in prominence, as they will host and send the majority of globally mobile students [30].

ISM is more than an exchange of financial and human capital. It opens up broader questions of interactions between the global and the local on highly uneven geopolitical and socio-economic ground. Globally, the relationship between knowledge hubs is being discussed in terms of the "academic West" and the "academic rest" [30]. "Western" degrees, in particular, are associated with many benefits including language and intercultural skills, and a greater degree of self-reliance (e.g., see [36–38]).

As agents of knowledge production, students pass through different education and spatial contexts during their academic careers, often settling only temporarily in higher education institutions. Instead of identifying individual "push" and "pull" factors (e.g., economic) to understand ISM, connectivity can serve as a model to analyze the career pathways of students and dynamics of knowledge formation [4]. According to Baumann, et al. [30], (p. 194), "a university can be a portal acting on its own account, and it can be a portal if the government wants it to be one. In both scenarios, connectivity to the world can be strategically steered [. . .] The university has gained significant importance and can be considered empowered under the global condition".

Young people who study abroad are more likely to maintain a transnational lifestyle and transnational networks with multiple ways of identification. Some settle in a foreign country temporarily, others permanently (e.g., see [9,39]). Their decision to study abroad can be partly understood based on assumptions about prospective returns on investments in education for individual students, but also for their families and communities as a whole; these calculations are not made in a void, but rather within socially distinct value systems and in relation to various mobility practices. The relevance of social networks in shaping and sustaining migration processes has been intensely debated and acknowledged since the 1970s (e.g., see [13,40–43]). A new focus of ISM research has emerged in the context of the UN's Agenda 2030 [44], addressing the question whether ISM and related alumni associations are contributing to advancing social change in lower and middle-income countries [13]. While social networks are based on personal relationships [13], they are also strongly shaped by power relations and should not be discussed without considering such relationality [9,45,46], which is also key in the context of transformative learning for sustainable development [47].

2.2. Power Asymmetries in Higher Education

Debates on power and mobility emphasize the difficulty of forging equitable networks and describe the uneven power constellations shaping interactions between spatially dispersed actors and places [48–50] including dominant opportunity-oriented imaginaries of mobility versus the reality of potential disappointments when studying abroad (e.g., see [37]). Besides carrying multiple responsibilities related to their family background and home countries, international students often confront challenges with the requirements of Western academic structures and epistemologies based on the assumed primacy of Western higher education [9]. As sites of education, universities are shaped both by within-country national priorities and by international competition [4]. Both levels inhere within fundamental relations of power. Numerous students and faculty worldwide have criticized the increasing commoditization of universities and called for the protection of fundamental values of free (higher) education [30]. According to Baumann et al. [30], many universities currently struggle to serve different societal needs and work for harmony in the world, while simultaneously adapting themselves to the marketization of knowledge and education. Among other things, this reproduces power asymmetries between the global North and South.

In the context of research for sustainable development, this fundamental contradiction must be addressed. Lange [51] does so by linking postcolonial theory and a critique of transformative learning theory, introducing the concept of relationality and Bhabha's Third Space [52]—a space where cultural meanings are dynamically negotiated, bringing about new hybrid identities in a process of cultural translation and contestation. In postcolonial and transformative learning debates [28,51], facilitation of such a space is seen

as a way of overcoming the dichotomy of "self" and "other" as well as the postcolonial condition that impedes transformation toward more equitable and sustainable interaction between peoples and institutions. However, such efforts in higher education remain the exception [19].

Depending on the performance of "their" universities in standardized rankings, states increasingly seek to position themselves globally [30]. When examining global university rankings, universities from the global South seem to fall off the map. They largely appear poorly financed, lacking quality, and insufficiently networked with other universities. However, in terms of raw numbers, it quickly becomes clear that Africa, Asia, and Latin America are home to the majority of the world's students and higher education institutions, possessing major promise in terms of human capital [30]. Existing ISM studies, however, focus almost exclusively on major "sending" countries (e.g., China, South Korea, India) and "receiving" countries/continents (e.g., North America, Europe, Australia) in the global knowledge system, thus reproducing rather than questioning the geography of higher education hierarchies.

Discussions of unequal student mobility between the global South and North typically refer to the concepts of "brain drain", "brain gain", and "brain circulation". Brain drain debates go back to 1960s–70s research on student and skilled-labor mobility from the global South to the North; they expressed a concern about the loss of "brain power" in the South due to the attractiveness of living in the North after having benefitted from a Northern scholarship. Brain gain and circulation debates gained momentum in the 1990s, when researchers and policymakers began acknowledging that migrants (for education) did not necessarily sever ties with their home countries, but rather fostered international connections, leading to gains for the global South. Migrant students and laborers sometimes gained knowledge and experience abroad and applied it upon returning home [13,32,53–58]. Several recent studies on post-graduation mobility have shown that many students do not return to their "sending" countries [59–61]. These studies appear to confirm long-running concerns about brain drain, while simultaneously perpetuating a somewhat misleading emphasis on Western countries. As noted by others, "Student mobility is a process largely driven by students from non-Western countries, a fact that is often overlooked by assessing impacts on host institutions or debates about brain drain" [30, p. 197]. However, brain gain and circulation have also been observed in the context of studies with a focus on social engagement and sustainability impact (e.g., see [13]), supporting the idea that motivates programs such as the NCCR North–South or the Ford Foundation International Fellowships Program [11,12].

2.3. The NCCR North–South: An Inter- and Transdisciplinary Research Network

The link between knowledge, place, and power is particularly relevant in the context of research for sustainable development [62]. This understanding informed the design and implementation of the NCCR North–South program from 2001 to 2013 [63]. The program's aim was to investigate pathways for sustainable development. It also gave PhD students from the global South a chance to participate in an international research network while simultaneously studying at or through their home university [64,65]. Much of the research was conducted by PhD candidates associated with one of the many partner universities. A shared PhD graduate program was created to support students in their efforts to understand and master the tasks of inter- and transdisciplinary research. They participated in an annual two-week summer school in a local setting—often, but not exclusively, in global South countries—including a tailored fieldwork component and interdisciplinary, intercultural activities [66]. Students were selected by the participating institutions in consultation with the candidates and their supervisors. The guiding criteria for selecting students were thematic fit with each summer school's focus and completion of the definition phase of a candidate's PhD project. All students were required to attend one summer school in the course of their PhD. Thus, all students in the program experienced mobility to different countries on different continents, regardless of their university of

enrolment, yet remained locally rooted to their home university, while closely collaborating with other research institutes and the wider program research group [58]. This often inspired discussions about the many differences between university systems and an acute awareness of the relationality of the academic system. The summer school continues to be carried out in different parts of the world. It was and is an intercultural learning setting—arguably a Third Space, as articulated by Bhabha [52]—in which PhD candidates collaborate in interdisciplinary groups.

Besides training PhD students, the program's two-week summer school is used to train future trainers (i.e., junior and senior lecturers still unfamiliar with the training approach needed for research for sustainable development—an approach quite similar to an education for sustainable development (ESD) approach). Indeed, it has become clear that international students need learning settings that go beyond traditional classroom experiences and enable the development of the skills, methods, and attitude required to address global challenges in an interdisciplinary, team-oriented manner [5,8,20,67] and that these settings are not available at their home institutions.

3. Sample and Methods

To identify and understand the pathways of the international program's alumni and their perceptions of their trajectories, we adopted a mixed-methods approach [68]. Our starting point was an alumni tracking survey of graduates from the NCCR North–South program, first conducted in 2012 [58] and repeated five years later. The program brought together 222 PhD students from eight regions, with research occurring in 40 countries and involving 140 organizations in Africa, Asia, Latin America, and Europe [63]. The first alumni tracking survey was designed as part of the program's internal impact monitoring "to find out whether the NCCR North–South's aims were achieved, specifically with regard to capacity development and career building" [58] (p. 7). The second tracking initiative additionally sought to obtain insights into the graduates' career trajectories by means of qualitative interviews. Following the rules of qualitative research, we anonymized the answers of our respondents and provided maximum background information on our research to the interviewees; in addition, the research project received clearance from the program's scientific board.

3.1. Alumni Tracking Survey 2012 and 2017

The methods used for the first alumni tracking survey in 2012 are described in detail in Heim et al. [58]. We summarize this description here: the questionnaire was developed based on an intensive review of the program's proposal and ten years of annual reporting, and on an outcome monitoring framework set up for the program by the management center. A focus group discussion of the questionnaire was then organized with the regional coordinators of each partnership region. Finally, the questionnaire was tested with five alumni. The questionnaire (Supplementary A) captured the alumni's self-assessments regarding all program levels including the perspectives of coordinators and participants from the program regions. The second alumni survey in 2017 adopted the same questionnaire, but eliminated a few items (see Supplementary B). The second survey was conducted online via *LimeSurvey* in January 2017. About two-thirds (111) of the possible respondents (181) were the same as those surveyed in 2012. The others (70) were graduates who completed their degree between 2012 and 2017, in the context of a newly established successor program, the International Graduate School (IGS) North–South. All but two participants had begun and conducted most of their PhD research within the original NCCR North–South program or a direct follow-up project. In total, 170 former doctoral students were successfully contacted. Of these, 103 responded to the online survey and 78 completed it, resulting in a satisfactory participation rate of 45.9% [69–71].

The 2017 survey data were analyzed using Microsoft Excel. This provided initial insights into the demographics, career development, and life phases of the PhD graduates. In sorting the survey data, all participants were grouped according to their geographic

country of origin; their results were then divided into the categories "global North" and "global South" and analyzed accordingly. This classification—particularly important in the context of the NCCR North–South program—was done according to the official United Nations HDI, or Human Development Index [72]. The cutoff was made at an HDI of 0.8: all countries with a "very high" HDI were classified as "North", and those with a HDI below 0.8 were classified as "South" [72]. Tables 1 and 2 show that the demographic breakdown and the socio-economic background of survey participants in 2017 were very similar to that of the 2012 survey.

Table 1. Overview survey sample in 2017 and 2012 regarding gender and origin.

	2012		2017 [1]	
Geographic Origin	**Male**	**Female**	**Male**	**Female**
North	18 (22%)	21 (25%)	11 (14%)	23 (30%)
South	33 (40%)	11 (13%)	35 (46%)	8 (10%)
Total	51 (62%)	32 (38%)	46 (60%)	31 (40%)

Data sources: NCCR North–South alumni tracking surveys, conducted in 2012 and 2017. The largest group consisted of male alumni from the global South (2017, 46%; 2012, 40%) and the smallest group consisted of female alumni from the global South (2017, 10%; 2012, 13%). A survey of scientists in African countries and UNESCO data confirm this picture of over-represented male researchers [73]. [1] In the 2017 sample, one participant failed to indicate their country of origin.

Table 2. Breakdown of survey sample in 2017 and 2012 regarding socio-economic background (self-assessed class, parents' education level).

Geographic Origin	**2012 Socio-Economic Background**		**2017 [1] Socio-Economic Background**	
	Lower Class or Lower–middle Class	**Upper–middle Class or Upper Class**	**Lower Class or Lower–middle Class**	**Upper–middle Class or Upper Class**
North	13 (34%)	26 (66%)	15 (44%)	19 (56%)
South	29 (65%)	15 (35%)	29 (67%)	14 (33%)
	Both Parents' Highest Academic Degrees		**Both Parents' Highest Academic Degrees**	
	Attended no formal school or reached primary or secondary school	Achieved a post-secondary degree	Attended no formal school or reached primary or secondary school	Achieved a post-secondary degree
North	4 (10%)	35 (90%)	4 (12%)	30 (88%)
South	23 (52%)	21 (48%)	20 (47%)	23 (53%)

Data sources: Responses from the global South alumni concerning their socio-economic background were very similar between 2017 and 2012. In 2017, 67% of the Southern participants indicated having a lower class or lower–middle class background—versus 65% in 2012. In contrast, while 66% of global North graduates classified themselves as having an upper–middle class or upper class background in 2012, only 56% did so in 2017. To find out more about the socio-economic background of the PhD graduates, the alumni survey inquired about both parents' highest academic degree. The 2012 and 2017 results were comparable, revealing a striking difference between the South and North: In 2017, 88% of Northern students' parents had achieved a post-secondary degree (vs. 90% in 2012); whereas 47% of Southern students' parents had no formal schooling or only reached primary or secondary school (52% in 2012). [1] In the 2017 sample, one participant failed to indicate their country of origin.

3.2. Semi-Structured Interviews

Qualitative data collection took place in April and May 2017 using semi-structured interviews designed to deepen insights from the quantitative survey data and bring the graduates' own perspectives on their experience to light. After a first analysis of the interview data and coding results, we also tried to elucidate whether alumni had any "transformative" learning experiences while in the sustainable-development research program, and whether the program enabled a Third Space [52] or "safe space" for learning (see [25]) where disruptive moments [27,28] were possible, leading to epistemological insights and changes of mindsets in the context of a multidisciplinary, multicultural, and multi-institutional reality.

Interviewees were selected based on Flick [74] using criteria chosen for their adequateness to explore our research questions: gender balance; representation of the NCCR North–South program's focus regions (West Africa, East Africa, Horn of Africa, Central Asia, South Asia, Southeast Asia, Central America, South America, Swiss Alps); doctoral thesis defended during different phases of the 12-year program; and balance between submission of thesis in country of origin versus submission in a foreign country. This resulted in a selection of eight respondents, of whom only seven agreed to an interview. One of the remaining interviews was excluded from the dataset because it was marred by technical difficulties during the Skype session. Thus, six interviews were analyzed. The interviewees were from Colombia (female, 49 years, PhD in 2008), Kyrgyzstan (female, 41 years, PhD in 2014), Nepal (male, 51 years, PhD in 2006), Kenya (female, 39 years, PhD in 2013), and Switzerland (female, 32 years, PhD in 2014; and male, 30 years, PhD in 2016).

The semi-structured interviews were structured to enable open and flexible handling of the sessions [74]. Interviewees were informed in advance about the purpose and focus of the interviews, providing them with some orientation and the freedom to speak openly about their personal experiences during the program. The interview guide consisted of four main questions with sub-questions. One question aimed at finding out about their social networks. A second question asked about the career pathway of the alumni including information about geographic movement, job positions, and job opportunities. A third question aimed to find out whether they thought their work in the academic context had an impact on today's global challenges. The fourth question was specifically about the support PhD candidates had experienced through the program; this question was supplemented by the quantitative survey questions (see Supplementary A, questions 48–53 and Supplementary B, questions 34–37). To limit the length and scope of interviews, no question focused on social distinctions. After obtaining the respondents' informed consent, the interviews were recorded and then transcribed verbatim. The questionnaire contained four main themes: social networks, description of career pathways, experiences within academia, and graduate school support.

The interviews were analyzed using the program MaxQDA, based on Döring and Bortz [75]. First, a within-case analysis was done by working through each interview transcript to gain an overview of the content. Next, the data were coded, with codes generated deductively based on the research questions as well as inductively based on insights gained from the interviews. This led to two main codes: *Knowledge* and *Collaboration*. In a follow-up stage, cross-case analysis was carried out to apply the generated codes to all interviews. The categories were further developed and compared with each other, requiring additional revision of the codebook to adapt to all cases. As a result, the two main categories *Knowledge* and *Collaboration* were then subdivided into subcategories, namely: (i) under Knowledge: diploma, meaning of PhD, program aspects, North–South differences, summer school, skills, and push/pull elements; and (ii) under Collaboration: intercultural aspects, research/education collaboration and networks. The theme of "safe space" emerged after analyzing the results of the second coding round as a result of the high rate of mentions of the effect of the summer school on the PhD candidates' learning experience. This iterative thematic analysis was done by authors LT and CS, leading to identification of the most-relevant topics across all cases in the context of the research questions. The analysis also shaped a subsequent literature review. In a final step, the codes were grouped into seven thematic areas: networks, career pathways, career boost, submission, work in academia, motivation for PhD, and summer school. Several questions emerged from this inductive procedure: What forms of interaction and transformative spaces did the alumni experience? What in the program setting did the students consider enabling of career advancement? What forms of liminality did students experience, if any? What were the related limitations of the program?

4. Results and Discussion

4.1. Brain Circulation and Alternative Pathways to Reduce Inequality

The study results captured the spatial mobility of alumni in terms of their place of origin and their place of residence at the time of the second survey in 2017. At this time of data collection, most of the alumni (73%) resided in their home country and held a working position there. Table 3 provides an overview of the PhD graduates' North–South mobility after completing their degree. Altogether, only 14% of the program alumni from the global South moved to a country in the global North after completing their degree, in stark contrast to dominant "brain drain" findings by others. These quantitative results confirm the picture obtained in the original NCCR North–South alumni survey in 2012, which also showed that most students from Southern countries stayed in their place of origin or returned to it [58].

Table 3. Geographic movement after completing their PhD.

Geographic Movement	Number and Percent of Students [1]
Student Category North	
North to North	9 (26%)
North to South	2 (6%)
No movement	23 (68%)
Student Category South	
South to South	3 (7%)
South to North	6 (14%)
No movement	34 (79%)

[1] One survey participant did not indicate their country of origin or country of current residence.

Furthermore, the survey findings suggest that the NCCR North–South program addressed education inequality within the scope of its network, evidenced by two-thirds of its alumni from the global South classifying their family background as lower class or lower–middle class in both the 2017 and 2012 surveys. Moreover, the program noticeably provided a career boost to smart young people from low-income and low-educated family backgrounds. This advancement is evidenced by comparison of the work positions held by students before and after graduation, at the time of the second survey (2017). Table 4 shows that in the global South, most alumni (81%) held a position as an employee, intern/trainee, or in middle management before starting their PhD. A minority of students (12%) already had a leading position prior to joining the program. After finishing their PhD, the number of global South alumni who held a leading position increased to 49%. In the global North, most alumni (56%) indicated having an employee position prior to starting their PhD; this share remained about the same (50%) after earning their PhD degree. At the same time, the percentage of leading positions held by global North students increased after graduation from 3% pre-PhD to 20% post-PhD—a significant improvement, though less than that experienced by Southern students. Only one participant was still in a lower-level intern/trainee position after completing their PhD (an alumna from the South)—all others advanced. Taken together, the results of the second survey (2017) confirmed the original survey (2012) results showing a significant and immediate career impact of PhD completion for students, especially in the global South. Furthermore, the latest survey results also confirmed the trend suggested by Eva Heim et al. [58] that PhD graduates in the global North required longer to obtain a leading position than those in the South. Finally, the 2017 survey echoed the 2012 results showing that most alumni worked in academia after graduation.

Table 4. Professional positions of alumni before their PhD and position in 2017.

Professional Position	North		South	
	Position Before PhD [1]	Current Position [2]	Position Before PhD	Current Position [2]
Leading position	1 (3%)	7 (20%)	5 (12%)	21 (49%)
Middle management	5 (16%)	6 (18%)	13 (30%)	10 (23%)
Employee	18 (56%)	17 (50%)	15 (35%)	7 (16%)
Intern, trainee	7 (22%)	0 (0%)	7 (16%)	1 (2%)
Independent	1 (3%)	4 (12%)	3 (7%)	4 (10%)

[1] In the sample in category North, two participants failed to indicate their position before their PhD. [2] "Current position" is the position in 2017 at the time of the survey.

The location where PhD students submitted their thesis was always the place of the university where they were enrolled. The data showed that the alumni from the global South obtained leading positions irrespective of whether they submitted their PhD thesis at a Northern or Southern university. Half (50%) of Southern graduates whose PhD title was awarded by a Northern university held a leading position at the time of the second survey, and almost half (47%) of those who submitted their thesis at a Southern university also held leading positions. This confirms the findings of a survey of African universities, showing the great need for academic staff with PhD degrees throughout the continent [76]; to our knowledge, this need is also strong in other countries of the global South, though with regional differences.

In total, 53 alumni submitted their thesis at a Northern (European, American, or Chilean) university, most (46) in Switzerland. Another 24 alumni submitted at a Southern university. Notably, not one Northern PhD candidate submitted his or her thesis at a Southern university. However, virtually all fieldwork was conducted in the global South (Africa, Asia, Latin American, Caribbean, Central Asia, India, Sri Lanka, and Southeast Asia). Only three surveyed alumni conducted their fieldwork in the global North, specifically in Switzerland, their country of origin. Looking at the relationship between students' place of university enrolment and place of fieldwork, the importance of spatial context emerges clearly. As agents of knowledge, the students pass through various spatial stages according to life-course trajectories [2], settling only temporarily in most cases.

The data depict various alumni pathways, but the overall picture is of high mobility during the fieldwork stage, followed by the resettlement of most study participants (two-thirds) to their country of origin after graduation. The majority of fieldwork was done in countries in Africa, Asia, South and Central America—with the exception of a handful of candidates from the global South who did research in the global North (mainly Switzerland), enabling unique scientific insights into Northern contexts from researchers with different cultural backgrounds [77,78].

Looking closer at Southern alumni, we observe that 79% of them remained or returned to their country of origin after graduation. This aligns with "brain circulation" theories of academic mobility [53,55], with students gaining knowledge and skills during their PhD, sharing this knowledge with diverse stakeholders in different parts of the world, and fostering connections between countries [79]. It highlights the potential of skilled PhD graduates from the global South to play key roles in their countries of origin while cultivating and benefitting from a global network. However, the complete absence of Northern alumni submitting their thesis at Southern universities points to the ongoing devaluation of Southern higher-education institutions [30]. Nonetheless, it is exceptional that half (51%) of the Southern students were based and enrolled at a university in their country of origin while pursuing a PhD funded by Switzerland. About two-thirds of students were fully or partly funded by the NCCR North–South program, while one-third was associated and funded independently through other projects [63].

4.2. Empowering Space for Transformation

4.2.1. What Forms of Interaction and Possibly Transformative Spaces Did Students Experience?

The results from the in-depth interviews indicate how the students perceived the space in which they conducted their PhD work and what they considered empowering within the NCCR North–South program. According to the survey data, a significant majority of alumni (over 80%) stayed in contact with fellow graduates. The main reasons cited for staying in contact were friendship (66%) and/or general networking (44%). Another key reason for ongoing contact was continued research on a shared topic or region. Less strong was networking solely for career reasons. As shared by one graduate:

> *The networks you build also inform you in many other aspects. Apart from just academia, they also give you aspects on social interactions [and] cultural background[s] [. . .] they spice up your life, and you start to see things in a different way. (Kenyan woman)*

Strong connections and ongoing networks between alumni were particularly emphasized by respondents in the in-depth interviews. Alumni described writing proposals together and cultivating bonds in research and professional collaborations. They mentioned the strong support they provided to each other and the importance of social media such as Facebook and LinkedIn. For real-time communication, they often used Skype to exchange and talk, but they also continued to use email. Furthermore, alumni benefitted from extended networks based on shared supervisors and other key academic contacts.

As Baláž et al. [4] highlighted, connectivity and linked spatially diverse knowledge acquisition play a major role in understanding relationships between students. The importance of maintaining academic contacts has also been shown in other studies [13,79]. Collaboration and partnership-based research enabled students in the NCCR North–South program to co-author articles and share the weight of pressure in competitive academic surroundings, as described by the interviewees. Students gradually developed working relationships, especially by designing project proposals together. The networks they created, called "allies" by one interviewee, also gave rise to later job opportunities. Alumni offered support to each other by sharing knowledge and material, and helping to build their respective careers. However, their networks were more than only academic collaborations, they were shaped by the element of friendship. This sense of friendship among members is also highlighted as a key finding in the alumni study by Campbell and Baxter [13].

Friendly connections, mostly kept up via social media platforms and email, were actively cultivated and alumni took advantage of their international contacts when travelling. Student collaboration and networks extended beyond the alumni circle and program graduation, reaching from South to North and vice versa, encompassing academia as well as high-level decision-makers. The networks fostered crucial exchange opportunities including invitations to conferences and keynote speaker requests.

> *I already had some network. But the PhD has given me another network. [. . .] So I get connected to lots of PhD researchers, university people, and high-level government decision-makers. (Nepali man)*

As noted by Baas [39] and Rizvi [9], transnational networks open up many opportunities for students. One interviewee said that the international setting gave her the opportunity to "sit on two chairs". She was able to maintain her existing job, providing economic security for herself and her family, while simultaneously pursuing a PhD linked to a wide network. She and others also had access to a broader-based supervisory team, comprising experts from the global North and South. Importantly, the project design of the NCCR North–South program enabled flexible institutional arrangements adapted to each local context. During the annual summer school course, participants had the opportunity to play different roles (e.g., student, peer-teacher, and supervisor) and to experience shifting perceptions of the "self" and "other". Moreover, during research, they assumed diverse roles while co-producing knowledge for sustainable development [80]. The "training of

future trainers" program component was cited by interviewees as highly valuable for affording self-reflective learning within a nascent community of practice.

> *You need that. And it's not just being trained and that's it. You also need to be trained to train others. (Kenyan woman)*

Overall, the program provided transnational and social networking opportunities through which students exchanged knowledge and information. Additionally, the networks and meetings created a space in which students forged new friendships. This important form of in-person meetings is also mentioned in the research by Campbell and Baxter [13]. The annual summer school provided room for testing things out, reflecting on and practicing different roles, and experiencing an empowering "safe space" [25] or Third Space [52] with disruptive moments leading to completely new insights linked with changes of practice (especially scientific practice) and changes of attitude with regard to identities—both ones' own and that of others. These participatory spaces for learning are also highlighted in the work of Sallah [28].

4.2.2. What Program Elements Supported Career Advancement among Alumni?

The structure of the NCCR North–South program included a supervisory team comprising different mentors, typically a local partner and another supervisor. This was both challenging and enriching for students and supervisors, as described by one student from Kyrgyzstan:

> *My research [. . .] was something new for the local science [and] academia [. . .] which made me proud and, also, I think it was good for the country. [. . .] I had a local supervisor who, you know, through this joint research [. . .] she got introduced to some new concepts. [. . .] especially [those of the] older generation in the former Soviet Union [lack] foreign language skills, so they do not always have access to the latest, in terms of publications, in their field. (Kyrgyz woman)*

This co-supervisory structure meant that local partner universities also had an important stake in the research projects, based on institutional agreements with the Swiss program. It expanded the horizon of many participating supervisors, enabling them to deepen themselves in a new research approach focused on sustainable development, also echoing the conception of Phelps [8] regarding the valuable role of locally rooted institutions connected to transnational spaces. This advantage of the NCCR North–South program was also explicitly underlined by the eight Regional Coordinators, who provided a number of examples of positive academic, professional, and institutional impacts of supervision arrangements. In addition, the substantial funds available and the sheer size of the network and its sustainability orientation, also led to the initiation of new collaborative projects and mobilization of resources, establishment of new academic programs and curricula, integration of interdisciplinary and transdisciplinary research in existing programs, efficient management of research, internal training, and improved supervision visibility and recognition of organizations [65] (pp. 36–39). Only a few criticisms of how supervision took place were expressed [65] (pp. 58–59).

The survey data showed that many alumni continued working in interdisciplinary (55%) and/or transdisciplinary (32%) teams. During the summer school course, students learned to navigate an intercultural, interdisciplinary, and transdisciplinary setting. Interview respondents repeatedly highlighted the importance and eye-opening nature of this course:

> *[The summer schools] were all interdisciplinary. Some [participants] were hardcore biologists, hardcore soil scientists, others from the human sciences, so all bringing together, discussing it, so you widen your part and widen your discussions. (Nepali man)*

On the one hand, students had to overcome challenges of collaborating with colleagues from different disciplinary backgrounds, a typically disruptive learning moment that was purposefully triggered by one of the group exercises of the summer school [56]. On the

other, students drew inspiration from the diversity of perspectives and opportunities to receive or provide mentorship. Conducting fieldwork as a group in a transdisciplinary setting including developing a research strategy with local stakeholders demanded and fostered open attitudes, interpersonal responsiveness, understanding, and acceptance of differing worldviews and cultural perspectives [15].

The prevailing spirit of sharing and exchange also included making knowledge-production methods and knowledge publication accessible to all. Providing open access to materials was deemed crucial and integrated in the partnership principles [64] and in the program's publication strategy [81]. In the annual summer school, participants experienced innovative teaching-and-learning arrangements that concretized education for sustainable development. Supported by theoretical and methodological sessions, the core of the summer schools was an exploratory case study involving preparation, fieldwork, analysis, and presentations, followed by peer-review processes. This case study-based approach encompassed five to seven days of training, in which students played an increasingly active role and assumed more responsibility for their learning, while the instructors increasingly acted as coaches. The case studies always addressed real-life development issues in the respective local context, allowing both intense interdisciplinary work with other students of different disciplines as well as transdisciplinary encounters with local actor groups. While attending the course—especially the fieldwork component—students gained skills for future work environments requiring collaboration with diverse stakeholders.

> *Just this whole approach of [learning] how to set up a research project. That you include various points of view and, if possible, also involve [local] stakeholders and then formulate research questions based on their statements. I really benefited from this. (Swiss man)*

4.2.3. What Negative Experiences of Liminality and Mobility Did PhD Students Have?

A key stumbling block mentioned by interviewees was that of self-perceived rootlessness, presenting challenges to their sense of identity. Some students felt in limbo and not necessarily able to experience the liminal, transnational program space in a fully empowering way.

> *I don't feel at home. [. . .] I feel comfortable [. . .] but I don't feel at home. I think there are a lot of things that are not mine [. . .]. I don't belong to everything, but that became stimulating. (Colombian woman)*

Grimshaw and Sears [7] state that young international students are always challenged to negotiate and make sense of their identity. They emphasize the importance of the social environment of international student migrants, also highlighting how lifetime trajectories and language skills strongly influence their actions.

Furthermore, according to the interviewees, it is not always reasonable to educate students at the PhD level when they come from a completely different context and education standards diverge widely. The interviewees cited becoming aware of knowledge gaps when studying in different countries. National education standards are set in different ways and often not comparable—sometimes causing unwillingness to recognize or value certain foreign degrees and vice versa.

> *My objective was to come back to Colombia and to have this [Swiss] title. And I think there is a better value, I think. And for [Switzerland] I am sure that if I had a diploma from Colombia it would be not recognized. (Colombian woman)*

A major divide between Northern and Southern universities can be observed regarding the perceived substance and quality of these educational institutions. Indeed, the geographic "place" of universities still matters a great deal, with top schools competing to gain the best students and make their institution as attractive as possible. While looking at global rankings, universities in the global North dominate while countries from the global South can scarcely be found [82]. Several African countries are not even included in university rankings. Interviewees pointed to the dominance and prestige of European, North American, and some Asian universities:

> *Particularly in political science or international relations, it is seen as better if you go to a university in Canada or the US. These university rankings and the high prestige afforded to European and American universities, in contrast to African universities, I find it problematic. I experienced it myself while doing a simultaneous exchange in America, at Columbia University, and in the Congo at another university. And, well, what I did at the university in the Congo doesn't count for anything in Europe. (Swiss woman)*

This highlights complex issues of science inequality in development research. On the one hand, countries in the global South are arguably valued, in particular, as sites for fieldwork. While collecting data during fieldwork in the global South, students obtain "international experience" and burnish their sustainable development credentials. On the other hand, these countries are devalued as places for data analysis and teaching. The "knowledge" obtained in the field is often taken back to the global North, along with the resulting prestige.

> *Even if people want to, even if people are capable of doing a PhD, not everybody can afford to [. . .] In addition to being a long process, in addition to being a difficult process if you are really working on your research, it's also expensive. [People] like teachers with local salaries, they cannot afford such expenses. (Kyrgyz woman)*

Finally, another well-known stumbling block are education costs, which especially hinder talented students from the global South. Baumann [30] confirms that students from African countries are less mobile than other international PhD students, with the rate of tertiary education enrolment lower overall in Africa. This, too, reinforces inequality in education.

4.3. Third Space and Relationality: Conditions for "Space for Transformation"

The interview results also provide insights into the students' increasing feeling of agency as researchers, spurred by the unconventional learning space facilitated by the program, and by the multiple opportunities for networking and relating to one another in an "in-between" setting in which the foundations for research for sustainable development were being negotiated [83]. Students appreciated that their task as researchers was not just to produce knowledge, but rather to develop skills for an engaged form of science.

> *I feel like the PhD showed me how to start something, take responsibility, and keep going and find solutions when things get difficult. [. . .] Besides the theoretical and empirical knowledge you gain during the PhD, these soft skills are really important. (Swiss woman)*

In our literature review, we described the necessity of addressing the discourse on inequalities in education and aptitude in science, especially science that aims to support society in the difficult path toward sustainable development. In our view, this can only take place in a "safe space" [25] or a Third Space [51] where hybridity is possible and relationality becomes the driving force of transformation.

Our study results highlight different forms of "safe space" or Third Space experienced by students on their PhD journey. The place between dichotomies opens up space for attentiveness/mindfulness; it can be considered as a creative space. On the one hand, a Third Space can trigger a feeling of liminality that challenges people's innate social need to belong. This experience has been reported among migrant laborers (e.g., see [84]). Interestingly, however, this feeling of liminality also shows up among wealthier, transnational elites (e.g., see [85]) such as the PhD students who reported feeling "rootless" while studying abroad. On the other hand, if properly structured, such interventions can trigger an experience of being in a safe space for experimentation and transformation [25,27].

The NCCR North–South program appears to have offered students such a safe space by means of its annual summer school course, the overall program structure, its key principles of partnership, and the provision of adequate funding. In this way, students had a chance to test new modes of thinking and doing. They were able to confront learning edges and a liminal state—a "safe space" or Third Space—in which transformation could take place [25,86].

> *I think it's more the process to be part of this bigger project [and] to meet people to exchange, [and] to see the difficulties. I remember that it was very difficult, and there was a lot of constraints and a lot of discussions and it was not easy. And it takes a lot of time to start, to advance, to really understand the inside of the research. (Colombian woman)*

Overall, the summer school course provided program participants with a "transformational space" or "learning space", in which people from diverse backgrounds could come together, discuss, listen to each other, learn together, and find compromises. Beginner students were inspired by more advanced scholars, were introduced to new fields, and had the chance to share dreams and expand their role. Acting as coaches, lecturers helped students overcome apparent dilemmas and states of frustration. Interviewees experienced this as empowering and enriching—especially because it fostered competences for interacting despite differences, enriched perspectives, and sparked new friendships. Participants were encouraged to take risks, confront complexity, step into uncertainty, and try new things [87]. These characteristics define a transformative place where education for sustainable development is possible [88–90]. In the words of Gutiérrez [91] (p. 187), we "simply cannot rely on efficiency and market-driven models of education that are certain to bankrupt the future of our nation's youth. We need models for educational intervention that are consequential—new systems that demand radical shifts in our views of learning."

> *Doing their PhD in Nairobi but also linked up to a university in the North, just to be able to borrow up some insights and mix them. It's more like complementing, you know? That's when I think I have seen it happening and I think that's the way that most of the things are going to go. (Kenyan woman)*

Although our data offer hints, we cannot prove whether students really experienced personal transformation. Was this safe and transformative space really sufficiently inspiring and enriching for the students? Was this the beginning of a transformation for them? These are possible questions for another study, requiring a completely different questionnaire and approach. Indeed, as Jickling [92] (p. 27) points out, "we do not create transformative moments, but can create spaces for them to arise"; this presents challenges for traditional impact monitoring. While the NCCR North–South summer schools created spaces for transformation, it is unlikely that everyone experienced the same degree of transformative learning. Additionally, the present study did not investigate whether and how alumni went on to conduct engaged and transformative science after graduation, or moved into teaching in a competence-oriented way similar to the program. Furthermore, our surveys failed to capture students who dropped out for diverse reasons—reasons that would be useful to know. The final report of the program shows a dropout rate of about 10% [63]. Another limitation is that alumni tracking studies are always marred by difficulties such as incomplete alumni databases, uncompleted questionnaires, and survey/interview declines.

5. Conclusions and Recommendations

In the present article, international student mobility (ISM) provided an entry point for understanding the journey of young researchers training for integration into a life of work and, simultaneously, in our sample, to join an international community of practice dedicated to striving for greater sustainability. Against the backdrop of ISM studies, reflections on global knowledge systems, inquiries into the inequalities of tertiary education, studies on the role of science for sustainable development, and reflections on spaces for transformative learning, we examined the perceptions of PhD graduates of the 12-year NCCR North–South program and analyzed the pathways of alumni through this training setting to address current global challenges. Offering students an opportunity to conduct research for sustainable development and earn a PhD, the program was explicitly designed to address fundamental inequalities in the science landscape. Indeed, higher education institutions, in this case universities, provide a legal and infrastructural framework for tertiary education, but unfortunately also provide a basis for unequal career trajectories that isolate countries of the global South and enable Northern (Western) universities to reinforce

their privileged position. Furthermore, universities remain organized in disciplines that provide individual careers with clear academic identities, but constrain options for systemic perspectives urgently needed to address global challenges.

The purpose of an alumni tracer study is usually to understand how individuals have benefited (or not) from a university degree in terms of their employability. In our understanding, a tracer study can do much more. It can provide indications regarding the personal growth of students, enable insights into their understanding of the purpose of their career, and illuminate their ongoing negotiation of identity.

Two alumni tracking surveys conducted in 2012 and 2017 provided the basis for the present research, complemented by several in-depth qualitative interviews. The quantitative results indicate a high degree of mobility among students during the fieldwork phase of their research, followed by two-thirds of students settling back in their country of origin following graduation. Very few students moved from the global South to the global North. Additionally, the results from both surveys showed that PhD degrees provide a major career boost for graduates in the global South. Furthermore, the data showed that graduates from the global South successfully obtained leading positions irrespective of whether they submitted their PhD thesis at a Northern or Southern university. In this way, our results point to "brain circulation" rather than "brain drain".

In the qualitative results, this "circulation" was further expressed in the students' statements about the important role of friendship, new networks they forged, collaboration, and a spirit of sharing. Furthermore, they valued the exchange they experienced with scientists from different disciplines as well as non-academic stakeholders.

A key learning space experienced by students was the annual summer school with its intercultural, inter-, and transdisciplinary setting, a Third Space in which students were able to develop hybrid and relational identities in a North–South research context devoted to addressing sustainability issues. Students from diverse cultural and disciplinary backgrounds were brought together in a sharing environment—or safe space—characterized by peer learning, open learning, challenges, risks, new experiences, and a focus on inter- and transdisciplinary research for sustainable development. On the one hand, it enabled students to test new approaches and scientific perspectives, step out of their individual comfort zone, and experience disruptive learning. This demanded openness and trust to confront uncertainty and address epistemological and power issues inherent in efforts to address sustainability in a North–South context. On the other hand, course experiences as well as the overall NCCR North–South research program, triggered a sense of liminality and rootlessness in some students, while also providing a feeling of creative possibility and ethical purpose in research. To challenge yourself and dive into this state of liminality can typically trigger transformative learning moments where students take a chance to experience a learning edge and reconsider their mindsets, provided the space made available for this experience is shaped as a safe space. In our view, such safe spaces for transformative learning are needed to tackle today's global challenges.

But how can universities transform their structures and international relations to create more of these learning spaces and enable research and teaching on behalf of sustainable development? Putting this into practice would require many Northern (Western) universities to lay down their privileges in the fundamental manner suggested by Spivak, who writes of unlearning one's privileges [93]. Moreover, a focus on collaboration instead of competition is urgently needed, also transforming power relations. Finally, a rethinking of research settings and career pathways is needed, for example, by officially recognizing and accrediting research visits and degrees from all over the world, in order to overcome postcolonial structures in academia [94]. From the perspective of educational and research policymaking, recommendations based on our insights are the following:

Educational programs should . . .

➢ . . . provide safe and innovative learning spaces where students can reflect on their mindsets and values, confront power issues inherent to research for sustainable development, and experiment new ideas to tackle today's challenges;

- ➢ . . . bring together students from different parts of the world and different disciplines and make them work with non-academic stakeholders (inter- and transdisciplinarity);
- ➢ . . . appropriately acknowledge exchange and capacity development programs as an integral part of PhD education and provide certificates for inter- and transdisciplinary work;
- ➢ . . . provide learning opportunities for trainers to create an adequately safe and creative learning environment;
- ➢ . . . support universities in the global South and North willing to adapt their curricula, in order to provide PhD degrees that will make a difference in the local and global context;
- ➢ . . . and promote and enable network building.

ISM-based research should . . .

- ➢ . . . conduct more systematic research on North–South and South–South movement;
- ➢ . . . focus on the content and aim of programs and their impact on alumni's expected career pathways in sustainable development;
- ➢ . . . and gather more alumni data including type of subjects, experience with spaces for learning, diversity of steps into the labor market (including academic careers starting with PhD programs), potential remaining links to home university, who stays abroad and who returns.

Supplementary Materials: The following are available online at https://www.mdpi.com/2071-1050/13/4/2413/s1, Questionnaires: Supplementary A—Questionnaire Alumni Tracking 2012, Supplementary B—Questionnaire Alumni Tracking 2017.

Author Contributions: Conceptualization, L.J.T., A.B.Z., C.S., T.B., K.H. and S.T.; Methodology, L.J.T., A.B.Z., C.S. and S.T.; Validation, L.J.T., A.B.Z., C.S. and S.T.; Formal analysis, L.J.T. and C.S.; Investigation, L.J.T. and C.S.; Data curation, L.J.T. and C.S.; Writing—Original draft preparation, L.J.T. and A.B.Z.; Writing—Review and editing, L.J.T., A.B.Z., C.S., T.B., K.H. and S.T.; Visualization, L.J.T. and C.S.; Supervision, A.B.Z., T.B. and S.T.; Project administration, L.J.T. and C.S.; Funding acquisition, T.B. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author. The data are not publicly available due to confidentiality agreements with the interviewees.

Acknowledgments: We would like to thank all participants in the survey, particularly, our interviewees for generously giving their time and insights. Many thanks also go to Anu Lannen for his constructive and insightful editing of the manuscript, and to the three anonymous reviewers, whose comments helped to sharpen our argument and considerably improve the paper.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Trechsel, L.J.; Zimmermann, A.B.; Graf, D.; Herweg, K.; Lundsgaard-Hansen, L.; Rufer, L.; Tribelhorn, T.; Wastl-Walter, D. Mainstreaming Education for Sustainable Development at a Swiss University: Navigating the Traps of Institutionalization. *High. Educ. Policy* **2018**, *31*, 471–490. [CrossRef]
2. Findlay, A.M.; King, R.; Smith, F.M.; Geddes, A.; Skeldon, R. World class? An investigation of globalisation, difference and international student mobility. *Trans. Inst. Br. Geogr.* **2012**, *37*, 118–131. [CrossRef]
3. Waters, J.L. Education unbound? Enlivening debates with a mobilities perspective on learning. *Prog. Hum. Geogr.* **2016**, *41*, 279–298. [CrossRef]
4. Baláž, V.; Williams, A.M.; Chrančoková, M. Connectivity as the facilitator of intra-European student migration. *Popul. Space Place* **2017**, *24*, e2101. [CrossRef]

5. King, R.; Raghuram, P. International Student Migration: Mapping the Field and New Research Agendas. *Popul. Space Place* **2013**, *19*, 127–137. [CrossRef]
6. UNESCO. *UNESCO Science Report: Towards 2030*; United Nations Educational, Scientific and Cultural Organization (UNESCO): Paris, France, 2015.
7. Grimshaw, T.; Sears, C. Where am I from? Where do I belong?' The negotiation and maintenance of identity by international school students. *J. Res. Int. Educ.* **2008**, *7*, 259–278. [CrossRef]
8. Phelps, J.M. International Doctoral Students' Navigations of Identity and Belonging in a Globalizing University. *Int. J. Dr. Stud.* **2016**, *11*, 001–014. [CrossRef]
9. Rizvi, F. International Students and Doctoral Studies in Transnational Spaces. In *The Routledge Doctoral Supervisor's Companion. Supporting Effective Research in Education and the Social Sciences*; Walker, M., Thomson, P., Eds.; Routledge: New York, NY, USA, 2010; Volume 1, pp. 158–170.
10. Campbell, A.C.; Kelly-Weber, E.; Lavallee, C. University teaching and citizenship education as sustainable development in Ghana and Nigeria: Insight from international scholarship program alumni. *High. Educ.* **2021**, *81*, 129–144. [CrossRef]
11. Martel, M. *Leveraging Higher Education to Promote Social Justice: Evidence from the IFP Alumni Tracking Study*; Institute of International Education: New York, NY, USA, 2019.
12. Martel, M.; Bhandari, R. *Social Justice and Sustainable Change: The Impacts of Higher Education. Ford Foundation International Fellowships Program Alumni Tracking Study*; Institute of International Education: New York, NY, USA, 2016.
13. Campbell, A.C.; Baxter, A.R. Exploring the attributes and practices of alumni associations that advance social change. *Int. J. Educ. Dev.* **2019**, *66*, 164–172. [CrossRef]
14. Messerli, P.; Kim, E.M.; Lutz, W.; Moatti, J.-P.; Richardson, K.; Saidam, M.; Smith, D.; Eloundou-Enyegue, P.; Foli, E.; Glassman, A.; et al. Expansion of sustainability science needed for the SDGs. *Nat. Sustain.* **2019**, *2*, 892–894. [CrossRef]
15. Schneider, F.; Kläy, A.; Zimmermann, A.B.; Buser, T.; Ingalls, M.; Messerli, P. How can science support the 2030 Agenda for Sustainable Development? Four tasks to tackle the normative dimension of sustainability. *Sustain. Sci.* **2019**, *14*, 1593–1604. [CrossRef]
16. United Nations. *The Future Is Now—Science for Achieving Sustainable Development (Global Sustainable Development Report 2019)*; United Nations–Department of Economic and Social Affairs: New York, NY, USA, 2019.
17. Sterling, S. Assuming the Future: Repurposing Education in a Volatile Age. In *Post-Sustainability and Environmental Education*; Jickling, B., Sterling, S., Eds.; Palgrave Macmillan: Cham, Switzerland, 2017; pp. 31–45.
18. Leicht, A.; Heiss, J.; Byun, W.J. *Issues and trends in Education for Sustainable Development*; United Nations Educational, Scientific and Cultural Organization: Paris, France, 2018.
19. Barth, M.; Lang, D.J.; Michelsen, G. Transdisciplinary learning to foster sustainable development: Institutionalizing co-engaged South–North collaboration. *GAIA-Ecol. Perspect. Sci. Soc.* **2019**, *28*, 382–385. [CrossRef]
20. Villeneuve, D.; Durán-Rodas, D.; Ferri, A.; Kuttler, T.; Magelund, J.; Mögele, M.; Nitschke, L.; Servou, E.; Silva, C. What is Inter-disciplinarity in Practice? Critical Reflections on Doing Mobility Research in an Intended Interdisciplinary Doctoral Research Group. *Sustainability* **2020**, *12*, 197. [CrossRef]
21. Wiek, A.; Withycombe, L.; Redman, C.L. Key competencies in sustainability: A reference framework for academic program development. *Sustain. Sci.* **2011**, *6*, 203–218. [CrossRef]
22. Barth, M. *Implementing Sustainability in Higher Education: Learning in an Age of Transformation*; Routledge: Abingdon, UK, 2015.
23. Herweg, K.; Zimmermann, A.B.; Lundsgaard-Hansen, L.; Tribelhorn, T.; Hammer, T.; Tanner, R.P.; Trechsel, L.J.; Bieri, S.; Kläy, A. *Integrating Sustainable Development into Higher Education—Guidelines with In-depth Modules for the University of Bern; Foundations*; University of Bern, Vice-Rectorate Quality, Vice-Rectorate Teaching, Centre for Development and Environment (CDE), Educational Development Unit (ZUW), and Bern Open Publishing (BOP): Bern, Switzerland, 2017. [CrossRef]
24. Kläy, A.; Zimmermann, A.B.; Schneider, F. Rethinking science for sustainable development: Reflexive interaction for a par-adigm transformation. *Futures* **2015**, *65*, 72–85. [CrossRef]
25. Förster, R.; Zimmermann, A.B.; Mader, C. Transformative teaching in Higher Education for Sustainable Development: Facing the challenges. *GAIA—Ecol. Perspect. Sci. Soc.* **2019**, *28*, 324–326. [CrossRef]
26. Thieme, S.; Fry, P. Transdisziplinarität erleben-Prinzipien für die universitäre Lehre. In *Prinzipien, Strukturen und Praktiken geographischer Hochschullehre*; Wintzer, J., Mosing, I., Hof, A., Eds.; UTB: Stuttgart, Germany, Forthcoming.
27. Tillmanns, T. Learning sustainability as an effect of disruption. *Environ. Educ. Res.* **2019**, *26*, 14–26. [CrossRef]
28. Sallah, M. Generating disruptive pedagogy in informal spaces: Learning with both the head and the heart. *Vzgoja Izobr.* **2020**, *51*, 16.
29. Kläy, A.; Schneider, F. Zwischen Wettbewerbsfähigkeit und nachhaltiger Entwicklung: Forschungsförderung braucht Politikkohärenz. *GAIA—Ecol. Perspect. Sci. Soc.* **2015**, *24*, 224–227. [CrossRef]
30. Baumann, C.; Dietze, A.; Maruschke, M. Managing Processes of Globalization: A Spotlight on the University as a Key Institution in the 21th Century. *Comparativ. Z. Glob. Vgl. Ges.* **2017**, *27*, 168–202.
31. Kölbel, A.; Thieme, S.; Pfaff-Czarnecka, J. *Universities as Transformative Social Spaces: Mobilities and Mobilisations from South Asian Perspectives*; Oxford University Press: Oxford, UK, 2021; Forthcoming/print March 2021.
32. Lindberg, E.; Chakrabarti, P.; Thieme, S. *Brain Drain or Brain Circulation? Career Paths of International Students: Swiss Scholarships for International Students at ETH Zurich and the University of Zurich*; ETH Global, ETHZ and UZH: Zurich, Switzerland, 2014.

33. Riaño, Y.; Lombard, A.; Piguet, E. *The Global Race for Talent in Switzerland. How to Explain Migration Policy Liberalisation to Allow International Students Staying after Graduation?* Working Paper #14; NCCR on the Move: Neuchâtel, Switzerland, 2017; pp. 1–20.
34. NCCR North–South. *Partnerships in Research for Sustainable Development. Research Highlights and Their Implications for Policy and Practice*; Centre for Development and Environment (CDE) and National Centre of Competence (NCCR) North–South: Bern, Switzerland, 2013.
35. UNESCO. UNESCO Online Databank. Available online: http://data.uis.unesco.org/Index.aspx?queryid=172 (accessed on 27 February 2020).
36. Madge, C.; Raghuram, P.; Noxolo, P. Engaged pedagogy and responsibility: A postcolonial analysis of international students. *Geoforum* **2009**, *40*, 34–45. [CrossRef]
37. Kölbel, A. Imaginative geographies of international student mobility. *Soc. Cult. Geogr.* **2020**, *21*, 86–104. [CrossRef]
38. Hannerz, U. *Cultures, People, Places*; Routledge: London, UK, 1996.
39. Baas, M. Students of migration: Indian overseas students and the question of permanent residency. *People Place* **2006**, *14*, 9–24.
40. Tilly, C.; Brown, C.H. On Uprooting, Kinship, and Auspices of Migration. *Int. J. Comp. Sociol.* **1967**, *8*, 139–164. [CrossRef]
41. Boyd, M. Familial and Personal Networks in International Migration: Recent Development and New Agendas. *Int. Migr. Rev.* **1989**, *23*, 638–670. [CrossRef]
42. Portes, A.; Sensenbrenner, J. Embeddedness and Immigration: Notes on the Social Determinants of Economic Action. *Am. J. Sociol.* **1993**, *98*, 1320–1349. [CrossRef]
43. Thieme, S. *Social Networks and Migration. Far West Nepalese Labour Migrants in Delhi*; LIT: Münster, Germany, 2006; Volume 7, p. 243.
44. United Nations. *Transforming our World: The 2030 Agenda for Sustainable Development. A/RES/70/1*; United Nations: New York, NY, USA, 2015.
45. Alff, H.; Berny, A. Tracing Connection: Explorations of Spaces and Places. In *Tracing Connection: Explorations of Spaces and Places in Asian Contexts*; Alff, H., Berny, A., Eds.; Wissenschaftlicher Verlag: Berlin, Germany, 2014; pp. 7–20.
46. Beech, J.; Larsen, M.A. Replacing Old Spatial Empires of the Mind. *Eur. Educ.* **2014**, *46*, 75–94. [CrossRef]
47. Lange, E.A. Transforming Transformative Education Through Ontologies of Relationality. *J. Transform. Educ.* **2018**, *16*, 280–301. [CrossRef]
48. Cresswell, T. Mobilities I: Catching up. *Prog. Hum. Geogr.* **2010**, *35*, 550–558. [CrossRef]
49. Sheller, M.; Urry, J. The New Mobilities Paradigm. *Environ. Plan. A Econ. Space* **2006**, *38*, 207–226. [CrossRef]
50. Massey, D. Power geometry and a progressive sense of place. In *Mapping the Futures. Local Cultures, Global Change*; Bird, J., Curtis, B., Putnam, T., Robertson, G., Tickner, L., Eds.; Routledge: London, UK; New York, NY, USA, 1993.
51. Lange, E.A. Transformative learning and concepts of the self: Insights from immigrant and intercultural journeys. *Int. J. Lifelong Educ.* **2015**, *34*, 623–642. [CrossRef]
52. Bhabha, H.K. In the cave of making. Thoughts on third space. In *Communicating in the Third Space*; Ikas, K., Wagner, G., Eds.; Routledge: New York, NY, USA, 2009; pp. 9–14.
53. Jöns, H. Brain circulation and transnational knowledge networks: Studying long-term effects of academic mobility to Germany, 1954–2000. *Glob. Netw.* **2009**, *9*, 315–338. [CrossRef]
54. Lowell, B.L.; Findlay, A.M.; Steward, E. *Brain Strain: Optimising Highly Skilled Migration from Developing Countries*; Migration Working Paper 3; Institute for Public Policy Research: London, UK, 2004; pp. 1–41.
55. Thieme, S. An international degree, social ties and return: When international graduates make a career back home in Kyr-gyzstan. *Int. Asienforum* **2014**, *45*, 113–128.
56. Thieme, S. Coming Home? Patterns and Characteristics of Return Migration in Kyrgyzstan. *Int. Migr.* **2012**, *52*, 127–143. [CrossRef]
57. Wolfeil, N. *Auswirkungen des Auslandstudiums auf spätere Mobilitäts- und Karrieremuster. Das Beispiel der Polnischen Studierenden an Deutschen Hochschulen*; Vienna University Press: Göttingen, Germany, 2012.
58. Heim, E.M.; Engelage, S.; Zimmermann, A.B.; Herweg, K.; Michel, C.; Breu, T. *Tracking Alumni Career Paths: Third NCCR North-South Report on Effectiveness*; NCCR North–South Dialogue, Management Centre, Centre for Development and Environment (CDE), University of Bern: Bern, Switzerland, 2012.
59. Bahna, M. Study choices and returns of international students: On the role of cultural and economic capital of the family. *Popul. Space Place* **2017**, *24*, e2082. [CrossRef]
60. Bjørsted, A. Denmark: Danish Degree students abroad: What can register data tell us? In *Nordic Students Abroad. Student Mobility Patterns, Student Support Systems and Labour Market Outcomes*; Saarikallio-Torp, M., Wiers-Jenssen, J., Eds.; Kela Research Department: Helsinki, Finland, 2010; pp. 119–128.
61. Wiers-Jenssen, J. Degree Mobility from the Nordic Countries. *J. Stud. Int. Educ.* **2013**, *17*, 471–491. [CrossRef]
62. Zingerli, C. A Sociology of International Research Partnerships for Sustainable Development. *Eur. J. Dev. Res.* **2010**, *22*, 217–233. [CrossRef]
63. Hurni, H.; Breu, T.; Wiesmann, U. *NCCR North–South Final Report, 1.7.2001–30.6.2013. [Internal Report]*; NCCR North–South: Bern, Switzerland, 2013; pp. 1–82.

64. Stöckli, B.; Wiesmann, U.; Lys, J.-A. *A Guide for Transboundary Research Partnerships: 11 Principles*, 3rd ed.; Swiss Commission for Research Partnerships with Developing Countries (KFPE), Ed.; KFPE, Swiss Academy of Sciences, and Swiss National Science Foundation: Bern, Switzerland, 2018.
65. Upreti, B.R.; Zimmermann, A.B.; Debele, B.; Cissé, G. *Partnerships in Development-oriented Research. Lessons Learnt and Challenges Ahead*; NCCR North–South, South Asia Coordination Office: Kathmandu, Nepal, 2012.
66. Herweg, K.; Schäfer, N.; Zimmermann, A. *Guidelines for Integrative Training in Inter- and Transdisciplinary Research Settings: Hints and Tools for Trainers of Trainers*; NCCR North-South and Centre for Development and Environment (CDE): Bern, Switzerland, 2012; p. 64. [CrossRef]
67. Madge, C.; Raghuram, P.; Noxolo, P. Conceptualizing international education. *Prog. Hum. Geogr.* **2014**, *39*, 681–701. [CrossRef]
68. Johnson, R.B.; Onwuegbuzie, A.J.; Turner, L.A. Toward a Definition of Mixed Methods Research. *J. Mix. Methods Res.* **2007**, *1*, 112–133. [CrossRef]
69. Baruch, Y. Response Rate in Academic Studies—A comparative Analysis. *Hum. Relat.* **1999**, *52*, 421–438. [CrossRef]
70. Baruch, Y.; Holtom, B.C. Survey response rate levels and trends in organizational research. *Hum. Relat.* **2008**, *61*, 1139–1160. [CrossRef]
71. Morton, S.M.; Bandara, D.K.; Robinson, E.M.; Carr, P.E. In the 21st Century, what is an acceptable response rate? *Aust. N. Z. J. Public Health* **2012**, *36*, 106–108. [CrossRef]
72. United Nations. United Nations Development Programme Human Development Reports. Available online: http://hdr.undp.org/en/composite/HDI (accessed on 27 September 2020).
73. Beaudry, C.; Mouton, J.; Prozesky, H.E. *The Next Generation of Scientists in Africa*; African Minds: Cape Town, South Africa, 2018.
74. Flick, U. *Designing Qualitative Research*; SAGE Publications Pvt Ltd.: London, UK, 2007.
75. Döring, N.; Bortz, J. *Forschungsmethoden und Evaluation in den Sozial- und Humanwissenschaften*; Springer-Lehrbuch; 5. Vollständig überarbeitete Ausgabe; Springer: Berlin/Heidelberg, Germany, 2016; ISBN 978-3-642-41089-5.
76. Hayward, F.M.; Ncayiyana, D.J. Confronting the Challenges of Graduate Education in Sub-Saharan Africa and Prospects for the Future. *Int. J. Afr. High. Educ.* **2014**, *1*, 43. [CrossRef]
77. Fokou, G.; Liechti, K.; Abdiev, A.; Kozhomurato, J. North–South Exchange—Research in JACS ALPS. In *Report of the Study on Institutions and Mechanisms Regulating Swiss Alpine Pasture Use and the Marketing of Pastoral Products [Internal Report]*; National Centre of Competence in Research (NCCR) North-South: Bern, Switzerland, 2008.
78. Liechti, K. Forschungspartnerschaften und Weidenutzungsfragen. *GeoAgenda* **2008**, *4–5*, 4–5.
79. Kahn, M.; Gamedze, T.; Oghenetega, J. Mobility of sub-Saharan Africa doctoral graduates from South African universities—A tracer study. *Int. J. Educ. Dev.* **2019**, *68*, 9–14. [CrossRef]
80. Pohl, C.; Rist, S.; Zimmermann, A.; Fry, P.; Gurung, G.S.; Schneider, F.; Speranza, C.I.; Kiteme, B.; Boillat, S.; Serrano, E.; et al. Researchers' roles in knowledge co-production: Experience from sustainability research in Kenya, Switzerland, Bolivia and Nepal. *Sci. Public Policy* **2010**, *37*, 267–281. [CrossRef]
81. NCCR North–South. *Publication Strategy for the NCCR North–South, Phase 3 (Revised Version of Phase 2 Document). First Version: 2006 [Internal Report]*; Management Centre of the NCCR North–South: Bern, Switzerland, 2010.
82. State Secretariat for Education, Research and Innovation (SERI). University Rankings Results. Available online: https://www.universityrankings.ch/ (accessed on 28 April 2020).
83. Hurni, H.; Wiesmann, U. Transdisciplinarity in Practice. Experience from a Concept-based Research Programme Addressing Global Change and Sustainable Development. *GAIA—Ecol. Perspect. Sci. Soc.* **2014**, *23*, 275–277. [CrossRef]
84. Killias, O. Intimate encounters: The ambiguities of belonging in the transnational migration of Indonesian domestic workers to Malaysia. *Citizsh. Stud.* **2014**, *18*, 885–899. [CrossRef]
85. Colic-Peisker, V. Free floating in the cosmopolis? Exploring the identity-belonging of transnational knowledge workers. *Glob. Netw.* **2010**, *10*, 467–488. [CrossRef]
86. Sterling, S. Transformative Learning and Sustainability: Sketching the conceptual ground. *Learn. Teach. High. Educ.* **2011**, *5*, 17–33.
87. Lange, E.A. Transformative and Restorative Learning: A Vital Dialectic for Sustainable Societies. *Adult Educ. Q.* **2004**, *54*, 121–139. [CrossRef]
88. Lotz-Sisitka, H.; Wals, A.E.J.; Kronlid, D.; McGarry, D. Transformative, transgressive social learning: Rethinking higher education pedagogy in times of systemic global dysfunction. *Curr. Opin. Environ. Sustain.* **2015**, *16*, 73–80. [CrossRef]
89. Wals, A.E.J. *Social Learning towards a Sustainable World: Principles, Perspectives, and Praxis*; Wageningen Academic Publishers: Wageningen, The Netherlands, 2007.
90. Wals, A.E. Sustainability in higher education in the context of the UN DESD: A review of learning and institutionalization processes. *J. Clean. Prod.* **2014**, *62*, 8–15. [CrossRef]
91. Gutiérrez, K.D. Designing Resilient Ecologies: Social Design Experiments and a New Social Imagination. *Educ. Res.* **2016**, *45*, 187–196. [CrossRef]
92. Jickling, B. Education revisited: Creating educational experiences that are held, felt, and disruptive. In *Post-Sustainability and Environmental Education*, 1st ed.; Jickling, B., Sterling, S., Eds.; Palgrave Macmillan: Cham, Switzerland, 2017; pp. 15–30. [CrossRef]

93. Spivak, G.C. Can the Subaltern Speak? In *Marxism and the Interpretation of Culture*; Nelson, C., Grossberg, L., Eds.; University of Illinois Press: Urbana, IL, USA; Chicago, IL, USA, 1988; pp. 271–313.
94. Trechsel, L.J.; Steinböck, C.; Ayeri Ogalleh, S.; Zimmermann, A.B.; Herweg, K.; Breu, T.; Lannen, A. *Unlocking Knowledge for Sustainability: Partnership-Based Research and Education*; CDE Policy Brief, No. 17; Centre for Development and Environment (CDE): Bern, Switzerland, 2020.

5.3 **Paper 3:** Students at the Science–Society Nexus: Why Students' Learning Experiences in Transformative Spaces are Vital to Higher Education Institutions

Students at the Science–Society Nexus: Why Students' Learning Experiences in Transformative Spaces are Vital to Higher Education Institutions

Abstract

Purpose – This study investigates students' learning experiences in self-led sustainability projects conducted outside formal curricula. The projects are conceived as learning spaces in "ecologies of learning" (Wals, 2020) in which five learning dimensions can be examined. We explore the role of student project leaders working at the science–society boundary in a "whole institution" approach.

Design/methodology/approach – Using a grounded-theory-based qualitative approach and sensitizing concepts, 13 in-depth semi-structured interviews were conducted exploring students' learning experiences. Interviews were categorized in MAXQDA and analysed against a literature review.

Findings – Results revealed that non-formal students' experiences in student-led projects triggered deep learning; trust, social cohesion, empowerment, and self-efficacy were both results and conditions of learning. Students' learnings are classified according to higher education institutions' (HEIs) sustainability agendas, providing insights for HEIs regarding their accommodative, reformative, or transformative (Sterling, 2021) path to sustainable development.

Originality – The education for sustainable development (ESD) debate focuses mainly on ESD competences in formal settings. Few studies investigate students' learnings where formal and non-formal learning meet. This article investigates a space where students interact with different actors from society while remaining rooted in their HEIs. When acting as "change agents" in this hybrid context, students can also become "boundary agents" helping their HEIs move the sustainability agenda forward towards a whole institution approach.

Keywords: student learning, ecologies of learning, education for sustainable development, boundary agent, non-formal learning, whole institution approach

Paper type Research paper

1. Introduction

What role should students have in higher education institutions (HEIs)? Given the urgency of current challenges worldwide, HEIs are increasingly committing to sustainable development (SD) in their mission. However, they often conceive of SD sectorally, in a mode that Sterling (2021) calls "accommodation". While HEIs can contribute to the Sustainable Development Goals in this manner, they would likely be more effective if they adopted an SD-oriented "whole institution approach" (Wals, 2020, Sterling, 2021). In so doing, HEIs would ideally stop viewing students as mere recipients of knowledge and skills (Tilbury, 2016, Leal Filho et al., 2018), and instead view them as stakeholders capable of transforming their institutions of learning and making meaningful contributions to SD (Winter et al., 2015). The need for this type of broader understanding of education and learning is clearly articulated by the Berlin Declaration on Education for Sustainable Development (ESD) (UNESCO, 2021), adopted on 19 May 2021. Besides calling for ESD and a whole institution approach, the Berlin Declaration explicitly calls for mainstreaming transformative learning in all educational

efforts, in accordance with the globally agreed 2030 Agenda (United Nations, 2015) and its observation that education is a key transformation lever: “Transformative learning for people and the planet is a necessity for our survival and that of future generations. The time to learn and act for our planet is now” (UNESCO, 2021, p. 4).

According to Mezirow (2012, p. 76), transformative learning is “the process by which we transform our taken-for-granted frames of reference (meaning perspectives, habits of mind, mindsets) to make them more inclusive, discriminating, open, emotionally capable of change, and reflective so that they may generate beliefs and opinions that will prove more true or justified to guide action”. Against this backdrop, what does the Berlin Declaration’s urgent call for transformative learning imply for HEIs, staff, and students? Overall, HEIs need to expand their understanding of learning – both in terms of how they understand their educational mission and how they understand who should be the learners. First, students need to acquire more than just (disciplinary) knowledge and skills – they also need to engage critically with societal attitudes, human values, and the need for action (Hay et al., 2019, Balakrishnan et al., 2019). Second, HEIs must recognize that learning is not exclusive to the classroom and similar formal settings (Wals et al., 2017) and that students are not the only learners, nor do they learn solely as individuals. Indeed, opportunities for non-formal and joint learning are crucial for everyone involved in HEIs and should be fostered as a matter of institutional culture; Sterling and Maxey (2013) refer to this as creating a “culture of critical commitment”. If HEIs fail to foster cultures of continuous learning, learning together, and rethinking institution-wide mindsets, they run the risk of remaining frozen in existing structures and values, unable to contribute to SD effectively (Macintyre et al., 2020).

This highlights the rationale underpinning whole institution approaches to ESD, which emphasize awareness of sustainability challenges, critical thinking, joint and lifelong learning for change, and empowerment for sustainability agency in everyday contexts (Wals and Benavot, 2017). Additionally, there is a need for exploration and consolidation of “sustainability-oriented ecologies of learning” (Wals, 2020), whereby learning occurs in a holistic, interconnected way in collaboration with different actors. Here, there must be opportunities for transformation of people’s mindsets, in settings that include diverse stakeholders – in addition to students – and provide learners with space for reflection and experimentation as well as taking action and developing change agency. One important feature of such ecologies of learning is that distinctions between formal, non-formal, and informal learning lose their saliency. Wals (2020) also recommends focussing on five different dimensions of learning (*learning to know, to do, to care, to be, and to transform*) that are highly connected, depend on different learning mechanisms, and contribute to very different outcomes and processes. As a result, spaces for transformation are developed in which students and other members of HEIs can challenge prevailing attitudes, experiment with new ways of thinking, and co-create new ideas for change (Mezirow, 2012), that is, experience and shape transformative learning towards SD.

Recent studies have explored how teaching and learning formats enable transformative moments in formal curricula and potentially support the development of change agency among participants (Rodríguez Aboytes and Barth, 2020). However, few studies have analysed the learning experiences of students in HEI-associated non-formal settings (Wals and Benavot, 2017, Rodríguez Aboytes and Barth, 2020) that incorporate societal actors and aim to contribute to SD. Exploring students’ learning experiences can help to identify whether and how students develop change agency based on their learnings in non-formal HEI contexts, as well as how they can become “boundary agents” (McNie et al., 2008) between science and society.

We address this research gap by examining the learning experiences of students who launched initiatives at HEIs and explored spaces for sustainability mainly beyond their walls, i.e. in wider society. In this way, they experimented with change agency both in their HEI and in society. Their initiatives were supported by the Swiss U Change programme (2017–2020), which enabled students at Swiss HEIs to create action-learning spaces for various experiments, including all-gender restrooms, ranking of smartphones, and mapping of sustainable dietary guidelines. As initiatives occurred outside formal curricula, U Change projects present ideal case studies for use in exploring students' learning for SD experiences in non-formal settings. For this, we examined such projects based on the following questions:

- What transformative spaces did students use and shape? (conditions)
- How and what did students learn through their initiatives and projects? (process and outcomes)
- How can student-led projects foster transformation in their HEIs? (steps towards a transformation)

Guided by the concept of "ecologies of learning" (Wals, 2020), we sought to answer our research questions by conducting qualitative analysis of interviews with student project leaders. To capture the specificities of associated learning processes, we structured our analysis according to the five dimensions of learning proposed by Wals (2020). Finally, we reflected on lessons regarding the role of students as potential boundary agents and change agents vis-à-vis three different types of HEIs: "accommodative", "reformative", or "transformative", in line with Sterling's (2021) differentiation of HEIs by how they engage with sustainability.

2. Literature review

Our research questions emerged from a literature review, which also gave rise to the following conceptual focuses.

2.1 The role of learning in higher education institutions: Reformative model or transformative model?

Interest in what forms of pedagogy and curricula can foster SD competences in students has generated a rich literature featuring diverse pedagogical models. Shephard et al. (2018) have sought to unravel the complexity of resulting ESD discourses. Their hermeneutic inquiry reveals that the terms "competences" and "capabilities" are often marred by misunderstandings, especially across languages and pedagogical cultures. Their conclusion is:

> ESD does need to agree [on] terms that adequately describe educational processes designed to change *what learners will be willing to do or to be*, as different from processes designed to change *what learners know or what learners can do, if they choose to* (Shephard et al., 2018, p. 13, our italics).

This fundamental distinction is arguably the line that can be drawn between HEIs that aim to *transform* themselves and those that seek only to *reform* themselves (Sterling, 2021). While the former are likely to include formats for transformative learning in their curricula and institutional practices, the latter are likely to opt instead for narrower understandings of teaching and learning focused on acquisition of knowledge, skills, and critical thinking, but wary of tackling human values and the emotions related to them or the need for action.

The aim of learning in the *reformative model* is that students move towards interdisciplinarity to improve their systemic understanding of sustainability and real-world problems (Ashby and Exter, 2019). The aim of learning in the *transformative model* is that students (and other actors) advance towards hands-on change agency for SD (Briggs et al., 2019, Trechsel et al., 2021). Whatever the striven-for degree of change – reformative or transformative – ESD experts agree that HEIs must support creation of "safe spaces" to facilitate disruptive learning concerning SD challenges and inspire students to step outside their comfort zone. By contrast, Sterling's (2021) "accommodation" model refers to learning *about* SD, which does not require creation of safe spaces for disruptive learning.

2.2 What do safe spaces enable?

In line with the reformative model, interdisciplinarity has become an almost universally expressed aim of HEIs today. Despite this, competition for funds, careers, and corresponding power continues to occur according to disciplinary criteria, making it unattractive to provide students with truly interdisciplinary education programmes (Tarrant and Thiele, 2017), especially at research universities. Meaningful interdisciplinary education demands strong collaboration between teachers from different faculties, is student-centred, and makes it possible to confront disciplinary mindsets. This requires greater efforts, teamwork, and dedicated support by HEIs (Ashby and Exter, 2019), especially to create safe spaces in which students are encouraged to reach across epistemological boundaries, to develop critical and systemic thinking, and to question the nature of knowledge itself.

In the transformative model, use of transdisciplinary approaches complements and reinforces interdisciplinarity. Besides transgressing disciplinary boundaries, transdisciplinarity seeks to integrate different forms of knowledge and to "provide possibilities for engaged, lived experience of transformative praxis for all […] students; to be seen as learning capability necessary for encountering the future" (Lotz-Sisitka et al., 2015, p. 78). Many ESD scholars favour the transformative model, including Wals (2020), for example, who advocates blended spaces where disruption and discomfort are triggered, enabling boundary-spanning learning to occur. He also emphasizes that social cohesion, trust, and respect are needed as a basis for interaction in such spaces. In addition, students benefit from a sense of freedom and empowerment in safe spaces (Haber-Curran and Tillapaugh, 2014). Further, Briggs et al. (2019) and Barth and Michelsen (2013) add that providing a safe space in which students can fail is essential, while Förster et al. (2019) and Winter et al. (2015) emphasize that a change of mindset (and ultimately behaviour) is only possible if participants' emotions and intuitive selves are given space in the learning process.

Another crucial aspect of learning in such spaces is critical self-reflection (e.g. Haber-Curran and Tillapaugh, 2014, Singer-Brodowski, 2016, Drupp et al., 2012). Singer-Brodowski (2016) highlights self-organized, problem-based learning and shows how self-determination in self-organized learning can increase students' intrinsic motivation and foster a deeper sense of ownership. Focusing on student initiatives for SD as learning spaces, Drupp et al. (2012) emphasize how students experience self-empowerment by acquiring knowledge in a self-reflective way; moreover, through participation and cooperation, they experience self-efficacy, self-learning, and self-organization. A recent study of student interventions concerning Urban Greening Processes (Stobbelaar, 2020) confirmed the self-organizing, empowered, networked, and mutual learning paths forged by students in their campus initiatives and underscored particular benefits, stating:

> [students having] time, thinking out of the box and a certain innocence, as they (unconsciously) used their outsider position to ask questions that more involved people cannot ask. Students can bring excitement, action and energy. Their mere presence can make a difference and start a process of change (p. 12).

Interestingly, this pro-active student role has also been confirmed from a historical perspective by Lange (2019), who observed that students have always been more than passive learners of curricula regardless of the change model that guides an HEI. Indeed, students have also been actors engaged in questioning and trying to transform society and their HEIs, sometimes against the grain of institutional and societal structures, and other times as institutional allies.

2.3 Students as "change agents" and "boundary agents" between science and society

Building bridges between science and society is part of HEIs' third mission (Geier, 2018) and thus relevant to integrating sustainability in HEIs. The question is: How can this science–society interface be shaped to serve sustainability and what role can students play? ESD scholars have emphasized that students can assume the role of "change agents". This role has been defined as one in which "the researcher seeks to motivate and empower participants, for example, to address local (sustainability) challenges, and networks with stakeholders outside the protected space" (Wittmayer and Schäpke, 2014). This definition certainly applies to students who initiate and lead HEI-supported societal projects. Such students can also help overcome various boundaries between the worlds of science and society, enabling joint learning and decision-making for action (Schröder et al., 2020, Drupp et al., 2012).

This position at the boundary between science and society has often been explored in connection with science and policy. Guston (2001) highlighted the ability of "boundary organizations" to use "boundary objects" (Star and Griesemer, 1989) and link (scientific) knowledge and action (in society) in a "simultaneous production of knowledge and social order" (Guston, 2001, p. 401). In sustainability research, the term "boundary agent" has also emerged. According to observers, experience shows that "boundary agents, individuals who may work for or with the boundary organization […,] play a central role in creating and sustaining relationships, building trust, communicating information needs and concerns, and bridging gaps between various stakeholder groups" (McNie et al., 2008, p. 2). Further, the success of such agency depends on how deeply given actors are embedded in the communities they are engaged in. This requires trusting relationships, which can only be developed in a boundary-spanning "safe space" where trust is built because the "boundary agent" is a member of both worlds (McNie et al., 2008). Here, the change agency of boundary agents is arguably heightened by the *credibility* and *legitimacy* afforded them for belonging to each world; their agency also acquires *salience* due to the immediacy of the sustainability concerns and the contexts addressed. In this way, all three conditions cited by Cash et al. (2003) as necessary for making knowledge for SD effective – i.e. *credibility*, *legitimacy*, and *salience* – are available and can lead to action, as part of a social learning process.

2.4 Social learning and ecologies of learning as central elements in students' learning spaces

Students experience social learning in diverse ways outside of HEIs, including in their families, job environments, and communities. Social learning, whether deliberate or unintentional, has been shown to foster transformations of actors' cognitive, normative, relational, and emotional competences as well as social capital (Boix Mansilla et al., 2015). Hence, social learning – with "learning by doing" at its core (Poland, 2021) – can lead to sustainability-related changes in values, perceptions, and cultural beliefs both individually and collectively (Tàbara and Pahl-Wostl, 2007).

In HEIs, fostering social learning requires a more holistic understanding of education, in which non-formal and informal learning can occur within the formal context (Wals and Benavot, 2017, Lotz-Sisitka et al., 2015). Holistic learning can be facilitated by allowing "diversity and dissonance, in order to deepen the learning, recognize multiple ways of knowing and being in the world" (Macintyre et al., 2020, p. 19). In Wals' (2020) view, ecologies of learning offer "blended learning space[s]" – "an organic system that allows those who are actively engaged *in* and *with* the system to learn in different ways" (p. 63) and in different learning dimensions. According to Wals:

> [I]n line with systems-thinking thought, the whole is [considered] more than the sum of its parts. The "learning" refers to the reflexive element. […] A sustainability-oriented ecology of learning essentially comprises a vital coalition of multiple stakeholders engaged in addressing a common challenge and/or realizing a common vision […] (pp. 63–64).

An HEI with a whole institution approach can help foster such spaces, with students working with others not only to acquire knowledge, but also to "do", to "be" (Shephard et al., 2018), to "care", and to "transform" (Wals, 2020) in a process of social learning.

3. Methodology

3.1 Context

In the present study, we focused on students' learning experiences in projects they successfully submitted to U Change, a Swiss national programme funded by the State Secretariat for Education, Research and Innovation (SERI). The aim of this four-year programme (2017–2020) was to provide a platform for SD that would enable students to work across disciplinary boundaries and develop connections with societal actors, with a view to learning and working for SD in self-initiated projects. The programme enabled students to practise critical reflection, develop a systems perspective, contribute concrete and practice-oriented inputs, establish contacts with future employers, and learn to plan and implement a project while developing business skills (swissuniversities, 2016). Student project proposals had to obtain a 50% financial commitment from their home university before submission; if successful, they received the other 50% from the U Change programme and launched their project.

3.2 Sampling, data collection, and data analysis

In June 2020, we contacted all 42 U Change student project leaders by email. Of these, 13 students, aged 24–40 (average: 29.5 years, representative of the overall age distribution) agreed to be interviewed in January and February 2021. Interviewees were either still enrolled or recently graduated. Interviews lasted 31–77 minutes (average: 48 minutes); 11 were conducted in German and two in English. Interviewees were guaranteed confidentiality and asked to sign a consent declaration. Other ethical issues were addressed in thorough discussion of the research design with a group of experts.

The interview guide for the in-depth semi-structured interviews contained five open-ended questions, allowing interviewees to speak freely about their personal experiences. A few additional sub-questions were available, if needed, to go into greater depth. Interviewees were only sent a brief description of the purpose and focus of the interviews in advance. In the interviews, students were first asked what they were able to initiate through their project and what results they were particularly pleased with. Question two inquired about any important experiences that were enabled in the project. The third question investigated the difference between learning experiences

garnered in the project and learning experiences obtained in formal university courses. Afterwards, interviewees were asked to describe any situation in which their learnings were particularly rich. Finally, they were asked to describe their learnings with partners.

All interviews were conducted and recorded online due to COVID-19. Transcription was done verbatim with voice recognition software (FX4), followed by careful corrections. Our initial test interview was included in the final dataset, as it was complete and satisfactory.

Our overall qualitative approach was inspired by grounded theory (Strauss and Corbin, 1996), which enables collection of data in a structured and simultaneously open, self-reflective way. Sensitizing concepts were used to initiate the output-oriented process of analysis (Kruse, 2015). For the inductive analysis of interview data, core categories were first developed based on the aggregation of different categories drafted independently by three authors, so as to avoid a one-sided perspective. These core categories where then divided into 25 main categories and 88 sub-categories. The core categories were defined using selective coding, i.e. according to the main elements derived from our three initial research questions, enriched by the five learning dimensions (Wals, 2020) of ecologies of learning: *learning to know, to do, to care, to be,* and *to transform*. Interviews were categorized and analysed using the program MAXQDA. Deeper analysis of selected data was conducted on a sub-sample exported to Excel.

The conceptual argumentation presented above in our introduction and literature review served as the analytical frame in which our three research questions were set and interview data were analysed, with the overall aim of addressing the question of what role students can play in their HEIs, considering their learning experiences and the diversity of HEIs' SD strategies.

4. Results and discussion

4.1 Creative and safe spaces for transformation

In the interviews, students highlighted the collaboration and networks that they built in their respective HEIs – between different disciplines (interdisciplinarity) and with fellow actors such as sustainability managers. They also emphasized the networks and collaboration they developed beyond the walls of their HEIs when working with societal actors. Many encountered open doors when interacting with these actors but found it challenging to provide them with suitably packaged scientific insights. They experienced acting as "bridge builders" or "catalysts", occupying a boundary-spanning position, and described this as a way of overcoming barriers between science and society.

> It's not just "ivory tower" science, but something concrete and real. It doesn't increase the divide between science and society, but instead tries to repair certain rifts in some way. (Respondent 9)

Students were enthusiastic about motivating other students and moving together in the same direction. They enjoyed exchanging with students from other HEIs and sharing their experiences dealing with stubborn structures. They also appreciated their project-related role at their respective HEI, which enabled them to "jump hierarchies" and gain an audience with university rectors or presidents.

> To implement certain things, there's an initial spark needed that students can provide, since we can be a bit more disruptive in our demands and more disruptive about existing structures; many others can't bypass certain hierarchies and remain more or less blocked […] We [simply] went to the office, knocked on the door, and said we'd like a meeting. (Respondent 8)

Interviewees described how their student projects enabled them to learn in a more dynamic, creative way at various levels, and to engage in a continuous learning process. This also gave them room to let go of scientific knowledge acquisition habits and to experience learning differently. They highlighted how a new, creative, safe space for learning opened up, not only for themselves, but also for others – a space they had never occupied before, in which more diverse groups of people belonged. They described it as a valuable space for learning and a more comfortable educational space for "our generation".

> It's a place where you can express yourself, in a safe space and surrounded by people who encourage you to keep going […]. In many places, there's simply no such space where you can express yourself that way and receive a genuinely well-intentioned suggestion in return, rather than just criticism. (Respondent 8)

Interviews revealed that recognition from others is crucial. In the formal teaching environment, some students felt they were assessed as "either right or wrong"; and if they were seen as wrong, they felt disqualified. The fear of being judged as a non-achiever was described as crippling and isolating. By contrast, the student projects provided students with a sense of security, backing, and legitimacy with regards to the topics/activities they engaged in. In one case, the legitimacy came because the student was perceived to be neutral in a conflictual setting. The projects also provided them with institutional legitimacy and the opportunity to assume a leadership role and leverage impacts. Interestingly, in the context of COVID-19 restrictions, interviewees repeatedly mentioned that they preferred and missed the "physical space", including face-to-face meetings, and found online communication difficult.

Overall, students emphasized the importance of building networks and collaboration beyond their HEIs. They described the bridge created between their home institution and local community members as a flourishing environment (Schröder et al., 2020). Students created new spaces with their projects, sometimes adopting unconventional approaches and exhibiting a certain innocence (Stobbelaar, 2020). They profited from a safe and creative space where "out of the box" thinking and doing were allowed (Briggs et al., 2019) and where diversity and mutual recognition empowered students.

4.2 Understanding the processes and outcomes of students' learning experiences

4.2.1 Learning to know

Project leaders developed soft skills, which helped them to organize, plan, and manage their activities. Enhancing their communication and management skills and handling finances were listed as key learnings. Students emphasized the need and the importance of such skills in the labour market. The knowledge they gained was useful not only for their university life, but also for life in general.

> These are things that not only help in the daily work at the university, but also help you to stand on your own two feet in life. And they also help to organize life. (Respondent 4)

Students emphasized that, in their usual studies, they typically learned much more about "the what" than "the how" of particular fields. The hands-on learning involved in their student projects was highly appreciated. For many, an important step was writing the project proposal – some failed in the first round and this pushed them to do it again and better.

Students highlighted that they acquired knowledge in multiple ways (Macintyre et al., 2018). They experienced forms of failure that did not disqualify them, for example, because they had a second

chance to hand in proposals. This culture of advancing through "failure" has been observed as an enabling factor by Briggs et al. (2019) and Barth and Michelsen (2013).

4.2.2 Learning to do

One core experience students had in their projects was that of testing out new things in a trial-and-error manner. They learned to do things themselves in real-world contexts, often finding that the reality of matters was much different from what they had learned in "theory". They spoke of the importance of the unconventional paths they took in their projects, the value of having the chance to make mistakes, and how they learned from this. They explicitly spoke about the relevance of acknowledging errors and how it was useful to make mistakes specifically because the resulting lessons were so valuable.

> In certain phases, we had to fall on our face yet again in order to realize that the original idea maybe wasn't the smartest one (Respondent 9)

Good communication was acknowledged to be an important skill in settings where "learning by doing" was paramount. Interviewees emphasized the importance of taking time to reflect. They reflected on their own actions by listening to each other and getting to know different perspectives, with the goal of working as a team to find out why some things worked and others did not.

> And then you just begin to reflect and you ask yourself: "Why didn't it work?". In the conversation afterwards, when you discuss things, you realize maybe that there are very different perspectives. (Respondent 5)

Students strove to overcome their own limitations and reach the same wavelength as others. They succeeded in going beyond their original disciplinary thinking, identifying links between complex topics. They developed new mental maps and learned to think more holistically. They spoke about the flexibility they developed to grapple with uncertainties.

Students also emphasized the importance of developing the ability to present in front of audiences of experts.

> You learn to stand up in front of people and to talk to people you see as authorities, and you gain the confidence to express yourself and to present yourself in front of others. (Respondent 4)

In this sense, students' learning experiences were similar to what Stobbelaar (2020) found when he explored how students organize themselves and share information. A major part of the student projects entailed learning to self-organize. Students also appreciated "learning by doing", which lies at the centre of social learning (Poland, 2021). Additionally, self-learning facilitates deep learning processes and challenges students emotionally (Singer-Brodowski, 2016).

4.2.3 Learning to care

Interviewees also pointed out how important the emotions were that they experienced in their project teams, including sharing similar feelings, the same mindset and passion, and the desire to head in the same direction to reach a goal. Students spoke about the power they felt knowing that the team stood behind them. Many interviewees mentioned the deep learning experience they had when laughing or crying together and sharing great moments: this made them appreciate and support each other, getting to know what it feels like to contribute to a team – an emotional experience that continued to resonate well beyond the end of the project.

> The wonderful moments we shared together, they warm your heart, there's no other way to put it. (Respondent 9)

Getting to know each other's perspectives enabled students to feel empathy and respect and to encourage one another to go on. Many team members became friends. They learned from each other by giving and receiving trust, establishing emotional ties, and allowing everyone to speak about failures, fears, and obstacles.

> If we hadn't become friends, if we hadn't cultivated this team spirit, it would have been difficult to say: "I have failed". (Respondent 8)

Interviewees' emphasis on caring and sharing values highlights how individual learning is strongly connected to social learning. Meanwhile, Tàbara and Pahl-Wostl (2007) argue that social learning facilitates change towards sustainability. Additionally, Wals (2020) highlights that social cohesion makes it possible to build social ties in a heterogeneous groups and enables questioning of mindsets.

4.2.4 Learning to be

Observations made by Haber-Curran and Tillapaugh (2014) underline the dependency on and fluid relationship between the experience of challenging mental models, building trust, finding freedom and empowerment, developing commitment, and reframing learning and the self (p. 16). Placing the "self" in focus, students experienced personal development and self-awareness as a challenging, enriching process: they realized their limitations, resolved to work on them, and sometimes experienced themselves as a new person. Many of the interviewees increased their sense of self-efficacy, giving them the confidence to feel good in their own skin or individual personality.

> I was able to create an environment in which I feel comfortable in my own identity. (Respondent 8)

Often learning experiences that led to self-awareness were linked to positive emotions generated by the team experience. Joy came from pulling in the same direction, working with one's heart and soul, and realizing that it is possible to change things. Such social ties can foster awareness, learning, and action (Lange 2019). Students emphasized that taking action, taking risks, and showing perseverance opened their eyes to opportunities for success.

> The progression of the project demonstrated that "constant dripping wears away the stone". And if you really keep at something, it will eventually lead somewhere. (Respondent 9)

Nevertheless, the learning situation sometimes triggered negative emotions. Some students felt challenged by difficult interpersonal relationships, loss or lack of teamwork, dealing with individuals with dominant egos, and moments of deep frustration or harsh criticism. Handling frustrating moments showed students the importance of emotional learning, which requires time and reflection.

> And then you're frustrated, above all, because the house of cards you built, so to speak, comes tumbling down […] and [it] takes time to process these emotions. (Respondent 5)

4.2.5 Learning to transform

Facing emotional challenges can be an important learning edge (Förster et al., 2019), enabling students to "learn to transform" (Wals 2020). Students realized that being in an uncertain life phase opened them to new ideas. They felt very flexible in their way of thinking and receptive to unplanned knowledge and experiences. They described their state as "free-floating" and underlined their strong desire to be disruptive and engage on behalf of SD, other students, and necessary changes. They felt that being a student could lead them through rites of passage resulting in new orientations, lifestyles, and thinking.

> Because, as an adult, you can get stuck in compartmentalized thinking, day-to-day thinking, routine thinking. But as a student it's different […]. We have so many different perspectives that we bring with us, and if you really stimulate [our imagination] and encourage us to think for ourselves, there's huge potential there for numerous ideas. (Respondent 10)

Interviewees emphasized the different perspectives they acquired by sharing experiences. They felt that what they do provides fertile ground for different kinds of learning and change, as well as motivation for new initiatives.

> It's a different kind of learning because you don't do it simply to learn, but rather because you're motivated to change something (Respondent 4)

They also experienced the power to motivate other students and societal actors. Joint learning is highly valuable here (Schröder et al., 2020). Collaboration between students and local stakeholders can empower participants and produce change agency (Drupp et al., 2012).

4.3 Transformation of HEIs and beyond

The empirical data reveal major potential for change in and outside HEIs. Students described how they successfully "sowed the first seed", provided an "initial spark", or "set the ball rolling". Many felt the need to sensitize others and act as bridgebuilders between their HEIs and various external domains (e.g. work, community, city, country).

> After all, students are just at university for a certain amount of time and take [their experience] with them also in their learning following university – so, longer term, I might also imagine an impact there. (Respondent 13)

Students experienced significant support from university staff, especially their supervisors, and found allies within HEIs. Financial support from the programme and their HEI also played a fundamental role, not least in legitimating their project. They received recognition for their work from external partners and felt empowered as potential "boundary agents" (McNie et al., 2008).

However, while students' projects received basic funding, a large part of the work was done on a voluntary basis. This voluntary work was seen as a two-edged sword, raising disruptive questions (Wals, 2020) about the role of the wider economic system vis-à-vis SD goals. On the one hand, voluntary work was experienced as very fulfilling, a source of precious learnings, and as providing an opportunity to demonstrate commitment. On the other, students reported that this voluntary work was only possible for those who were indirectly supported, e.g. by parents who helped them cover their living expenses. Some reported that it was difficult to find motivated colleagues to support their initiative, as their fellow students were too busy studying to join a project. Others mentioned that they did not feel recognized as equal partners because unpaid work was not valued the same as paid work, especially by external partners. Students also viewed the transition from voluntary work to work outside HEIs as difficult.

Importantly, the interviewees also realized that they acquired power through their initiatives: they found ways to put pressure on HEIs and influence their SD strategies.

> You can achieve a lot like this, because you have a lot of supporters within existing structures, some of whom cannot or aren't allowed to express things openly, but who are still very happy to join when they see such a movement coming together. (Respondent 8)

Students also expressed a desire for their HEIs to serve as SD role models. They hoped their initiatives would spill over and impact HEI structures. They argued that student initiatives bear great

potential for HEI public outreach. Further, students emphasized the importance of building soft skills to make them ready for the labour market, benefitting from contacts for new job arrangements, and exchanging and reflecting with actors from society, something they missed in the normal course of studies at HEIs. They emphasized that the time they spent in their HEI was short but that their learnings would last much longer.

5. Learning from students' learnings: different pathways towards integration of sustainability in HEIs

Heeding the call to transform HEIs on behalf of the sustainable development goals, our research sheds light on students' learning experiences where formal and non-formal learning meet. We analysed these experiences along the five learning dimensions Wals (2020) evokes in his model of "ecologies of learning". Our results show that student-led projects provide significant, diverse potential for deep learning, going beyond disciplinary, formal learning. Such learning is often transformative, individually and socially, both within HEIs and outside them.

The study setting, supported by a Swiss programme for tertiary students, enabled students to enter a safe and transformative space to acquire new skills, self-reflect, experiment with social learning, co-design new practices based on SD knowledge, and translate these practices into action. Students exploited these spaces and also shaped them: some worked in sustainability projects as boundary agents, learning and acting in two worlds, providing crucial links between science and society. Such projects bear great potential for HEIs that want to strengthen their contributions to sustainability, no matter how ambitious these strategies are in terms of contributing to societal transformation. In Table I, based on our empirical and theoretical results, we propose three learning environments through which students (and other actors) can support SD changes at their HEIs. We suggest that HEIs can foster one or more of these learning environments based on their level of sustainability ambition, in line with Sterling's (2021) distinction between:

- *accommodation*: HEI espouses third mission for "business as usual", adopts campus greening, and education on sustainability in obvious disciplines;
- *reform*: HEI integrates SD at policy level in a sectoral way in campus, curricula, and research activities; and
- *transformation*: HEI follows sustainability ethos that leads to fundamental redesign and iterative learning, as well as to a holistic approach (whole institution approach).

Table I. Three learning environments arranged according to the degree of HEI sustainability ambition: the more transformative the ambition, the more transformative the learning will be that is made possible in the environment, and the more likely students will be able to contribute to that ambition via their learning experience.

Level of HEI sustainability ambition (Sterling, 2021) and corresponding learning environment*	**Creates a safe space and/or spaces between science and society in which students learn by…**
Accommodation: In an accommodative environment, HEIs can accomplish their third mission by enhancing students' options for…	… making their activities visible … conducting pioneering SD project … being SD innovators … experiencing success … closing the society–science gap
Reform: In a reformative environment, HEIs with a sectoral SD policy approach can enhance students' options for…	... being self-reflective … doing, sharing, and searching … using dynamic, creative learning approaches … collaborating and building networks beyond HEIs … building professional skills for life (e.g. communication) … acting as multipliers by inspiring and motivating others … sowing seeds, having impacts … experiencing continuous learning … gaining recognition from others
Transformation: In a transformative environment (ecology of learning, Wals, 2020), HEIs can enhance students' and other learners' options for…	… widening the range of knowledge, skills, and perspectives … failing creatively … leaving their comfort zone … being empowered for action … facing emotions and dealing with disruptive moments … taking risks and acting based on transformative insights … increasing self-awareness and -efficacy … caring for, respecting, trusting, and doing things for others … being open to unplanned knowledge and unconventional paths … thinking and learning holistically … consciously acting as free-floaters, mediators, or catalysts … transcending hierarchies and developing reflective leadership skills ... acquiring power to contribute to HEI SD commitments … becoming aware of the problematic dichotomy between voluntary and paid work

*The shades of grey indicate that "reform" can include "accommodation" strategies, and "transformation" can include both others.

We agree with Sterling (2021) that many HEIs remain in the "accommodative" category, at best, while others even refuse to respond to urgent sustainability issues in their strategies (Sterling calls this the "no response" category). While national programmes like U Change increase the chances that HEIs can and will begin responding, it is also crucial to ensure that HEIs recognize the opportunities they can gain from students' learning paths. Our research shows the benefits of creating spaces that enable boundary crossing between formal and non-formal learning. Moreover, if learning is understood holistically, all stakeholders should have the chance to be learners, experience mindset changes, and confront the challenges of societal transformation. We perceive transformative spaces as essential to enable students to shape their HEIs towards SD. Let us strive to fulfil the decades-old vision (Stephens et al., 2008) that HEIs become change agents themselves, tackling the challenges of the future using a collaborative whole institution approach, facilitating ecologies of learning, and partnering with society in a transformative way.

References

ASHBY, I. & EXTER, M. 2019. Designing for interdisciplinarity in higher education: Considerations for instructional designers. *TechTrends,* 63**,** 202–208.

BALAKRISHNAN, B., TOCHINAI, F. & KANEMITSU, H. 2019. Perceptions and attitudes towards sustainable development among Malaysian undergraduates. *International Journal of Higher Education,* 9.

BARTH, M. & MICHELSEN, G. 2013. Learning for change: An educational contribution to sustainability science. *Sustainability Science,* 8**,** 103-119.

BOIX MANSILLA, V., LAMONT, M. & SATO, K. 2015. Shared cognitive–emotional–interactional platforms. *Science, Technology, & Human Values,* 41**,** 571-612.

BRIGGS, S. J., ROBINSON, Z. P., HADLEY, R. L. & LAYCOCK PEDERSEN, R. 2019. The importance of university, students and students' union partnerships in student-led projects. *International Journal of Sustainability in Higher Education,* 20**,** 1409-1427.

CASH, D. W., CLARK, W. C., ALCOCK, F., DICKSON, N. M., ECKLEY, N., GUSTON, D. H., JÄGER, J. & MITCHELL, R. B. 2003. Knowledge systems for sustainable development. *PNAS,* 100**,** 8086–8091.

DRUPP, M. A., ESGUERRA, A., KEUL, L., BEER, D. L., MEISCH, S. & ROOSEN-RUNGE, F. 2012. Change from below – student initiatives for universities in sustainable development. *In:* FILHO, W. (ed.) *Sustainable Development at Universities: New Horizons.* Frankfurt: Peter Lang Scientific Publishers.

FÖRSTER, R., ZIMMERMANN, A. B. & MADER, C. 2019. Transformative teaching in higher education for sustainable development: Facing the challenges. *GAIA - Ecological Perspectives for Science and Society,* 28**,** 324-326.

GEIER, I. 2018. Active citizenship learning in higher education. *Zeitschrift für Hochschulentwicklung,* 13**,** 155-168.

GUSTON, D. H. 2001. Boundary organizations in environmental policy and science: An introduction. *Science, Technology, & Human Values,* 26**,** 399-408.

HABER-CURRAN, P. & TILLAPAUGH, D. W. 2014. Student-centered transformative learning in leadership education: An examination of the teaching and learning process. *Journal of Transformative Education,* 13**,** 65-84.

HAY, R., EAGLE, L., SALEEM MUHAMMAD, A., VANDOMMELE, L. & LI, S. 2019. Student perceptions and trust of sustainability information. *International Journal of Sustainability in Higher Education,* 20**,** 726-746.

KRUSE, J. 2015. *Qualitative Interviewforschung. Ein integrativer Ansatz.* Weinheim: Beltz Verlag.

LANGE, E. A. 2019. Transformative learning for sustainability. *In:* LEAL FILHO, W. (ed.) *Encyclopedia of Sustainability in Higher Education.* Cham: Springer Nature.

LEAL FILHO, W., RAATH, S., LAZZARINI, B., VARGAS, V. R., DE SOUZA, L., ANHOLON, R., QUELHAS, O. L. G., HADDAD, R., KLAVINS, M. & ORLOVIC, V. L. 2018. The role of transformation in learning and education for sustainability. *Journal of Cleaner Production,* 199**,** 286-295.

LOTZ-SISITKA, H., WALS, A. E. J., KRONLID, D. & MCGARRY, D. 2015. Transformative, transgressive social learning: Rethinking higher education pedagogy in times of systemic global dysfunction. *Current Opinion in Environmental Sustainability,* 16**,** 73-80.

MACINTYRE, T., CHAVES, M., MONROY, T., ZETHELIUS, M. O., VILLARREAL, T., TASSONE, V. C. & WALS, A. E. J. 2020. Transgressing boundaries between community learning and higher education: Levers and barriers. *Sustainability,* 12**,** 1-24.

MACINTYRE, T., LOTZ-SISITKA, H., WALS, A. E. J., VOGEL, C. & TASSONE, V. 2018. Towards transformative social learning on the path to 1.5 degrees. *Current Opinion in Environmental Sustainability,* 31**,** 80-87.

MCNIE, E. C., VAN NOORDWIJK, M., CLARK, W. C., DICKSON, N. M., SAKUNTALADEWI, N., SUYANTO, JOSHI, L., LEIMONA, B., KURNIATUN, H. & KHUSUSIYAH, N. 2008. Boundary organizations, objects, and agents: Linking knowledge with action in agroforestry watersheds. *Report of a*

Workshop held in Batu, Malang, East Java, Indonesia — 26–29 July 2007. CID Graduate Student and Research Fellow Working. Cambridge: ICRAF Working Paper No. 80, World Agroforestry Centre.

MEZIROW, J. 2012. Learning to think like an adult. Core concepts of transformation theory. *In:* TAYLOR, E. W. & CRANTON, P. (eds.) *The Handbook of Transformative Learning: Theory, Research, and Practice.* San Francisco: Jossey-Bass.

POLAND, B. 2021. From classrooms to social movements. *GTI Forum Contribution.* Cambridge: Tellus Institute.

RODRÍGUEZ ABOYTES, J. G. & BARTH, M. 2020. Transformative learning in the field of sustainability: A systematic literature review (1999-2019). *International Journal of Sustainability in Higher Education,* 21**,** 993-1013.

SCHRÖDER, L.-M. U., WALS, A. E. J. & VAN KOPPEN, C. S. A. 2020. Analysing the state of student participation in two eco-schools using Engeström's second generation activity systems model. *Environmental Education Research,* 26**,** 1088-1111.

SHEPHARD, K., RIECKMANN, M. & BARTH, M. 2018. Seeking sustainability competence and capability in the ESD and HESD literature: An international philosophical hermeneutic analysis. *Environmental Education Research***,** 1-16.

SINGER-BRODOWSKI, M. 2016. Students' competency development in the context of self-organised and project-oriented sustainability seminars: Research at the interface between self-description and real-life action. *In:* BARTH, M., MICHELSEN, G., RIECKMANN, M. & THOMAS, I. (eds.) *Routledge Handbook of Higher Education for Sustainable Development.* London: Routledge.

STAR, S. L. & GRIESEMER, J. R. 1989. Institutional ecology, 'translations' and boundary objects: Amateurs and professionals in Berkeley's museum of vertebrate zoology, 1907-39. *Social Studies of Science,* 19**,** 387-420.

STEPHENS, J. C., HERNANDEZ, M. E., ROMÁN, M., GRAHAM, A. C. & SCHOLZ, R. W. 2008. Higher education as a change agent for sustainability in different cultures and contexts. *International Journal of Sustainability in Higher Education,* 9**,** 317-338.

STERLING, S. 2021. Educating for the future we want. *GTI Forum Opening Essay.* Cambridge: Tellus Institute.

STERLING, S. & MAXEY, L. 2013. The sustainable university: Taking it forward. *In:* STERLING, S., MAXEY, L. & LUNA, H. (eds.) *The Sustainable University: Progress and Prospects.* Abingdon: Earthscan (Routledge).

STOBBELAAR, D. J. 2020. Impact of student interventions on urban greening processes. *Sustainability,* 12**,** 1-19.

STRAUSS, A. & CORBIN, J. 1996. *Grounded Theory: Grundlagen qualitativer Sozialforschung.* Weinheim: Beltz Verlag.

SWISSUNIVERSITIES. 2016. *Projektgebundene Beiträge 2017-2020 nach HFKG Projektantrag, [pdf], Schweizerische Hochschulkonferenz, Bern,* available at: https://api.swiss-academies.ch/site/assets/files/33388/pgb_u_change_pa_18_studierendenprojekte_nachhaltige_entwicklung.pdf (accessed 30 June 2021).

TÀBARA, J. D. & PAHL-WOSTL, C. 2007. Sustainability learning in natural resource use and management. *Ecology and Society*, 12, 3.

TARRANT, S. P. & THIELE, L. P. 2017. Enhancing and promoting interdisciplinarity in higher education. *Journal of Environmental Studies and Sciences*, 7, 355-360.

TILBURY, D. 2016. Student engagement and leadership in higher education for sustainability. In: BARTH, M., MICHELSEN, G., RIECKMANN, M. & THOMAS, I. (eds.) *Routledge Handbook of Higher Education for Sustainable Development*. London: Routledge.

TRECHSEL, L. J., ZIMMERMANN, A. B., STEINBÖCK, C., BREU, T., HERWEG, K. & THIEME, S. 2021. Safe spaces for disruptive learning in a North-South research partnership context: International mobility of doctoral students. *Sustainability,* 13.

UNESCO 2021. Berlin declaration on education for sustainable development. *UNESCO World Conference on Education for Sustainable Development. Learn for our Planet. Act for Sustainability.* Berlin: UNESCO.

UNITED NATIONS 2015. *Transforming our world: The 2030 Agenda for sustainable development*. A/RES/70/1; New York: United Nations.

WALS, A. E. J. 2020. Sustainability-oriented ecologies of learning: A response to systemic global dysfunction. *In:* BARNETT, R. & JACKSON, N. (eds.) *Ecologies for Learning and Practice. Emerging Ideas, Sightings, and Possibilities.* Oxon: Routledge.

WALS, A. E. J. & BENAVOT, A. 2017. Can we meet the sustainability challenges? The role of education and lifelong learning. *European Journal of Education,* 52**,** 404-413.

WALS, A. E. J., MOCHIZUKI, Y. & LEICHT, A. 2017. Critical case-studies of non-formal and community learning for sustainable development. *International Review of Education,* 63**,** 783-792.

WINTER, J., COTTON, D., HOPKINSON, P. & GRANT, V. 2015. The university as a site for transformation around sustainability. *International Journal of Innovation and Sustainable Development,* 9.

WITTMAYER, J. M. & SCHÄPKE, N. 2014. Action, research and participation: Roles of researchers in sustainability transitions. *Sustainability Science,* 9**,** 483-496.

5.4 Policy Brief: Unlocking Knowledge for Sustainability: Partnership-based Research and Education

2020 #17

b
UNIVERSITÄT
BERN

CDE
CENTRE FOR DEVELOPMENT
AND ENVIRONMENT

CDE POLICY BRIEF

International participants of summer school in Nanyuki, Kenya, take a break. Photo: Lilian J. Trechsel

Unlocking knowledge for sustainability: Partnership-based research and education

The pandemic has made it abundantly clear: the gravest threats we face today transcend national boundaries, are inextricably linked, and demand joint, *knowledge*-based actions in response. Partnership-oriented university-level research and teaching have a crucial role to play here. CDE and its longstanding partners at home and abroad have refined effective, transformative approaches to help solve current sustainability crises and train the next generation of change agents. This policy brief outlines lessons from CDE's long-term experience in tackling shared challenges and addressing inequalities through inclusive, globe-spanning research and education.

The research featured here is focused globally.

Borderless crises

The new decade wasted no time in reminding us of the borderless challenges we face. Indeed, fires ignited the decade before continued to rage worldwide. In January 2020, smoke from blazing landscapes in drought-afflicted Australia travelled over 4,000 km, darkening the skies above New Zealand and endangering the health of distant neighbours.[1] Travelling air pollution like this has threatened far-flung communities for years in countries like India and China – much of it owing not to fires but to dirty, climate-warming industrial production of goods for global consumers. Meanwhile, in Brazil, tropical forests that should clean and replenish the world's air continue to be wiped out at alarming rates, driven especially by global demand for meat, soybeans, and other "commodities".

And alongside these ecological crises, a social epidemic of inequality plagues countries everywhere. It, too, is *globally entwined* in both its causes, like

KEY MESSAGES

- Overcoming 21st-century threats like climate change, species extinction, infectious disease outbreaks, and inequality will demand unprecedented levels of cooperation and sharing of knowledge.
- Higher education and research for sustainable development is an ideal vehicle to bring people together towards a common purpose. It can foster urgently needed collaboration between different scientific and professional disciplines, public and private sectors, social strata, countries, and regions.
- CDE has pioneered a transformative approach to tackling shared global challenges. It emphasizes North–South partnership, transdisciplinarity, knowledge co-production, and training of *change agents* – i.e. the next generation of leaders, experts, bridge builders, and engaged members of civil society.
- High-income countries and donors should invest more in long-term partnership-based sustainability research and education, make published knowledge accessible to all, and help establish centres of advanced study and teaching in low-income countries.

Group fieldwork session near Pokhara, Nepal. Photo: Bishal Bhandari

"land grabs" and exploitation of workers, and its consequences, like economic refugees and reactionary politics.

These are just a few examples of our interwoven 21st-century sustainability challenges, none of which can be solved by individual countries in isolation.[2] And today, of course, we find ourselves struggling to contain a frightening pandemic – one that arguably resulted, like other major zoonotic disease outbreaks, from human mishandling of nature in our era of hyperglobalization.[3] In the big picture, COVID-19 might be seen as merely the latest globe-spanning sustainability crisis that demands international cooperation and scientific innovation if we hope to solve it. The question arises: How and where will such problem-solving collaboration take place – especially in our era of rising nationalisms, ideological divisions, and misguided zero-sum thinking? And how will new generations learn to tackle such challenges more *pre-emptively*, rather than simply being forced to react when the worst-possible scenarios come to pass?

Universities as networked laboratories for solutions and change agents

If history is a guide, university-level research and education will be decisive in overcoming present and future disease outbreaks and dealing with other worldwide sustainability challenges.[4] Indeed, universities have played a major role in past breakthroughs, ranging from the polio vaccine to renewable energy technology. They have also been instrumental in enhancing, systematizing, and sharing vitally important (but often less celebrated) practical and social innovations, such as techniques of sustainable land management and guidelines for governance of common-pool resources like rivers, forests, soils, and even clean air.[5] And crucially, universities are key sites where the next generation of experts, decision-makers, and engaged citizens forms or reshapes its worldview, learns to grasp the crises we face, and strives to design appropriate responses – whether targeted interventions or holistic transformations in the way we lead our lives.

Knowledge obstacles

For university-level research and education to realize its full sustainability potential, however, universities must simultaneously critically reflect on and address some homegrown problems.[6] First, scientists and teachers should more explicitly consider the ethical dimensions of their work, abandoning illusions of a neat split between human values and scientific facts.[7] Indeed, values are part and parcel of sustainable development and any science conducted in its service. Second, it is necessary to consciously work against trends of knowledge privatization, as evidenced by increasingly profit-oriented higher education systems, overly restrictive "intellectual property" regimes, and paywalled scientific journals run by multinational publishing companies.[8] Third, universities and science at large – especially in the global North – must critically examine their role in global power structures of the past (e.g. colonialism) and present (e.g. centre–periphery divides).[9] Fourth, they must actively strive to redress the knowledge impacts of these asymmetric power relations, above all the *highly unequal global distribution of scientific resources and capacities*.[10] Indeed, top-ranked, high-resource universities and peer-reviewed journals remain overwhelmingly concentrated in wealthy countries of the global North[11] – many of them former colonial powers or beneficiaries. Finally, a better balance must be struck between research and teaching – the latter has been increasingly sacrificed to the pressures of "publish or perish", much to the detriment of students, our future problem-solvers.

A transformative approach

There is no one right way for universities to effectively and reflectively tackle our shared sustainability crises. But important groundwork has been laid and lessons learned by pioneering institutions. Over the course of three decades, CDE and its collaborators have refined a productive, transformative research and education approach. It rests on several key pillars:

Partnership. If our problems are inextricably linked across borders, then we must address them together – as partners. Research projects and study programmes are an ideal means to bring actors from diverse (even conflicting) national settings together on a joint mission. CDE's longstanding strategy has been to build teams that comprise researchers and students from the global South and North – and to strive to put them on an equal footing.[12] This and other forms of "science diplomacy" can enable urgently needed constructive alliances in even the most turbulent of times; ideally, it will be complemented by capacity building and productive exchange about scientific norms.[13]

Transdisciplinarity. The shared challenges we face are also intrinsically multidimensional – ecological, social, and economic – and require many forms of expertise to solve them. CDE studies connect people from diverse disciplinary and vocational backgrounds. Land use or mining-sector specialists in a country (e.g. Peru) where goods are extracted might work together with tax and trade experts in a country (e.g. Switzerland) where the goods are imported, refined, and resold. Soil scientists and extension workers might be brought together with farmers in various different mountain regions worldwide to exchange insights about common challenges.[14]

Knowledge co-production. Importantly, these researchers and non-academic experts also engage directly with affected communities (e.g. water users), local policymakers (e.g. water authorities), and other stakeholders to co-produce knowledge.[15] Collaborative activities like group workshops typically emphasize production of three core forms of knowledge[16]: *systems knowledge*, for example mapping competing land uses in a given region (and identifying global drivers); *target knowledge*, such as articulating a consensus vision for the region that balances land uses like crop growing and nature conservation; and *transformation knowledge*, namely

identifying ways to make that vision a reality, often with reference to practical theories of change.[17] Every effort is made to ensure that resulting products – e.g. publications, websites, or raw data – are accessible to anyone who might benefit.

Training of change agents. At the heart of the approach are students and junior researchers, who are seen as the bridge builders to desirable, liveable futures. In the growing tradition of *education for sustainable development*, CDE's curricula emphasize acquisition of dynamic knowledge and various other key *competencies*[18] – like systems thinking, anticipation of possible scenarios, working collaboratively across disciplines and cultures, and grappling with human values – as opposed to rote learning of facts and isolated methodologies. Further, CDE is engaged in integrating sustainable development – both topically and in day-to-day practice – into all other faculties as part of a whole university approach (see Box 1).[19]

Reversing 'brain drain' and forging global ties

Virtually all of these elements come together in the International Graduate School (IGS) North-South, a cooperative PhD-level sustainability programme coordinated by CDE, which unites the universities of Bern, Basel, Lausanne, and Zurich and around 130 students from the global North and South. It brings together students from Switzerland/Europe, Africa, Asia, and Latin America.[20] In 2012 and 2017, CDE researchers surveyed and interviewed around 150 graduates of the programme,[21] producing several valuable insights:

Boosting students from the global South. Crucially, the IGS North-South appeared to reduce education inequality in its network. Instead of "brain drain", it arguably contributed to "brain gain" or "circulation" in the global South: About 90% of students from lower-income countries returned to live and work there after graduation. Many also experienced an immediate career boost: Those with a leading position in their field increased from 11% before the PhD to 49% after. Further, most alumni found jobs in academia, going on to train a new generation of Southern experts. Importantly, these programme participants were not simply the children of elites: two-thirds assessed themselves as *lower- or lower-middle-class*, and roughly half had parents with no formal education or only primary/secondary school.

Sensitizing students from the global North. The socio-economic story of alumni from the global North differed in revealing ways. Two-thirds assessed themselves as *upper-middle- or upper-class*, and nearly 90% had parents with advanced degrees. Yet they did not experience the same immediate career boost from obtaining their PhD. These results arguably highlight the existing concentration of wealth and expertise in Switzerland/Europe – and, among other things, the intense local (academic) job competition this produces. But Northern students ideally gain something much greater from studying tough issues of sustainable development in the field and shoulder-to-shoulder with Southern students: a shift in consciousness – and a calling for life.

Space for mutual risk-taking, growth, and networking. Finally, interviews with alumni also highlighted the unique *space for transformation* enabled by the programme, perhaps best embodied by its annual summer school. Held at a new global site each year (e.g. Côte d'Ivoire, Kenya, Bolivia, Nepal), the IGS summer school challenges its diverse participants to try out different roles – as students, field researchers, peer teachers, local informants, etc. – while they work on joint projects on the ground. The combination of exploring unfamiliar surroundings, exchanging perspectives with peers from different cultures and disciplines, and testing new methods provides many students with a growth-inspiring experience of liminality or "in-betweenness".[22] Students typically emerge from this and similar programme experiences with a greater understanding of the need for transdisciplinary cooperation, an increased sense of purpose, as well as strengthened competencies and new ways of learning. Finally, they acquire an expanded network of skilled colleagues and friends that enables more and better research and growth.

Going forward, CDE is working to share its offerings with greater numbers of up-and-coming researchers and students – particularly at the bachelor's and master's level (https://bit.ly/36IuQHw) – and with higher education institutions in the global South that wish to integrate sustainability in their curricula. We believe the more we extend the reach of our approach and collaborative networks, the more we can aid the fundamental changes needed to enable a better future.

Beyond zero-sum

In conclusion, as CDE and other mission-driven institutions continue to hunt for solutions to today's global sustainability crises, we would do well to remember one amazing feature of *knowledge*: it is essentially inexhaustible – the ideal common-pool resource.[23] In fact, the more we share our knowledge, the more it *grows* – exponentially and synergistically – as experts, teachers, students, and laypeople alike innovate, broaden, complement, and re-share each other's insights, techniques, and breakthroughs. The knowledge we collectively generate can be used to cure and prevent diseases, decarbonize energy, make our food systems safer, improve communication, expand creation and appreciation of the arts, and enhance access to all such public goods – if we enable it. Our universities (from *universitas* for "whole") and colleges (from *collegium* for "partnership") can and should be ideally positioned to realize the full potential of knowledge understood this way.

Box 1. Integrating sustainability in higher education

Universities can, should, and do contribute to happier, healthier, more just societies. But they can also be main contributors to problems of unsustainability. The long-running division of knowledge into siloed university disciplines is a prime example: students in economics or law, for instance, can rise to become top scholars in their field without ever seriously engaging with ecology or alternative (e.g. non-Western) value systems. Many eventually advise policymakers or even set policy themselves. This arguably makes us uniquely unprepared to tackle wicked problems like climate change and resource overexploitation in the comprehensive manner needed.

CDE is addressing this with strong backing from the University of Bern by helping to integrate urgent issues of sustainable development into the curricula of all university faculties – as well as in day-to-day operations (Trechsel et al. 2018).[24] In particular, lecturers are supported in finding links to sustainability issues in their subject areas, and incorporating them into their lesson plans. More broadly, they are encouraged to adopt a more competence-oriented and learner-centred teaching approach. So far, experience shows that a combined top-down (e.g. compulsory sustainability courses) and bottom-up (e.g. student-led initiatives; www.bene-unibe.ch)[25] strategy works best to motivate teachers and staff to integrate sustainability into their thinking and practice.

Lilian Trechsel, MSc
Coordination of Education and Training,
IGS North-South
Centre for Development and Environment (CDE)
University of Bern, Switzerland
lilian.trechsel@unibe.ch

Camilla Steinböck, BSc
Research Associate
Centre for Development and Environment (CDE)
University of Bern, Switzerland
camilla.steinboeck@unibe.ch

Sarah Ayeri Ogalleh, PhD
IGS North-South Alumna
Independent Researcher
Saskatchewan, Canada
sarahogalleh@gmail.com

Anne Zimmermann, PhD
Head of Education for Sustainable
Development Cluster
Centre for Development and Environment (CDE)
University of Bern, Switzerland
anne.zimmermann@unibe.ch

Karl Herweg, PhD
Head of Education for Sustainable
Development Cluster
Centre for Development and Environment (CDE)
University of Bern, Switzerland
karl.herweg@unibe.ch

Thomas Breu, Prof. Dr.
Director, CDE
Executive Director, IGS North-South
Centre for Development and Environment (CDE)
University of Bern, Switzerland
thomas.breu@unibe.ch

Policy implications

Invest in boundary-spanning sustainability research and education

To enable a future in which we all can thrive, governments and donors should further increase investment in advanced studies and teaching on and for sustainable development. Besides delivering targeted solutions, such science can foster the *systemic* perspective we urgently need to tackle today's interlinked wicked problems – including climate change, species extinction, epidemics, pollution, overconsumption, armed conflict, and inequality. Crucially, it can prompt a much-needed shift towards mainstreaming hands-on cooperation and knowledge-sharing across boundaries: between academic disciplines, public and private sectors, social strata, nations, regions, and more.

Tackle science inequality by committing to equal partnerships with global South

Worldwide crises like COVID-19 and climate-warming emissions will not be overcome unless societies everywhere are equipped with the knowledge and resources needed to combat them locally. Wealthy countries, many of which have arguably hoarded talent and prestige, can do much more. First, they should fund and institutionalize long-term research and education partnerships with countries in the global South. New digital formats (e.g. virtual classrooms and conferences) can enable even greater collaboration,[26] complementing in-person elements (e.g. joint fieldwork, summer schools) pioneered by programmes like the IGS North-South (www.igs-north-south.ch). Second, every effort should be made to fully unlock existing and future data, transforming scientific publishing models to enable open access to everyone as fast as possible (e.g. www.coalition-s.org). As the pandemic has shown, sharing data can save lives if done quickly and widely. Third, more generous support should be given to establish and improve centres of advanced research and education in the global South. Students and experts who conduct transdisciplinary research and/or study and teach in low-income countries should be incentivized and rewarded, in line with improved academic metrics that emphasize experience, research quality, and societal contributions over journal impact factors (e.g. www.sfdora.org).

Promote lifelong learning and holistic integration of sustainability in higher education

Finally, higher education policymakers should encourage integration of sustainability in the curricula and operations of all disciplines. This means providing space and time for transformative, lifelong learning – not only for students, but also for teachers (www.betterscience.ch/en/). Teachers should be given targeted support to incorporate sustainability issues in their courses (www.esd.unibe.ch), as well as more room for collaboration, knowledge sharing, experimentation, reflection, and a better work–life balance. Indeed, to overcome current crises, sustainability must become something that is *lived* (e.g. sufficient lifestyles), not just theorized and debated – especially in the global North.

Suggested further reading

OECD [Organization for Economic Cooperation and Development]. 2020. *Addressing Societal Challenges Using Transdisciplinary Research*. OECD Science, Technology and Industry Policy Papers, No. 88. Paris, France: OECD. https://doi.org/10.1787/0ca0ca45-en

Stöckli B, Wiesmann UM, Lys JA. 2018. *A Guide for Transboundary Research Partnerships: 11 Principles: 7 Questions*. 3rd edition. Bern, Switzerland: Swiss Commission for Research Partnerships with Developing Countries (KFPE). https://bit.ly/35eie8A

Trechsel LJ, Zimmermann AB, Graf D, Herweg K, Lundsgaard-Hansen L, Rufer L, Tribelhorn T, Wastl-Walter D. 2018. Mainstreaming education for sustainable development at a Swiss university: Navigating the traps of institutionalization. *Higher Education Policy* 31(4):471–490. https://link.springer.com/article/10.1057/s41307-018-0102-z

Centre for Development and Environment (CDE)
University of Bern
Mittelstrasse 43
3012 Bern
Switzerland
www.cde.unibe.ch

This issue
Series editor: Anu Lannen
Editor: Anu Lannen
Design: Simone Kummer
Printed by Varicolor AG, Bern

ISSN 2296-8687

creative commons

This policy brief is licensed under a Creative Commons Attribution 4.0 International (CC BY 4.0) Licence. See http://creativecommons.org/licenses/by/4.0/ to view a copy of the licence.

CDE policy briefs provide useful, timely research findings on important development issues. The series offers accessible, policy-relevant information on topics such as global change, innovations, sustainable development, natural resources, ecosystem services, governance, livelihoods, and disparities. The briefs and other CDE resources are available at: www.cde.unibe.ch

The views expressed in this policy brief belong to the author(s) concerned and do not necessarily reflect those of CDE as a whole, the University of Bern, or any associated institutions/individuals.

Citation: Trechsel LJ, Steinböck C, Ayeri Ogalleh S, Zimmermann AB, Herweg K, Breu T, Lannen A. 2020. *Unlocking Knowledge for Sustainability: Partnership-based Research and Education.* CDE Policy Brief, No. 17. Bern, Switzerland: CDE.

Keywords: Higher education, sustainable development, partnership, transdisciplinarity, knowledge, transformation

References and notes

[1] Salinger J. 2020. Australia's bushfires mean New Zealand has become the land of the long pink cloud. *The Guardian*. 7 January 2020. https://www.theguardian.com/world/2020/jan/08/australia-bushfires-aotearoa-new-zealand-has-become-kikorangi-mawhero-land-of-the-long-pink-cloud

[2] Messerli P, Kim EM, Lutz W, Moatti JP, Richardson K, Saidam M, Smith D, Eloundou-Enyegue P, Foli E, Glassman A, Licona GH. 2019. Expansion of sustainability science needed for the SDGs. *Nature Sustainability* 2(10):892–894. https://www.nature.com/articles/s41893-019-0394-z

[3] IPBES [Intergovernmental Platform on Biodiversity and Ecosystem Services]. 2020. *IPBES Workshop on Biodiversity and Pandemics. Workshop Report*. Bonn, Germany: IPBES. https://bit.ly/2TBRDNn

[4] Trechsel LJ, Zimmermann AB, Graf D, Herweg K, Lundsgaard-Hansen L, Rufer L, Tribelhorn T, Wastl-Walter D. 2018. Mainstreaming education for sustainable development at a Swiss university: Navigating the traps of institutionalization. *Higher education policy* 31(4):471-490. https://link.springer.com/article/10.1057/s41307-018-0102-z

[5] WOCAT [World Overview of Conservation Approaches and Technologies]. 2020. *WOCAT SLM Database*. Bern, Switzerland: WOCAT. https://qcat.wocat.net/en/wocat/list/

[6] Trechsel LJ, Zimmermann AB, Graf D, Herweg K, Lundsgaard-Hansen L, Rufer L, Tribelhorn T, Wastl-Walter D. 2018. *Op. cit.*

[7] Kläy A, Zimmermann AB, and Schneider F. 2015. Rethinking science for sustainable development: Reflexive interaction for a paradigm transformation. *Futures* 65:72–85. https://doi.org/10.1016/j.futures.2014.10.012

[8] Hil R, Lyons K. 2017. A post-neoliberal academy? *Arena Magazine* 147:44–77. https://www.academia.edu/download/53767389/postneoliberalacademic.pdf

[9] Mburu S, Huxley N, Miles R, Scott L, Cross A, Tufet M. 2020. *Race and Inequality in International Development Research: A UKCDR perspective*. UK Collaborative on Development Research blog post. https://www.ukcdr.org.uk/race-and-inequality-in-international-development-research-a-ukcdr-perspective/; Trechsel LJ, Zimmermann AB, Steinböck C, Breu T, Herweg K, Thieme S. 2020. *Safe Spaces for Disruptive Learning and Transformation: International Mobility of Doctoral Students*. Manuscript submitted for publication.

[10] UNESCO [United Nations Educational, Scientific and Cultural Organization]. 2015. *UNESCO Science Report: Towards 2030*. Paris, France: UNESCO. https://en.unesco.org/unescosciencereport; Barth M, Michelsen G, Rieckmann M, Thomas I, editors. 2015. *Routledge Handbook of Higher Education for Sustainable Development.* Routledge International Handbooks. London, New York: Routledge. https://bit.ly/3m3QF8F

[11] UNESCO [United Nations Educational, Scientific and Cultural Organization]. 2016. *World Social Science Report 2016: Challenging Inequalities – Pathways to a Just World*. Paris, France; Brighton, UK: UNESCO/International Social Science Council (ISSC); Institute of Development Studies (IDS). https://en.unesco.org/wssr2016

[12] Stöckli B, Wiesmann UM, Lys JA. 2018. *A Guide for Transboundary Research Partnerships: 11 Principles: 7 Questions*. 3rd edition. Bern, Switzerland: Swiss Commission for Research Partnerships with Developing Countries (KFPE). https://bit.ly/35eie8A; Trechsel LJ. In press. Experiences of PhD graduates researching and learning for sustainable development in an inter- and transdisciplinary setting. *ETH Learning and Teaching Journal*. https://learningteaching.ethz.ch/index.php/lt-eth

[13] Upreti BR, Zimmermann AB, Debele B, Cissé G. 2012. *Partnerships in Development-oriented Research. Lessons Learnt and Challenges Ahead*. Kathmandu, Nepal: NCCR North-South, South Asia Coordination Office. https://www.nccr-north-south.unibe.ch/Upload/Upreti-et-al-Partnerships-in-Development-oriented-Research-2012-lo.pdf

[14] OECD [Organization for Economic Cooperation and Development]. 2020. *Addressing Societal Challenges Using Transdisciplinary Research.* OECD Science, Technology and Industry Policy Papers, No. 88. Paris, France: OECD. https://doi.org/10.1787/0ca0ca45-en

[15] Schneider F, Giger M, Harari N, Moser S, Oberlack C, Providoli I, Schmid L, Tribaldos T, Zimmermann AB. 2019. Transdisciplinary co-production of knowledge and sustainability transformations: Three generic mechanisms of impact generation. *Environmental Science and Policy* 102:26–35. https://doi.org/10.1016/j.envsci.2019.08.017

[16] Pohl C, Hirsch Hadorn G. 2007. *Principles for Designing Transdisciplinary Research*. Munich, Germany: oekom. https://www.oekom.de/buch/principles-for-designing-transdisciplinary-research-9783865810465

References and notes

[17] Oberlack C, Breu T, Giger M, Harari N, Herweg K, Mathez-Stiefel SL, Messerli P, Moser S, Ott C, Providoli I, Tribaldos T. 2019. Theories of change in sustainability science: understanding how change happens. *GAIA – Ecological Perspectives for Science and Society* 28(2):106–111. https://doi.org/10.14512/gaia.28.2.8

[18] Wiek A, Withycombe L, Redman CL. 2011. Key competencies in sustainability: A reference framework for academic program development. *Sustainability Science* 6(2):203–218. https://link.springer.com/article/10.1007/s11625-011-0132-6

[19] Herweg K, Zimmermann AB, Lundsgaard Hansen L, Tribelhorn T, Hammer T, Tanner RP, Trechsel L, Bieri S, Kläy A. 2017. *Integrating Sustainable Development into Higher Education: Guidelines with In-depth Modules for the University of Bern. Foundations.* Bern, Switzerland: University of Bern, Vice-Rectorate Quality, Vice-Rectorate Teaching, Centre for Development and Environ-ment (CDE), Educational Development Unit (ZUW), and Bern Open Publishing (BOP). https://boris.unibe.ch/105009/1/online_2017_Guidelines_University%20of%20Bern.pdf

[20] Trechsel LJ. In press. Experiences of PhD graduates researching and learning for sustainable development in an inter- and transdisciplinary setting. *ETH Learning and Teaching Journal*. https://learningteaching.ethz.ch/index.php/lt-eth

[21] Heim EM, Engelage S, Zimmermann AB, Herweg K, Michel C, Breu T. 2012. *Tracking Alumni Career Paths: Third NCCR North-South Report on Effectiveness*. NCCR North-South Dialogue 42. Bern, Switzerland: NCCR North-South. https://boris.unibe.ch/17598/1/Heim_et-al_NCCR_Dialogue_42.pdf; Trechsel LJ, Zimmermann AB, Steinböck C, Breu T, Herweg K, Thieme S. 2020. *Safe Spaces for Disruptive Learning and Transformation: International Mobility of Doctoral Students*. Manuscript submitted for publication.

[22] Förster R, Zimmermann AB, Mader C. 2019. Transformative teaching in Higher Education for Sustainable Development: Facing the challenges. *GAIA – Ecological Perspectives for Science and Society* 28(3):324–326. https://doi.org/10.14512/gaia.28.3.18

[23] Hess C, Ostrom E. 2007. *Understanding Knowledge as a Commons: From Theory to Practice*. 2007. Cambridge, MA and London, UK: MIT Press. 381 pp. http://www.wtf.tw/ref/hess_ostrom_2007.pdf; Graeber D. 2011. *Debt: The First 5,000 Years*. Brooklyn, NY, USA: Melville House Publishing. https://libcom.org/files/__Debt__The_First_5_000_Years.pdf

[24] Trechsel LJ, Zimmermann AB, Graf D, Herweg K, Lundsgaard-Hansen L, Rufer L, Tribelhorn T, Wastl-Walter D. 2018. *Op. cit.*

[25] Trechsel LJ, Häderli S, Zimmermann AB. 2020. *What Do students of the University of Bern Consider Important for Their Future? Results and Discussion of a National Union of Students Survey*. Bern, Switzerland: Centre for Development and Environment (CDE), University of Bern, with Bern Open Publishing (BOP). https://boris.unibe.ch/146168/

[26] Mader C, Zimmermann AB, Diethart M, Mulà I. 2020. Virtual conferences in higher education: Teasing out their transformative potential for sustainable development. *GAIA – Ecological Perspectives for Science and Society* 29(1):57–59. https://doi.org/10.14512/gaia.29.1.12

6 Synthesis and outlook

> *The act of learning is itself a neutral process – what matters ethically are the purposes and values behind [the] curriculum and action associated with learning.* (Sterling, 2009, p. 71)

This quote from Stephen Sterling highlights the active role that learners, teachers, and other actors in higher education and wider society have in shaping our future. It is up to them and us to make the learning process meaningful, i.e. to give it an ethical orientation. While quality education is set as a separate goal at the international level through SDG 4, it is of high importance to argue more substantially that ESD is also a key enabler of SD (UNESCO, 2020).

On the one hand, my doctoral dissertation seeks to improve understanding of the role that HEIs and their members can play in shaping and contributing to societal transformations towards SD; on the other, it explores ways in which this can be done in practice, in order to contribute to redefining improvement of education and learning within the context of SD. The papers comprising this dissertation deal with a range of issues related to how HEIs can realize their potential and redefine their third mission, taking SD into account. My dissertation gives voice to PhD graduates and active students in order to learn from their personal experiences within academia and beyond, especially when engaging with actors from wider society.

While my findings confirm prior research results in certain areas, they also enable fresh insights into individual career pathways and the personal learning experiences of students. This, in turn, contributes to research on the different steps that HEIs can take to transform themselves, to better integrate students' learning and individual agency, and thereby to develop and redesign valuable spaces for learning.

The research contained in this dissertation underscores the importance of understanding learning as a driver of transformation, and grasping that "[t]he time to learn and act for our planet is now" in light of the urgent global challenges we face (UNESCO, 2021, p. 4). My research emphasizes that HEIs need to identify pitfalls along the path to transformation and learn how to avoid them. It seeks to increase awareness of the human values and normativity that inevitably shape our research and education, and to bravely address the resulting debate. The alumni tracer study contained herein tackles the issue of current power structures, which cement global inequalities and reflect the highly unequal global distribution of scientific resources and capacities. At the same time, current academic metrics appear to privilege competition over cooperation and serve an overwhelmingly neoliberal agenda. The impact of this agenda on the global South is arguably very problematic: the academic system reinforces preferences for journals that tend to have an inherent bias against authors and reviewers from the global South (Medie and Kang, 2018).The result is a desire in the global South to achieve the same results as the global

North, without the power or the means to do so. Solving this urgently requires Western HEIs to "unlearn" their privileges and to work towards structures that enable self-reflection as well as reflection on the impacts of academic education on societal reality. This can be guided by transformative learning that values manifold experiences, focuses more on quality than quantity, and contributes to reducing inequality at the local, national, or global level.

Published in three papers, my research has enabled exploration of "new" spaces. The inter- and transdisciplinary setting of an international research project, discussed in the present dissertation, made it possible for doctoral candidates to try out new things and to assume different roles in a safe space fostering transformative learning and deep, disruptive learning experiences. Similar experiences, occurring in a much different setting, were reported by students who interacted with different societal actors in the context of their student-led initiatives. These learning experiences highlight the significant value and indispensability of different learning formats that enable learning that goes beyond merely acquiring disciplinary knowledge and skills. It further highlights beneficial outcomes of students feeling embedded, establishing relationality, building relationships and networks for "life", and acquiring skills (e.g. conflict management) that cannot really be learned in a "classical classroom setting".

The heightened understanding of "relationality" experienced by students is especially valuable. According to Lange et al. (2021, p. 30):

> *Relationality means we understand reality as related at all scales, from the smallest quantum level to the cosmic level [….] Relationality is not only about embodiedness and processes, but embeddedness. [….] [We] are embedded in human, natural and cosmic relations.*

Grasping relationality means understanding the dynamics at play between the "self" and the "other", and becoming aware of one's role in larger systems. My research shows that experiencing the "other" in safe spaces is very important to students focusing on research towards SD. In addition, these safe spaces gave students a sense of change agency, leading them to feel empowered and to take action. This also enabled them to act as "boundary agents" bringing together different worlds and contributing to science–society dialogue, something that is urgently needed in our times of global crises and uncertainty.

> *New ways of seeing, thinking, and doing are burgeoning, prompted further by the disruptive effects of COVID-19. This ferment offers the exciting possibility of a shift in education from a vehicle of social reproduction and maintenance, towards a vision of continuous co-evolution of education and society in a relationship of mutual transformation: a 'future-creating, innovative and open system' of education.* (Sterling, 2021, p. 6)

With this dissertation, I have sought to underscore that it is not enough to merely educate students and provide them with knowledge; it is crucial that sustainability is included in the

education mission at HEIs in a future-oriented way. These and similar objectives drive me every day in my efforts to shape and change education. With my research, I want to help change the focus of education and teaching from outputs to processes, whereby learning is understood as a participatory process in which everyone (students, teachers, university staff, other social groups) should be considered a "learner". This implies abandoning the teacher–student "knowledge transfer" paradigm in favour of a new model promoting empowerment through knowledge. This change of paradigm requires safe learning spaces and a shift from achievement orientation to a focus on societal impacts and performance. Concurrently, there is a need for a change in focus from competition to cooperation in higher education. All this requires different forms of organizations (e.g. a whole institution approach), enhanced pedagogies, and modifications in assessment systems. On the one hand, engaged forms of pedagogy involving multiple actors remain in their infancy (Lotz-Sisitka et al., 2015). On the other hand, there are already several pedagogical models that include a transformative learning and engagement component, but further research and action are needed to understand how to integrate them holistically (e.g. in all curricula of an HEI combined with its education mission) rather than in isolation (e.g. in a single lecture with a different teaching method). Transformative approaches for SD, highlighted in my research, call for a more participatory way of understanding learning. This, in turn, requires not only different pedagogical approaches, but also new means of assessing and promoting quality. These new approaches and benchmarks must be jointly designed by all stakeholders, as they have institutional consequences for everyone involved at HEIs and sweeping support is needed to enable a whole institution approach. Future studies should explore and further develop alternative means of assessment and quality assurance that widen the criteria for evaluating quality such that they include proof of performance in (E)SD contents. Thus, it is important to explore learning and teaching processes further to provide sound research insights that will support HEIs on their transformation journey towards SD.

7 References

AMARAL, A. R., RODRIGUES, E., RODRIGUES GASPAR, A. & GOMES, Á. 2020. A review of empirical data of sustainability initiatives in university campus operations. *Journal of Cleaner Production,* 250**,** 119558.

BAMMER, G. 2013. *Disciplining interdisciplinarity: Integration and implementation sciences for researching complex real-world problems.* Canberra: ANU E Press.

BARTH, M. 2015. *Implementing sustainability in higher education: Learning in an age of transformation.* Abingdon: Routledge.

BARTH, M., ADOMßENT, M., FISCHER, D., RICHTER, S. & RIECKMANN, M. 2014. Learning to change universities from within: A service-learning perspective on promoting sustainable consumption in higher education. *Journal of Cleaner Production,* 62**,** 72-81.

BARTH, M., BRUHN, A., LAM, D. P. M., BERGMANN, M. & LANG, D. J. 2020. Capacity building for transformational leadership and transdisciplinarity. *GAIA - Ecological Perspectives for Science and Society,* 29**,** 195-197.

BARTH, M. & MICHELSEN, G. 2013. Learning for change: An educational contribution to sustainability science. *Sustainability Science,* 8**,** 103-119.

BAUMANN, C., DIETZE, A. & MARUSCHKE, M. 2017. Managing processes of globalization: A spotlight on the university as a key institution in the 21th Century. *Comparativ. Zeitschrift für Globalgeschichte und vergleichende Gesellschaftsforschung,* 27**,** 168-202.

BIBERHOFER, P. 2019. The economization of education and the implications of the quasicommodification of knowledge on higher education for sustainable development. *SRE-Discussion-2019/01.* Wien: Multilevel Governance and Development, Wirtschaftsuniversität Wien.

BICKMANN, L. 1987. The functions of program theory. *In:* BICKMANN, L. (ed.) *Using Program Theory in Evaluation.* San Francsico: Jossey-Bass.

BIESTER, U. & MEHLMANN, M. (eds.) 2020. *A Transformative Edge: Knowledge, Inspiration and Experiences for Educators of Adults,* Berlin: Transformation Hosts International publications.

BRUNDIERS, K., BARTH, M., CEBRIÁN, G., COHEN, M., DIAZ, L., DOUCETTE-REMINGTON, S., DRIPPS, W., HABRON, G., HARRÉ, N., JARCHOW, M., LOSCH, K., MICHEL, J., MOCHIZUKI, Y., RIECKMANN, M., PARNELL, R., WALKER, P. & ZINT, M. 2020. Key competencies in sustainability in higher education—Toward an agreed-upon reference framework. *Sustainability Science,* 16**,** 13-29.

CALDWELL, R. 2003. Models of change agency: A fourfold classification. *British Journal of Management,* 14**,** 131-142.

COMPAGNUCCI, L. & SPIGARELLI, F. 2020. The third mission of the university: A systematic literature review on potentials and constraints. *Technological Forecasting and Social Change,* 161**,** 120284.

DHILLON, L. & VACA, S. 2018. Refining theories of change. *Journal of MultiDisciplinary Evaluation,* 14**,** 64-87.

DRUPP, M. A., ESGUERRA, A., KEUL, L., BEER, D. L., MEISCH, S. & ROOSEN-RUNGE, F. 2012. Change from below – student initiatives for universities in sustainable development. *In:* FILHO, W. (ed.) *Sustainable Development at Universities: New Horizons.* Frankfurt: Peter Lang Scientific Publishers.

GUTIÉRREZ, K. D. 2016. Designing resilient ecologies: Social design experiments and a new social imagination. *Educational Researcher,* 45**,** 187-196.

HARGREAVES, L. G. 2008. The whole-school approach to education for sustainable development: From pilot projects to systemic change. *Policy & Practice: Education for Sustainable Development***,** 69-74.

HEISKANEN, E., THIDELL, A. & RODHE, H. 2016. Educating sustainability change agents: The importance of practical skills and experience. *Journal of Cleaner Production,* 123**,** 218-226.

HENDERSON, K. & TILBURY, D. 2004. Whole-school approaches to sustainability: An international review of sustainable school programs. *Report Prepared by the Australian Research Institute in Education for Sustainability (ARIES) for The Department of the Environment and Heritage, Australian Government.* North Ryde: ARIES.

HERWEG, K. & STEINER, K. 2002. *Impact Monitoring & Assessment. Instruments for Use in Rural Development Projects with a Focus on Sustainable Land Management. Volume 2: Toolbox.* Bern: Centre for Development and Environment.

HERWEG, K., TRIBELHORN, T., LEWIS, A. L., PROVIDOLI, I., TRECHSEL, L. J. & STEINBÖCK, C. 2021. *Transdisciplinary Learning for Sustainable Development – Sharing Experience in Course and Curriculum Design.* Bern: Centre for Development and Environment (CDE), University of Bern, with Bern Open Publishing (BOP).

HERWEG, K., ZIMMERMANN, A. B., LUNDSGAARD-HANSEN, L., TRIBELHORN, T., HAMMER, T., TANNER, R. P., TRECHSEL, L. J., BIERI, S. & KLÄY, A. 2017. *Integrating Sustainable Development into Higher Education – Guidelines with In-depth Modules for the University of Bern. Foundations.* Bern: University of Bern, Vice-Rectorate Quality, Vice-Rectorate Teaching, Centre for Development and Environment (CDE), Educational Development Unit (ZUW), and Bern Open Publishing (BOP).

HESSELBARTH, C. & SCHALTEGGER, S. 2014. Educating change agents for sustainability – learnings from the first sustainability management master of business administration. *Journal of Cleaner Production,* 62**,** 24-36.

ILLERIS, K. 2007. What do we actually mean by experiential learning? *Human Resource Development Review,* 6**,** 84-95.

JICKLING, B. 2017. Education revisited: Creating educational experiences that are held, felt, and disruptive. *In:* JICKLING, B. & STERLING, S. (eds.) *Post-Sustainability and Environmental Education.* Ontario: Springer Nature.

KHOO, S.-M., HAAPAKOSKI, J., HELLSTÉN, M. & MALONE, J. 2018. Moving from interdisciplinary research to transdisciplinary educational ethics: Bridging epistemological differences in researching higher education internationalization(s). *European Educational Research Journal***,** 1-19.

KLÄY, A., ZIMMERMANN, A. B. & SCHNEIDER, F. 2015. Rethinking science for sustainable development: Reflexive interaction for a paradigm transformation. *Futures,* 65**,** 72–85.

LANGE, E. A. 2015. Transformative learning and concepts of the self: Insights from immigrant and intercultural journeys. *International Journal of Lifelong Education,* 34**,** 623-642

LANGE, E. A., POLANCO O'NEIL, J. K. & ROSS, K. E. 2021. Educating during the great transformation. *Andragoška spoznanja,* 27**,** 23-46.

LEWIN, K. 1947. Frontiers in group dynamics. Concept, method and reality in social science; social equilibria and social change. *Human Relations,* 1**,** 5-41

LOTZ-SISITKA, H., WALS, A. E. J., KRONLID, D. & MCGARRY, D. 2015. Transformative, transgressive social learning: Rethinking higher education pedagogy in times of systemic global dysfunction. *Current Opinion in Environmental Sustainability,* 16**,** 73-80.

LOZANO, R., MERRILL, M. Y., SAMMALISTO, K., CEULEMANS, K. & LOZANO, F. J. 2017. Connecting competences and pedagogical approaches for sustainable development in higher education: A literature review and framework proposal. *Sustainability,* 9**,** 1889.

MACINTYRE, T., CHAVES, M., MONROY, T., ZETHELIUS, M. O., VILLARREAL, T., TASSONE, V. C. & WALS, A. E. J. 2020. Transgressing boundaries between community learning and higher education: Levers and barriers. *Sustainability,* 12**,** 1-24.

MASON, P. & BARNES, M. 2007. Constructing theories of change. *Evaluation,* 13**,** 151-170.

MCNIE, E. C., VAN NOORDWIJK, M., CLARK, W. C., DICKSON, N. M., SAKUNTALADEWI, N., SUYANTO, JOSHI, L., LEIMONA, B., KURNIATUN, H. & KHUSUSIYAH, N. 2008. Boundary organizations, objects, and agents: Linking knowledge with action in agroforestry watersheds. *Report of a Workshop held in Batu, Malang, East Java, Indonesia — 26–29 July 2007. CID Graduate Student and Research Fellow Working.* Cambridge: Center for International Development at Harvard University and World Agroforestry Centre - ICRAF Working Paper No. 80, World Agroforestry Centre.

MEDIE, P. A. & KANG, A. 2018. Global South scholars are missing from European and US journals. What can be done about it. *Faculty Publications: Political Science,* 100**,** 1-4.

MESSERLI, P., KIM, E. M., LUTZ, W., MOATTI, J.-P., RICHARDSON, K., SAIDAM, M., SMITH, D., ELOUNDOU-ENYEGUE, P., FOLI, E., GLASSMAN, A., LICONA, G. H., MURNININGTYAS, E., STANIŠKIS, J. K., VAN YPERSELE, J.-P. & FURMAN, E. 2019. Expansion of sustainability science needed for the SDGs. *Nature Sustainability,* 2**,** 892-894.

MEZIROW, J. 1997. Transformative learning: Theory to practice. *In:* CRANTON, P. (ed.) *Update on Informal and Incidental Learning Theory.* San Francisco: Jossey-Bass.

MOGREN, A., GERICKE, N. & SCHERP, H.-Å. 2018. Whole school approaches to education for sustainable development: A model that links to school improvement. *Environmental Education Research,* 25**,** 508-531.

MOHAMAD, Z. F., MAMAT, M. Z. & MUHAMAD NOOR, M. F. 2021. Students as change agents for campus sustainability in Malaysian universities. *International Journal of Sustainability in Higher Education,* 22**,** 404-422.

MORRELL, A. & O'CONNOR, M. 2002. Introduction. *In:* O'SULLIVAN, E., MORRELL, A. & O'CONNOR, M. (eds.) *Expanding the Boundaries of Transformative Learning: Essays on Theory and Praxis.* New York: Palgrave Macmillan.

OBERLACK, C., BREU, T., GIGER, M., HARARI, N., HERWEG, K., MATHEZ-STIEFEL, S.-L., MESSERLI, P., MOSER, S., OTT, C., PROVIDOLI, I., TRIBALDOS, T., ZIMMERMANN, A. & SCHNEIDER, F. 2019. Theories of change in sustainability science. Understanding how change happens. *GAIA - Ecological Perspectives for Science and Society,* 28**,** 106-111.

PEARCE, B. B. J., ADLER, C. E., KRÜTLI, P. & MICHAEL, S. 2018. Making the link between transdisciplinary learning and research: The art of collaborative research and collective learning. *In:* FAM, D., NEUHAUSER, L. & GIBBS, P. (eds.) *Transdisciplinary Theory, Practice and Education. The Art of Collaborative Research and Collective Learning.* Cham: Springer.

REINDERS, H. 2016. *Service Learning – Theoretische Überlegungen und empirische Studien zu Lernen durch Engagement.* Weinheim: Beltz Juventa.

RODRÍGUEZ ABOYTES, J. G. & BARTH, M. 2020. Transformative learning in the field of sustainability: A systematic literature review (1999-2019). *International Journal of Sustainability in Higher Education,* 21**,** 993-1013.

SCHEUNPFLUG, A. 2021. Global learning: Educational research in an emerging field. *European Educational Research Journal,* 20**,** 3-13.

SDSN 2020. *Accelerating Education for the SDGs in Universities: A Guide for Universities, Colleges, and Tertiary and Higher Education Institutions.* New York: Sustainable Development Solutions Network (SDSN).

SHEPHARD, K., RIECKMANN, M. & BARTH, M. 2018. Seeking sustainability competence and capability in the ESD and HESD literature: An international philosophical hermeneutic analysis. *Environmental Education Research***,** 1-16.

STAR, S. L. & GRIESEMER, J. R. 1989. Institutional ecology, 'translations' and boundary objects: Amateurs and professionals in Berkeley's museum of vertebrate zoology, 1907-39. *Social Studies of Science,* 19**,** 387-420.

STERLING, S. 2003. *Whole Systems Thinking as a Basis for Paradigm Change in Education: Explorations in the Context of Sustainability.* PhD, University of Bath.

STERLING, S. 2008. Sustainable education – Towards a deep learning response to unsustainability. *Policy & Practice: A Development Education Review,* 6**,** 63-68.

STERLING, S. 2009. Rinding the storm: Towards a connective cultural consciousness. *In:* WALS, A. E. J. (ed.) *Social Learning Towards a Sustainable World. Principles, Perspectives, and Praxis.* Wageningen: Wageningen Academic Publisher.

STERLING, S. 2011. Transformative learning and sustainability: Sketching the conceptual ground. *Learning and Teaching in Higher Education***,** 17-33.

STERLING, S. 2021. Educating for the future we want. *GTI Forum Opening Essay.* Cambridge: Tellus Institute.

STERLING, S. & MAXEY, L. 2013. The sustainable university: Taking it forward. *In:* STERLING, S., MAXEY, L. & LUNA, H. (eds.) *The Sustainable University: Progress and Prospects.* Abingdon: Earthscan (Routledge).

THIEME, S. & FRY, P. In press. Transdisziplinarität erleben – Prinzipien für die universitäre Lehre. *In:* WINTZER, J., I., M. & HOF, A. (eds.) *Prinzipien, Strukturen und Praktiken geographischer Hochschullehre.* Stuttgart: UTB.

TIKLY, L., DUPORGE, V., HERRING, E., MITCHELL, R., SPRAGUE, T., BATRA, P., FACER, K., LOTZ-SISITKA, H., MCGRATH, S. & WALS, A. E. J. 2020. *Transforming Education for Sustainable Futures: Foundations Paper.* Bristol: TESF.

TILBURY, D. 2013. Another world is desirable. A global rebooting of higher education for sustainable development. *In:* STERLING, S., MAXEY, L. & LUNA, H. (eds.) *The Sustainable University: Progress and Prospects.* Abingdon: Earthscan (Routledge).

TILBURY, D. 2016. Student engagement and leadership in higher education for sustainability. *In:* BARTH, M., MICHELSEN, G., RIECKMANN, M. & THOMAS, I. (eds.) *Routledge Handbook of Higher Education for Sustainable Development.* London: Routledge.

TRECHSEL, L. J., ZIMMERMANN, A. B., GRAF, D., HERWEG, K., LUNDSGAARD-HANSEN, L., RUFER, L., TRIBELHORN, T. & WASTL-WALTER, D. 2018. Mainstreaming education for sustainable development at a Swiss university: Navigating the traps of institutionalization. *Higher Education Policy,* 31**,** 471-490.

TRECHSEL, L. J., ZIMMERMANN, A. B., STEINBÖCK, C., BREU, T., HERWEG, K. & THIEME, S. 2021. Safe spaces for disruptive learning in a North–South research partnership context: International mobility of doctoral students. *Sustainability,* 13.

UNECE 2005. UNECE Strategy for Education for Sustainable Development. *In:* CEP (ed.) *AC. 13.* Vilnius: Committee on Environmental Policy.

UNESCO 2015. *Education 2030: Incheon Declaration and Framework for Action for the Implementation of Sustainable Development Goal 4. Ensure Inclusive and Equitable Quality Education and Promote Lifelong Learning Opportunities for All.* Incheon: UNESCO.

UNESCO 2020. *Education for Sustainable Development a Roadmap.* Paris: UNESCO.

UNESCO 2021. Berlin declaration on education for sustainable development. *UNESCO World Conference on Education for Sustainable Development. Learn for our Planet. Act for Sustainability.* Berlin: UNESCO.

UNITED NATIONS 2015. *Transforming our World: The 2030 Agenda for Sustainable Development. A/RES/70/1.* New York: United Nations.

UNITED NATIONS 2019. *The Future is Now – Science for Achieving Sustainable Development. Global Sustainable Development Report (GSDR).* New York: United Nations.

VAN POECK, K., LÆSSØE, J. & BLOCK, T. 2017. An exploration of sustainability change agents as facilitators of nonformal learning: Mapping a moving and intertwined landscape. *Ecology and Society,* 22.

VISSER, W. & CRANE, A. 2010. Corporate sustainability and the individual: Understanding what drives sustainability professionals as change agents. *SSRN Paper Series,* 1**,** 1-20.

WALS, A. E. J. 2012. *Shaping the Education of Tomorrow: 2012 Full-length Report on the UN Decade of Education for Sustainable Development.* Paris: UNESCO Education sector, DESD Monitoring & Evaluation.

WALS, A. E. J. 2020. Sustainability-oriented ecologies of learning: A response to systemic global dysfunction. *In:* BARNETT, R. & JACKSON, N. (eds.) *Ecologies for Learning and Practice. Emerging Ideas, Sightings, and Possibilities.* Oxon: Routledge.

WALS, A. E. J. 2021. The power of transgressive learning. *GTI Forum Contribution.* Cambridge: Tellus Institute.

WALS, A. E. J. & BENAVOT, A. 2017. Can we meet the sustainability challenges? The role of education and lifelong learning. *European Journal of Education,* 52**,** 404-413.

WALS, A. E. J. & VAN DER LEIJ, T. 2009. *Social Learning Towards a Sustainable World. Principles, Perspectives, and Praxis.* Wageningen: Wageningen Academic Publisher.

WEISS, M., BARTH, M. & VON WEHRDEN, H. 2021. The patterns of curriculum change processes that embed sustainability in higher education institutions. *Sustainability Science,* 16**,** 1579-1593.

WIEK, A., WITHYCOMBE, L. & REDMAN, C. L. 2011. Key competencies in sustainability: A reference framework for academic program development. *Sustainability Science,* 6**,** 203-218.

WIESMANN, U. & MESSERLI, P. 2007. Wege aus den konzeptionellen Fallen der Nachhaltigkeit – Beiträge der Geographie. *In:* KAUFMANN, R., BURGER, P. & STOFFEL, M. (eds.) *Nachhaltigkeitsforschung – Perspektiven der Sozial- und Geisteswissenschaften. Nachhaltige Entwicklung.* Bern: Schweizerische Akademie der Geistes- und Sozialwissenschaften SAGW.

ZALASIEWICZ, J., WATERS, C. N., ELLIS, E. C., HEAD, M. J., VIDAS, D., STEFFEN, W., THOMAS, J. A., HORN, E., SUMMERHAYES, C. P., LEINFELDER, R., MCNEILL, J. R., GAŁUSZKA, A., WILLIAMS, M., BARNOSKY, A. D., RICHTER, D. D. B., GIBBARD, P. L., SYVITSKI, J., JEANDEL, C., CEARRETA, A., CUNDY, A. B., FAIRCHILD, I. J., ROSE, N. L., IVAR DO SUL, J. A., SHOTYK, W., TURNER, S., WAGREICH, M. & ZINKE, J. 2021. The anthropocene: Comparing its meaning in geology (chronostratigraphy) with conceptual approaches arising in other disciplines. *Earth's Future,* 9.

Declaration of consent

on the basis of Article 30 of the RSL Phil.-nat. 18

Name/First Name:

Registration Number:

Study program:

Bachelor ☐ Master ☐ Dissertation ☐

Title of the thesis:

Supervisor:

I declare herewith that this thesis is my own work and that I have not used any sources other than those stated. I have indicated the adoption of quotations as well as thoughts taken from other authors as such in the thesis. I am aware that the Senate pursuant to Article 36 paragraph 1 litera r of the University Act of 5 September, 1996 is authorized to revoke the title awarded on the basis of this thesis.
For the purposes of evaluation and verification of compliance with the declaration of originality and the regulations governing plagiarism, I hereby grant the University of Bern the right to process my personal data and to perform the acts of use this requires, in particular, to reproduce the written thesis and to store it permanently in a database, and to use said database, or to make said database available, to enable comparison with future theses submitted by others.

Place/Date

Signature