ZfL Discussion Papers

Sustainability in teacher education around the world.

FIRST INSIGHTS IN NATIONAL LEGAL GUIDELINES AS WELL AS GOOD PRACTICE EXAMPLES AND INITIAL APPROACHES FROM UNIVERSITIES IN ARGENTINA, AUSTRIA, CANADA, ESTONIA, GERMANY, MEXICO, NAMIBIA, SWEDEN, THE USA, AND VIETNAM

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Summary: Sustainability in teacher education is discussed and enacted differently in various countries. A look into ten countries, as well as universities worldwide, offers insights, good practice examples and initial approaches to beneficially implement ESD in teacher education around the globe. First steps are already being taken and serve as a helpful blueprint for colleagues working in this field.

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Introduction

In the face of global environmental and social challenges, the need for a transformation towards sustainability is becoming increasingly urgent. Current economic practices and lifestyles are being put to the test in the face of planetary boundaries. Designating quantifiable thresholds within humanity can help to safely operate limits (Rockström et al. 2009). As a normative counter-model to further overexploitation of the planet, the conception of sustainable development has been established since the end of the 1980s. Development is considered sustainable if it "meets the needs of the present without compromising the ability of future generations to meet their own needs and choose their own lifestyles" (Brundtland 1987, p. XV). Shaping a liveable and sustainable Earth is not only a question of technical innovations, but also a question of political decisions and personal action. Sustainability is thus closely linked to educational processes in which human action, with its complex systemic consequences and interactions in ecological, economic and social terms, becomes a pertinent topic. Consequently one of the 17 Sustainable Development Goals, that are to be reached by 2030, addresses quality education as one target "knowledge and skills needed to promote sustainable development"[1]. UNESCO defines Education for Sustainable Development (ESD) as follows:

> "ESD gives learners of all ages the knowledge, skills, values and agency to address interconnected global challenges including climate change, loss of biodiversity, unsustainable use of resources, and inequality. It empowers learners of all ages to make informed decisions and take individual and collective action to change society and care for the planet. ESD is a lifelong learning process and an integral part of quality education. It enhances the cognitive, socio-emotional and behavioural dimensions of learning and encompasses learning content and outcomes, pedagogy and the learning environment itself".[2]

An also often-used term, highlighted in this article, is Environmental Education (EE). ESD is the formal commitment and therefore promoted by the United Nations, to ensure that countries achieve their sustainable development goals. In contrast, EE was the first educational trend with an environmental protection approach and has greater historical roots in some regions of the planet (Acosta Castellanos & Quieruga-Dios 2022).
Teacher education is an essential factor for the promotion of ESD. Teachers, as change agents, play a crucial role in preparing future generations for a world that is constantly changing and highly complex. In realizing ESD, two challenges, among others, especially come up in teacher education: On the one hand, the question arises as to how future teachers can be supported in developing professional action competences (Bürgener & Barth 2018). The above definition of ESD shows that it is a broad educational concept whose implementation requires different sub-competences. This results not only in demands on subject-specific and interdisciplinary knowledge, but also, for example, on the design of (participatory) learning processes and learning environments. A second challenge is to achieve clarity about the goals pursued. Is it primarily about promoting more sustainable attitudes and behaviours, or is the focus on developing critical reflection and judgement skills (Getzin & Singer-Brodowski 2016)? In this context, the tension between individual possibilities of influence and political responsibility must also be seen.

[1] https://sdgs.un.org/goals/goal4.
[2] https://www.unesco.org/en/education/sustainable-development/need-know.

A look at ten countries: What is already being done in the field of ESD in teacher education? What guidelines, laws, policies, programmes and strategies are in place?

Existing strategies and programmes that are disseminated worldwide (and yet are certainly received and anchored with varying intensity) include the UNECE Strategy "Education for Sustainable Development"[3], the UN Decade of "Education for Sustainable Development" (2005-2014)[4] or the UNESCO World Programme of Action "Education for Sustainable Development" (2015-2019)[5]. In addition, the Sustainable Development Goals of the United Nations (2015) also play an important role.[6]
However, the legal, as well as structural status quo, in teacher education are highly diverse in the different countries and must always be kept in mind, if one wants to understand what is already being implemented and what is missing in the field of ESD in teacher education and schools. The respective starting positions, the history of implementation, the responsible and/or involved institutions and consequently the national guidelines and frames of reference (e.g., laws and policies or initiatives at state and or federal level, programmes) are completely different in the ten countries in focus. Consequently, this article has to be read as a very first attempt towards an international comparison on the topic of ESD in teacher education and may therefore above all serve as a starting point and stimulus for further research projects and also teaching, which deal in much more detail with the individual requirements and the corresponding implementation. A look into ten countries, as well as universities worldwide, offers certainly insights, good practice examples and initial approaches to beneficially implement ESD in teacher education. First steps have already been taken and serve as a helpful blueprint for colleagues working in this field and hopefully also more systematic (international) research.[7]

In the **Argentinian** discourse the denomination Environmental Education (EE) continues to be used and increasingly the term Education for Sustainable Development (ESD). Following González Gaudiano (1999) and Tréllez Solís (2006), this is based on the independent development of EE in Latin America emerging from popular education (*Educación popular*)[8]. EE was institutionalised in Argentina in 1993 through the Federal Law of Education (*Ley Federal de Educación*). Ever since the implementation of EE into the educational system has been progressively concretised through different laws and the latest juridical action, the 2021 Law for the Implementation of Environmental Education in the Republique of Argentina (*Ley para la implementación de la educación ambiental integral en al república argentina*), has the goal to ensure the right to EE for everyone[9].

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[3] https://unece.org/2005.
[4] https://en.unesco.org/themes/education-sustainable-development/what-is-esd/un-decade-of-esd.
[5] https://www.unesco.org/en/education/sustainable-development.
[6] https://sdgs.un.org/goals.
[7] This article is based on an international Summer School on sustainability and teacher education held at the University of Cologne in September 2022. This took place as part of the *UNITE Cologne* project funded by the German Academic Exchange Service (DAAD), coordinated jointly by Department 93/International Mobility (International Office) and the Centre for Teacher Education since 2019.
[8] Estrella, Melisa & Zenobi, Viviana (2022). La Ley de Educación Ambiental Integral y la formación docente en Geografía. Red Sociales, Revista del Departamento de Ciencias Sociales, 9(1), 147-160.
[9] https://www.argentina.gob.ar/normativa/nacional/ley-27621-350594/texto.
Important to point out: Argentina is federal country and the educational system is provincially governed. Matters related to the education sector are supervised and administered by the

In connection with this law different instruments and institutions have been established for its implementation, such as the National Strategy for Environmental Education (*Estrategia Nacional de Educación Ambiental Integral (ENEAI)*), the National Strategy for Sustainability in Argentinian Universities (*Estrategia Nacional para la Sustentabilidad en las Universidades Argentinas (ENSUA)*) and the Executive Coordination of the National Strategy for Environmental Education (*Coordinación Ejecutiva de la Estrategia Nacional de Educación Ambiental Integral (CENEAI)*). These instruments have in common that they are occupied with determining in what ways EE can be incorporated into different areas of formal and informal education, including teacher education. Even though there is no universal way in which teacher education institutes and/or universities in Argentina include EE into the curricula of future teachers, there are many different ways in which ESD is developed. For instance, in the province of Buenos Aires EE has been incorporated in a transdisciplinary way. Likewise, Sustainable Development Goals (SDGs) were incorporated at a national level by the National Institute for Teacher Training (Instituto Nacional de Formación docente, INFOD) and, in the 2030 national science, technology and innovation plan that includes education and sustainability among its goals.

Teacher education in **Austria** embraces a multi-stakeholder strategy. In 1995, the ÖKOLOG program was initiated by the Austrian Ministry of Education[10]. ÖKOLOG is central to the institutional anchoring of sustainability as it bundles initiatives for all teacher education institutions. By 2022, 13 out of a total of 14 Austrian teacher education institutions and approx. 660 schools were involved and cooperate in environmental education projects. ÖKOLOG has been scientifically accompanied and evaluated from the beginning. In addition to in-service and professional continuing training, this also results in teaching materials and the opportunity to find supervisors for master's theses. Another important high-level initiative in the Austrian education system is the "Environmental Education Forum" by the Federal Ministry for Climate Protection, Environment, Energy, Mobility, Innovation and Technology and the Federal Ministry for Education, Science and Research[11]. Through cooperation with experts from educational institutions, NGOs, extracurricular youth education institutions and the media, interdisciplinary teams develop educational formats to convey topics such as the global sustainability goals for climate protection. At the university level, the *Alliance for Sustainable Universities* offers networking opportunities with working groups on the SDGs, including education for sustainable development. Since 2022, university lecturers can obtain a Certificate for Teaching in Higher Education "Education for Sustainable Development" with a total of 4 credits[12].

In the course of Agenda 2030, with which the **Estonian** government delegated various responsibilities to different ministries in order to achieve the sustainability goals, the Estonian Ministry of Education introduced the topic "Environment and Sustainable Development" into its national curriculum as an interdisciplinary

Ministry of Education and the National Council of Education lays down a standard curriculum that is followed by schools throughout the country. Teacher education is provided by: a) tertiary institutions that compose the teacher education institutes (Institutos Superiores de Formación Docente, not university-based), many of which were founded between the late 19th and early 20th centuries and, b) the universities which have an important offer of teacher training, not only but especially for the secondary level.

[10] https://www.oekolog.at/.

[11] https://www.umweltbildung.at/.

[12] https://nachhaltigeuniversitaeten.at/zertifikat/.

topic in 2002.[13] This means that all schools in Estonia must integrate sustainability into everyday school life.[14] The schools try to implement this curricular requirement through forest education, global education and outdoor education. However, other priorities are also set, such as human rights and global citizenship education. It is less about the environment and more about understanding local and global systems, learning critical thinking, and empowering students to make sustainable decisions for themselves and the planet. Environmental Education Centers were also founded in 2002 to give the population access to sustainable education outside of school. Also, in 2017 the Society for Sustainable Education was founded, which annually holds the Environmental Education Conference, attended by teachers, supervisors and practitioners from Estonia. In 2018, a Sustainable Education and Environmental Awareness Plan 2019-2022 was presented by the Department of Environment and the Department of Education and Research.[15]

In **Germany**, the goals set out in the "National Action Plan on Education for Sustainable Development" (2017)[16] serve as guidelines for the federal states and universities. They include, among other things, the anchoring of ESD in the initial and in-service training of teachers as well as the provision of funding for the competence development of teachers and further accompanying research (National Platform: 29f.).
Education is a matter of the 16 federal states in Germany and in most states, ESD courses are currently offered as an option and subject-related (e.g., Geography, Biology, sometimes also Humanities with a focus on Global Learning). Some universities award certificates for successfully completed transdisciplinary ESD modules. In Baden-Württemberg, the anchoring of ESD as one of six interdisciplinary "guiding perspectives" in the education curricula for teacher training is already structurally particularly advanced.[17] In the sense of a "whole institution approach", individual higher education institutions are specifically profiling themselves in the area of sustainability, for example the Leuphana University in Lüneburg.[18] Starting with concrete environmental protection measures on the campus, the activities are increasingly spreading to research and teaching.

Canada has an Association of Canadian Deans of Education (ACDE) working towards a more sustainable approach to teacher education.[19] The Association of Canadian Deans of Education published an "Accord on Education for Sustainable Education" in 2019[20]. In this article, the Deans recognize that Canada needs to acknowledge the harm they have caused to the First Nations, Metis, and Inuit people (ibid.: 6) and, specifically, to the sustainability of their environment. It is stated that moving towards a more sustainable approach to education means that "more formal education needs to take place outdoors," and educators need to take an interdisciplinary approach to teaching (ibid.: 8). Students need to become more aware of the interconnectedness of environmental systems and their planet. This holistic and interdisciplinary approach to sustainability in teacher education also accounts for social justice. They state that "humans are seen as a superior value to other species, thus justifying the exploitation of other creatures for human benefit" (ibid.). Creating a curriculum that ensures

[13] https://static1.squarespace.com/static/5f6decace4ff425352eddb4a/t/5fc0f122145a8629dcd2f298/1606480166130/Estonia-PR-report.pdf.
[14] https://unece.org/fileadmin/DAM/env/Estonia.pdf.
[15] http://forestpedagogics.eu/portal/2020/01/24/environmental-education-in-estonia/.
[16] https://www.bne-portal.de/bne/de/nationaler-aktionsplan/nationaler-aktionsplan.html.
[17] https://km-bw.de/,Lde/startseite/schule/Rahmensetzungen+_+Neuerungen.
[18] https://www.leuphana.de/universitaet/entwicklung/nachhaltig.html.
[19] https://csse-scee.ca/acde/.
[20] https://csse-scee.ca/acde/wp-content/uploads/sites/7/2022/03/Accord-on-Education-for-a-Sustainable-Future-1.pdf.

students learn about the effects of their lifestyles on our ecosystems is a key component of sustainability in teacher education. The Deans conclude the accord by suggesting land and place-based learning (ibid.: 11), which is argued as an inherent Indigenous understanding has the potential to support sustainable education.

In **Mexico**, future teachers will not necessarily come into contact with ESD during their initial training which is partly due to the diverse paths to becoming a teacher. Future educators have a variety of different institutions to choose from for their training, such as normal schools (*escuelas normales*), national pedagogy centres (*Centros de Pedagógica Nacional*) or teacher centres (*Centros de Maestro*) among others. In addition to that, qualifications also vary to a great degree. All teachers are required to obtain a licentiate level qualification called *Título Profesional de Educación Normal*, however continuing pedagogical training and graduate studies in different areas are typical[21]. The largest facility for teacher education is the National Pedagogical University (*Universidad Pedagógica Nacional* (UPN)) which consists of 76 units, 208 academic subunits and three decentralised universities creating a nationwide network[22]. The UPN offers the participation in thematical networks of which one is concerned with natural sciences and environmental education as well as a master's degree in Environmental Education[23]. Another example of the implementation of ESD into teacher education in Mexico is the introductory course to ESD at the University of Guadalajara which is based on UNESCO materials and has the aim to sensitise teachers to the topic[24].

As in Mexico and Canada, teachers in the **United States of America** are licensed through a number of programs and are granted licensure at the state, rather than at the federal level. Therefore, sustainability regulated at the federal teacher education level is virtually non-existent.[25] However, this was not always the case. In the 1990s, under the presidency of Bill Clinton, the USA was one of 70 countries that promoted sustainable education as part of Agenda 21 in order to promote sustainable development. In addition to founding an office for Education for Sustainability within the Department of Education, which was only funded for two years, a document with 12 actions was formulated to promote sustainable education. Since the working group at the time was not allowed to exercise legislative power, it was not given any real attention.[26] Today, there are no references to this list or sustainable education in the school curriculum at the federal level. However, universities still cover the topic. In the USA there is the US Teacher Education for Sustainable Development Network, which is a voluntary network of teachers and teacher education institutions such as universities and other private organizations. This network publishes articles on reorienting 'Teacher Education to Address Sustainability' in the US context. Throughout the United States, many science education programs within teacher certification programs and colleges of education include global responsibility and environmental consciousness as part of their curriculum, generally reaching preservice teachers seeking certification as an elementary (grades pre-kindergarten through sixth grade) teacher or as a secondary (grades 6-12) science teacher. The National Science Teacher Association[27] facilitates use of the *Next Generation Science Standards* used by each individual state teacher department of education. The

[21] https://files.eric.ed.gov/fulltext/ED598068.pdf.
[22] https://upn.mx/index.php/red-de-unidades/upn-naciona.l
[23] https://upn.mx/index.php/red-de-unidades/upn-nacional;
https://www.gob.mx/upn/acciones-y-programas/oferta-educativa-nidades-upn.
[24] http://www.sostenible.udg.mx/eje-educacion-para-el-desarrollo-sostenible-eds.
[25] https://www.emerald.com/insight/content/doi/10.1108/IJSHE-10-2012-0088/full/html.
[26] https://issuu.com/dgrowe/docs/esd_in_the_usa_8-19-09.
[27] National Science Teaching Association: https://www.nsta.org/science-standards.

states of Vermont and Washington are also considered pioneers in the USA regarding 'Sustainable Education'. Vermont actively promotes sustainable education and teacher training and in 2000 included sustainability as part of the curriculum of primary and secondary schools. Washington also issued several guidelines that prescribe sustainable education in all types of schools and also prescribes this in teacher training. In addition, Washington primarily supports courses in which secondary students are introduced to career opportunities in green industries.[28]

Namibia has a National Environmental Education (EE) and ESD Policy with a Strategy and Action Plan[29]. In addition, the country has a National ESD Task Force[30]. The ESD Policy is designed to support EE and ESD in formal, non-formal and informal education processes across all sectors of the Namibian society including higher education, teacher education, technical and vocational education institutions, and general education. The EE/ESD Policy Guidelines are in accordance with ecologically sustainable practice and serve as a basis for addressing local, national and global environmental issues. The mainstreaming of environmental and sustainability issues into education processes will help Namibians to appreciate, understand and support the natural ecosystems to adapt to climate change, ensure that food production is not threatened and enable social and economic development to proceed in a sustainable manner.[31]
Namibia is integrating EE/ESD into the K-12 curriculum to some extent, especially in Life Sciences subjects. Only a few schools have environmental clubs, school gardens and recycling as well as other ESD activities. ESD at lower primary is across the curriculum while secondary schools provide ESD through carrier subjects (e.g. Environmental Studies, Social Studies, Geography, Life Science, Biology, Development Studies, Natural Science and Health Education and Chemistry). New school curriculum is focused on attaining the SDGs, particularly Goal 4 (Quality Education). In terms of professional development, the country currently indirectly certifies teachers for EE/ESD through courses in e.g., Geography, Biology or Life Science (i.e., the carrier subjects or subjects in which EE/ESD aspects are integrated at secondary school level) at the Bachelor's level. The International University of Management (IUM) has introduced the Centre for Environmental Studies (CES) to teach and research on EE/ESD issues[32]. The Namibia University of Science and Technology (NUST) has a Nature Conservation and Energy Institute[33].

In **Sweden**, sustainability in teacher education has originally been influenced by the incorporation of sustainable development in the Higher Education Act (1992: 1434)[34] during the 1990s, stipulating that 'higher education institutions shall promote sustainable development to assure for present and future generations a sound and healthy environment, economic and social welfare, and justice.' This incorporates all three main areas of higher education, that is (1) research, (2) the provision of higher education, as well as the (3) cooperation of higher education institutions with society. However, given that higher education institutions have a relative sovereign position as a state agency, the contents of the teaching

[28] https://issuu.com/dgrowe/docs/esd_in_the_usa_8-19-09.
[29] https://www.unesco.org/en/articles/namibia-adopts-national-environment-education-and-esd-policy.
[30] https://nadeet.org/national-esd-task-force.
[31] https://neen.org.na/.
[32] http://www.ium.edu.na.
[33] https://www.nust.na.
[34] The Swedish Higher Education Act *(1992: 1434)*, Gov. of Sweden.

programmes are only highlighted to a very limited extent prescribed by regulatory documents. The Higher Education Ordinance (1993: 100)[35] which is a specification and amendment of the Higher Education Act stipulates for example with regards to Degree of Master of Arts/Science in Secondary/Upper Secondary Education a brief list of knowledges that the holder of that degree should have. All of them are related to the theoretical and practical knowledge of instruction and evaluation of learning, yet, none of them addresses sustainability.
Accordingly, there is no governmental mandated content related to sustainability specifically to be incorporated into teacher training. At the current time, teacher training institutions have relative freedom to define their own curricula in accordance with the broad stipulations of the Higher Education Ordinance with no comprehensive framework or implementation. The availability of such content is often dependent on either specialized and committed instructors or local department or university policy initiatives.

It can be said that ESD has been officially infused in **Vietnam** since the adoption of the Vietnam Agenda 21[36] in 2004. However, ESD incorporation in teacher education has remained limited. Sustainability in teacher education in Vietnam has been poorly researched with very few exceptions. Kieu (2017) examines how ESD has been implemented at Teacher Education Institutions in Vietnam, with a case study at Danang University of Education. The findings show that several courses related to ESD themes have been conducted in training programs. The courses, to some extent, provide student teachers with a basic understanding of ESD issues. However, developing ESD competencies for student teachers "has not been effectively enhanced by formal education due to the lack of practical and local knowledge related to sustainability, the prevalence of top-down pedagogy, large classes and poor facilities" (ibid.: i). Thao et al. (2022) conduct a Delphi study to explore the teachers' competencies in ESD in the context of Vietnam. The study highlights 13 competencies related to three dimensions (content knowledge/cognitive, pedagogical and pedagogical content knowledge, motivation and volition). This can be considered as a foundation for developing educational opportunities focusing on promoting the specific teachers' professional competencies in basic ESD training in the country. The study by Nguyen et al. (2022) investigates how ESD is incorporated in teacher training programs in terms of learning content, learning outcomes and didactic approaches with the case study by the Hanoi National University of Education (HNUE). The results show that some elements of ESD have been integrated in the programs but they lack coherence or systematic inclusion. The results suggest needed strategic changes at organizational (university) and individual (instructor) levels to improve ESD in teacher education.
While higher education has been becoming more engaged with sustainability through increasing charters and declarations signed by university leaders to promote ESD (e.g., Lozano et al. 2013), teacher education in Vietnam seems to lag behind others in this area. Teacher education institutions have not released any official mission statement that refers to ESD.

[35] The Higher Education Ordinance *(1993: 100),* Ministry of Education and Research Sweden.
[36] Prime Minister and Goverment of Vietnam (2004). *The Strategic orientation for Sustainable Development in Vietnam (Vietnam Agenda 21)*.

Sustainability in teacher education – Examples across the globe

In the following, examples of implementation at different universities are briefly presented. These examples are uniquely professionally anchored and locally situated. Taking this diversity as a point of reference, it offers numerous impulses for better ESD implementation according for local possibilities and specificities.

Paris Lodron University Salzburg

Salzburg City, with its institutions in higher education, has a long tradition and strong record in teacher education across all types of schools and school levels. 20% of students at the Paris Lodron University of Salzburg (PLUS) are enrolled in teacher education, with Bachelor and Master degrees offered for 19 school subjects. Together with the Salzburg University of Higher Education and the Mozarteum University Salzburg, 26 school subjects and 2 specialisations are offered in teacher education. With this high enrolment of students in teacher education, bottom-up, as well as third mission and network initiatives for sustainability, reach out into teacher education at all qualification levels, including alumni and in-service training. At University of Salzburg (PLUS), the PLUS Green Campus sustainability initiative[37] and the PLUS Green Campus Students[38] have been active since 2011 and 2015 respectively. In addition to these initiatives, since 2019 there has been a staff position to support the Scientists4Future (S4F)[39] regional group Salzburg[40] in cooperation with the Climate Strategy 2050 of the federal State of Salzburg. The S4F network connects interested and committed scientists from the PLUS, Mozarteum University Salzburg, University of Applied Sciences and Salzburg University of Higher Education as well as the Paracelsus Medical University, which also has an impact on society and deliberately tries to reach out to politicians and to support the climate movements with expertise.

However, the scientists at PLUS do not only focus on the third mission when it comes to sustainability issues, but also on research and teaching on sustainability. To strengthen this, the “Open your Course 4 Climate Crisis”[41] was initiated in 2019 in Austria. In this action week, which takes place once every semester, all teaching staff are invited to incorporate the topics of sustainability into their courses in a subject-specific manner and to empower students to contribute to the transformation towards a sustainable society. The PLUS has not only taken part in the action week every time but, in addition, a Sustainability Week[42] was created.

Furthermore, the University of Salzburg offers the “Studienergänzung” (Specialization Studies program) “Climate Change and Sustainability”, which students of all disciplines can complete. This “Studienergänzung” includes, for example, lectures on ecology, environmental psychology or environmental law to provide students with an interdisciplinary basis.[43] Furthermore, a course “Science for Sustainability” has been included since 2022, in which students can actively engage

[37] https://www.plus.ac.at/plus-green-campus/.
[38] https://www.plus.ac.at/plus-green-campus/herzlich-willkommen/team/student-team/.
[39] https://at.scientists4future.org/.
[40] www.plus.ac.at/s4f.
[41] https://at.scientists4future.org/oc4cc-open-your-course-for-climate-change/.
[42] www.plus.ac.at/s4f/sustainabilityweek.
[43] https://www.plus.ac.at/zfl-flexibles-lernen/service-fuer-studierende/studienergaenzungen/klimawandel-und-nachhaltigkeit/.

with their projects for more sustainability at the university and receive scientific support by teaching staff and also credits[44].
Despite all these initiatives and projects, there is still a lot of room for improvement at the PLUS in terms of how sustainability issues can be structurally and organizationally anchored in research, teaching, and the social responsibility of a university.

Mount Royal University

MRU, located in the west of Canada, has built an international education program that is widely regarded as leading-edge. The department's first response to ESD is through the more traditional lens of its commitment to the environment and response to climate change through engaged citizenship. STEAM is an educational approach to learning that uses Science, Technology, Engineering, the Arts, and Mathematics as access points for guiding teacher candidate inquiry, dialogue, and critical thinking. The results are teacher candidates who take thoughtful risks, engage in place-based experiential learning, persist in problem-solving, embrace collaboration, and develop a growth mindset (Education Closet 2017)[45].
Land-based learning is a key part of the Bachelor of Education Elementary program at Mount Royal University. Indigenous scholars are replacing the term "Place" with "Land" and argue that land-based pedagogies promote the decolonization of education by recognizing this intimate relationship between Indigenous peoples with their land. Currently, MRU works to find ways in which non-Indigenous peoples can authentically integrate land-based learning into their curriculum and develop an Indigenous understanding of the land that supports ESD.
The MRU Department of Education is associated with the NASA GLOBE (Global Learning to Benefit the Environment) program[46], which is rooted in environmental sustainability. Through environmental science-related activities and integration of Traditional Ecological Knowledge (TEK), students develop an enlightened recognition of the relationship of self, community and the global world. The curriculum in the province of Alberta is set by the Government of Alberta. Science is a program of study in this curriculum, and a required course in the Bachelor of Education program at MRU is the Program of Studies in Teaching Science which aims to infuse sustainability and social responsibility into the curriculum.
MRU has designed a STEAM semester for the teacher education program that utilizes Shulman's (2006)[47] concept of signature pedagogies and Kuh's (2008)[48] high-impact practices (HIPs). The STEAM semester focuses on the following transformative pedagogical approaches that are informed by (i) cross-curricular course integration, (ii) cohort placements and in-school seminars, (iii) community partnerships, (iv) faculty practicum supervision in K-9 schools and (v) peer mentorship. Additionally, teacher candidates engage in a semester long inquiry project in partnership with their mentor teacher and write journal reflections throughout the semester in order to connect the theory of their courses with the practice of their practicum experience. They use a digital learning plan (e-portfolio) to document their growth and development throughout the semester with respect to the B.Ed. programs core competencies; planning, facilitation, assessment, environment, and professional responsibilities.

[44] https://online.uni-salzburg.at/plus_online/pl/ui/%24ctx/wbLv.wbShowLVDetail?pStpSpNr=636341.
[45] http://educationcloset.com/steam/what-is-steam/.
[46] https://www.globe.gov/de/.
[47] http://www.jstor.org/stable/20027998.
[48] https://provost.tufts.edu/celt/files/High-Impact-Ed-Practices1.pdf.

Finally, MRU supports Indigenous ways of knowing and land-based experiential learning opportunities with First Nations partners (e.g., Tsuut'ina and Stoney Nakoda First Nations).

University of Namibia

The Faculty of Education at the University of Namibia (UNAM) ensures access to teacher education programs, offered on six different campuses across the country. UNAM has established the Namibia Green Hydrogen Research Institute in 2021. The institute's focus areas range from desalination, wind and solar energy, electrolysis, fuel cell technologies, community and societal impact, and emerging technologies – areas that UNAM has successfully run pilot projects on.[49]

Connected to these are pockets of ESD issues in Namibian higher education space. A study was conducted in 2022 to investigate Kavango East Secondary School teachers' perceptions on the possible strategies for addressing the challenges in sustaining the Rumanyo Language. Results indicated that there is a need to develop teaching materials in the Rumanyo language, the curriculum should be based on practical and life experiences that also reflect ESD and indigenous/local environmental knowledge practices. Most importantly, teachers should be trained to implement/teach the Rumanyo language at both pre-primary and secondary school levels. Preservation of the Rumanyo language in secondary schools is necessary in order to keep the identity, culture and norms sustainable. As Romaine (2007) affirms, thinking about natural resources must contain thinking about language as well. Languages must be seen as "vital parts of complex local ecologies" which need careful planning "if global biodiversity as well as human cultures and even humanity in general, are to be sustained" (ibid.: 130).

Universidad Nacional de San Martín

UNSAM, acronym for Universidad Nacional de San Martín, is an Argentine national and public state university founded in 1992, which provides high-level academic and professional training in research and teaching on issues related to science and technology, environmental management, humanities and social sciences, as well as artistic disciplines. This multidisciplinary teaching model helps develop the ability to get into the analysis of the political, social, educational, economic, administrative, legal, organisational and instrumental aspects required for the design and evaluation of the dynamics of State-Society-Nature relations.

In teacher education, there are several offers, such as the International Diploma in Climate Change, the Diploma of Advanced Studies in Environmental Education, Specialisation in Habitat Management and Production, Specialisation in Environmental Management, Doctorate in Human Sciences or the Doctorate in Environmental Sciences. Other degrees related to sustainability are involved in tourism, efficient energy, and architecture.

UNSAM has strong and important work with the educational system and the civil society organization of its territory. For instance, the Carcova environmental observatory[50] which involves the participation and joint work of the university, the neighbourhood community and schools in the study of social vulnerability and environmental problems. The observatory develops training actions, research and studies of urban decay and mitigation mechanisms for sustainable develop-

[49] https://forumonline.unam.edu.na.
[50] https://www.unsam.edu.ar/institutos/3ia/ambiental-carcova/.

ment. The collaboration involves researchers and university students (undergraduate and graduate) in the transdisciplinary study of educational, social and environmental issues. The observatory works with teachers, students and neighbours at the territory level.
Another project is the Feria de Ciencias Humanas y Sociales[51], an educational experience aimed at promoting social justice and inclusion through the articulation between the university and the school community. Throughout the school year, the fair generates meeting and exchange spaces that promote the development of research projects by high school students and teachers with the support and follow-up of specialized UNSAM professors and researchers through academic tutorials. At the end of the school year, the results of those projects are presented and shared during two days on the university campus.

Tallinn University

One of the oldest academic units in Tallinn University is the School of Educational Sciences, which has a strong interdisciplinary cooperation with all the other institutes within Tallinn University. In 2020, an attempt to train students in mediation was carried out in a virtual intercultural project “Erinnerungsorte in Deutschland, Estland und Sri Lanka” (Memory spaces in Germany, Estonia and Sri Lanka). Among the participants of the project were the students in teacher training at Tallinn University in Estonia and at the University of Kelaniya in Sri Lanka. The content of the project was to summarize the information on German Memory spaces such as “Deutscher Wald” (German forest) or “Weihnachten” (Christmas) and to compare these phenomena with the students’ own culture. Regarding the symbolic competence, the project showed that the students chose to present the aspects that they could relate to in a greater extent than the aspects not common in their culture. This fact was discussed and made visible to the students. The students could also build their skills in listening to people with different accents and discuss their relation to Germany and German language and culture. Intercultural learning also took place when students had to agree on how to schedule the work, distribute the tasks, present the content and design the presentation. Intercultural learning often happened through little misunderstandings, jokes, insights into each other’s’ lives, and through a shared success after presenting the results in front of fellow students and guests. The symbolic competence the students gained from both dealing with Memory spaces and doing it in an international team offered them new perspectives for understanding the role of teamwork, listening and explaining their culture in a foreign language as a part of international problem solving that our societies and our planet will need more and more every year.

Hanoi National University of Education

Hanoi National University of Education (HNUE) is one of the largest Teacher Education Institutions (TEI) in Vietnam. It comprises 25 faculties and currently offers 23 teacher education programs in a broad range of disciplines from Science and Technology to Social Science and Humanities. It is worth noting that discussion of competencies has been ongoing internationally in recent years, but in Vietnam it is a novel concept, which was integrated in the new general education curricula issued in 2018 and officially implemented in the 2021-2022 school year. In order to address the demands of the new curricula, TEIs in Vietnam, including HNUE, have to revise and redesign their training programs to orient them towards a competency-based approach. During the academic year of 2020-2021, HNUE developed new training programs oriented to a competency-based approach (Thao et al. 2022).

[51] https://www.unsam.edu.ar/feriahumanassociales/.

Nguyen et al. (2022) conducted a curricular assessment to examine how ESD is incorporated in teacher training programs in terms of learning content, learning outcomes and didactic approach, through analysing 429 course syllabi offered by HNUE. The results show that certain elements of ESD have been found in the curricula. The HNUE has defined six general key competencies for teachers. They are the general competencies that every teacher should have in order to function well as a member of an educational organisation and in society. Specifically, they include: 1) Autonomy and adaptive competency; 2) Communication and cooperation competency; 3) Leadership competency; 4) Problem-solving competency; 5) Self-awareness competency; 6) Critical thinking competency. These competencies greatly overlap with UNESCO key competencies for sustainability (Table 1). This should be considered a great opportunity to promote sustainability competencies for student teachers.

Table 1. The relationship between HNUE's general competencies and UNESCO key competencies for sustainability

HNUE's general competencies / UNESCO key competencies for sustainability	Autonomy and adaptivity	Communication and cooperation	Leadership	Problem-solving	Self-Awareness	Critical thinking
Systems thinking competency						
Anticipatory competency	X					
Normative competency	X					
Strategic competency			X			
Collaboration competency		X				
Critical thinking competency						X
Self-awareness competency			X		X	
Integrated problem-solving competency				X		

However, the absence of systems thinking as a sustainability competency, the considerable number of courses that did not integrate any sustainability content (76%) or competencies (28.9%), and limited pedagogies promoting action-oriented and transformative learning, reflect the lack of a systematic approach in developing curricula for ESD. It is thus vital to have institutional strategies and support in implementing ESD to make SD and ESD explicit in teacher training programs at HNUE and to accelerate the contribution of teacher education to SD through developing their teachers' competencies.

Uppsala University

The Department of Education at Uppsala University is running a number of research projects related to Education for Sustainable Development (ESD) and has also managed a national one-cohort graduate school on ESD (GRESD). In the following, three research projects related to ESD are highlighted:

Manners of teaching about controversial sustainability issues and students learning

The objective of the project[52] is to analyse the institutional dimension of teaching, i.e. to identify different manners of teaching dealing with controversial sustainability issues as well as to analyse what kind of learning the identified manners of teaching foster. The project has been designed as to a) identify general teaching traditions – manners of teaching regarding controversial sustainability issues that many teachers use –within subjects and to analyse b) the pros and cons of each of the traditions regarding learning. It incorporates a national survey in order to identify manners of teaching of controversial sustainable issues in the subjects of Biology, Geography, Civic Education, and Religion in lower secondary education as well as a study based on interviews with teachers.

Transactional investigations of learning in view of sustainability transitions – LESTRA

This project's key question is how learning can fruitfully contribute to Sustainability Transitions (ST). Its objectives are 1) to develop a new analytical and conceptual framework for investigating the connections between learning processes, the transformation of habits and customs, and (potential) STs; 2) to identify the key conditions for learning to contribute to STs; and 3) to develop a roadmap for future research in diverse settings and contexts. LESTRA aims to connect the process and outcomes of micro learning processes to the emergence of macro societal transitions. Transactional pragmatism will be used to develop a novel analytical and conceptual framework by building on earlier work in environmental and sustainability education research, didactics and sustainability transition studies.

Open schooling for sustainable cities and communities

This project investigates how teaching and learning in practices of 'open schooling' can contribute to creating more sustainable cities and communities. This project addresses the research gap of often poorly conceptualised and missing empirical research by studying teaching and learning practices that address sustainability problems in local communities. We investigate well-selected cases of 'open schooling', i.e. education practices in schools and universities that have the explicit ambition to fruitfully connect teaching and learning to identifying, exploring and tackling key sustainability problems in urban and rural communities in collaboration with local stakeholders. The created knowledge is translated into didactic models and guidelines for curriculum development and course didactics as well as scripts for in-service and pre-service training of practitioners.[53]

University of Cologne

Since 2022, sustainability competencies are, among others, a guiding principle in academic studies at the University of Cologne. Although ESD has not yet been systematically anchored in teacher education, there is a certain tradition of environmental education and ESD in social and natural science subjects. For example, science workshops for school classes and the university school garden are established didactical places for internships and used for final theses of student teachers. A unique location is the Ecological Rhine Station, a former Rhine ship

[52] https://www.edu.uu.se/research/curriculumstudies/teplab/research-projects/.
[53] More information about these and other ESD oriented research projects at our department can be found at the following website (https://www.edu.uu.se/research/curriculumstudies/teplab/Projects/).

converted to a lab for studies and experiments. As of late, foreign language didactics put a focus upon “global learning” incorporating ESD. However, due to the number of students in teacher education in Cologne (almost 13 000), these offers are niches for individual specialization.
A multidimensional and transdisciplinary offer has not yet been implemented. In response to this desideratum, the research project "ESD as a cross-cutting topic in teacher training" serves as a survey of student teachers. In the winter semester of 2022/23, students of all teaching professions were asked about their knowledge, ideas and the significance of ESD for their studies as well as for their later everyday school life/their teaching. The analyses provide information on a) which concepts and dimensions of ESD are widespread among students from different disciplines and teaching posts, and b) what status ESD has in the respective groups. Initial results confirm the lack of purposeful and widespread ESD mentioned above. Nearly one third of the respondents at a master’s degree level said they had no preparation in ESD, whereas 17% felt themselves ‘good’ or ‘very good’ in being trained in ESD competencies. In contrast, three-fourth of the participants regard ESD as ‘relevant’ or ‘very relevant’ for their own teaching subjects and future profession.
The results of the study form a starting point for the further implementation of future-oriented ESD in the training of future teachers at the University of Cologne and elsewhere. As a next step, representatives of different teaching disciplines will be invited to establish a forum for linking-up existing ESD-projects and further developing of curricula and content of teaching.[54]

Final thoughts: What do we take with us? What does this mean for the future?

Sustainability is already – somewhat – implemented in teacher education in different countries. And yet, in all presented countries, there is a lack of compulsory training and implementation in the entire range of subjects and school types. As a result, probably only a few teachers feel responsible and competent to promote ESD. In teacher education, still, mainly Biology, Environmental Studies, Geography and Economics courses address ESD. For new curricula, a stronger anchoring in the individual subjects is required and ESD should become a fixed-part of in-service training. A way forward could be to initiate more mandatory programs and training opportunities and to offer extra-occupational courses, which, in addition to imparting knowledge (e.g., climate data), also can convey values and attitudes. System competences should be included and the development of design competence (e.g., through project-oriented methods) should be promoted. Furthermore, affective and emotional aspects, as well as values and attitudes, are to be taken into account. An open question under discussion is whether separate subjects might be considered (e.g., political education and education for sustainable development).
Sustainability in education is usually connected to the environment in order to support behaviour that reduces waste and overconsumption. However, it is also crucial to teach students to understand how cultures shape our identities and our attitudes towards nature, as well as to give students opportunities to interact with learners from other countries to discuss these topics. Instead of only learning and understanding meanings of words in another language, transcultural

[54] More information about ESD courses and curriculum developing can be found at the website of the Center for Teacher Education: https://zfl.uni-koeln.de/schulnetzwerk/veranstaltungen/fokus-bne.

learners today need to be able to understand the practices of making meaning and find out where and how they are able to contribute. Intercultural competences are a prerequisite for overcoming barriers between the global North and South, which are not only linguistic but also touch on economic, social and cultural issues. For the preservation of a liveable planet Earth, it is a question of who can take responsibility and in what way. The need for dealing with linguistic and cultural ambiguity in intercultural encounters is recognized by the recent Companion volume of the Common European Framework of Reference for Languages (2018) where 'mediation' is added to the previously listed skills of reading, listening, writing and speaking.[55]

The pursuit of sustainable development is the subject of growing global attention. To realise this, a lot of hopes are pinned on teaching and learning. Yet, despite omnipresent references to the importance of it, the notion of learning, teacher education and its role in relation to sustainability transitions are poorly conceptualised and empirical research is further needed.

[55] https://rm.coe.int/common-european-framework-of-reference-for-languages-learning-teaching/16809ea0d4.

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