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(Re-)Imagining Teacher Education for a Future in Flux
Perspectives from the Erasmus+ Teacher Academy *teff*

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Digital Learning Modules for Sustainability Education

Abstract
To support teachers in addressing the contemporary challenges of education, one of the key objectives of the Erasmus+ Teacher Academy *"Teacher Education for a Future in Flux"* (*teff*) is to enhance European student teachers' and in-service teachers' sustainability competencies. To achieve this goal, the online course on Sustainability Education was designed in cooperation with the *teff* project partners. The course consists of three digital learning modules: the first module focuses on supporting learners' understanding of sustainability as a complex and multifaceted concept, the second module aims to familiarize the student with the various frameworks and approaches for sustainability education, and the third module supports teacher students in embedding sustainability in their own teaching. In addition to the self-studied learning materials, the course includes various interactive activities and self-assessment tasks that encourage students to evaluate their own learning progress. While the course design enables independent self-pacing, it also includes assignments that encourage learners to share ideas and discuss the topics with others, as well as collects learners' feedback to guide future online course design. All course materials and assignments are openly available and accessible for all student teachers, teachers and teacher educators across Europe.

Keywords: Sustainability, Sustainability Education, Digital Learning Module, Online Course

1. Introduction

Education plays a key role in worldwide efforts to address the global sustainability crises. In European teacher education, there is a burning need for pedagogical frameworks and competencies in sustainability and sustainability education. In the Erasmus+ Teacher Academy "Teacher Education for a Future in Flux" (*teff*) project, sustainability was recognized as one of the four skill areas of transversal futures literacy. Recognizing the pronounced need for further development of sustainability and sustainability education competencies in teacher education, *teff* planned and developed Digital Learning Modules (DLM) for Sustainability Education. Teacher educators can incorporate the digital learning materials into their broader teaching concept allowing

the competencies to be further strengthened in practice. The course is available for everyone online: https://zfl-lernen.de/online-kurs/teff_sustainability-education/

2. Overview of the Online Course on Sustainability Education

This online course is structured around three interconnected topics that form the learning modules. These modules guide learners from foundational theories through a deeper exploration of educational frameworks and, ultimately, to the application in practice. The online course focuses on the theme of sustainability education, with a simple and user-friendly design, allowing easy access to all learning materials with a single click. The landing page offers a clear overview, presenting the key topics of sustainability education in a progressive manner: (1) Sustainability as a Concept, (2) Sustainability Education Approaches, and (3) Sustainability Education Planning. The intended learning outcomes, core contents, and the assessment methods of each of the three modules are presented in Table 1.

Table 1: Sustainability education digital learning modules

Intended Learning Outcomes	Core Contents	Assessments
Module 1. The student is able to recognize sustainability as a complex and multifaceted concept	• Strong & Weak sustainability • Planetary boundaries • Doughnut Economics • Entry points for Sustainability • Transformations • Eco-social Bildung	• Pre-post mind map • Multiple-choice questionnaire • Self-evaluation questionnaire
Module 2. The student is able to identify different frameworks and approaches for sustainability education	• Transformations in sustainability education • Pedagogical approaches • Implementation of Sustainability Education	• Comparative reflection tasks • Multiple choice questionnaire • Self-evaluation questionnaire
Module 3. The student is able to plan a constructively aligned learning activity to address sustainability education	• Planning Learning Outcomes, Objectives, Activities & Assessments • Operationalisation of Sustainability Skills	• Learning activity planning • Self-evaluation questionnaire

2.1 Module 1: Sustainability as a Concept

Module 1 introduces a framework of sustainability theories. Students will be able to recognize sustainability as a complex and multifaceted concept. Through exploring key ideas such as *weak* and *strong* sustainability (Giddings et al., 2002), planetary boundaries (Rockström et al., 2009), doughnut economics (Raworth, 2017), and eco-social Bildung (Kothari et al., 2019), students develop an understanding of sustainability transformations and their multiple entry points (United Nations, 2019).

Learning is supported by reflective tools including pre–post mind maps, multiple-choice questionnaires, and self-evaluation questionnaires.

By introducing a range of conceptual frameworks, this module helps learners develop a foundational understanding of sustainability as a multifaceted construct. Building on this conceptual grounding, the module gradually guides learners towards a synthesis, encouraging them to build an integrated understanding rather than treating the concepts in isolation. It further guides the learners to think about how these theoretical perspectives can inform transformative actions in education and society. During the module, learners test their knowledge by answering quiz questions. If they answer incorrectly, they can click to view the solution alongside an explanation and retry.

Creating and developing mind maps both before and after learning helps learners organize their thoughts throughout the learning process. They are encouraged to upload their mind maps to the collaborative EduMaps space, where they can share their work, view the work of other learners, and give comments and feedback (see Figure 2).

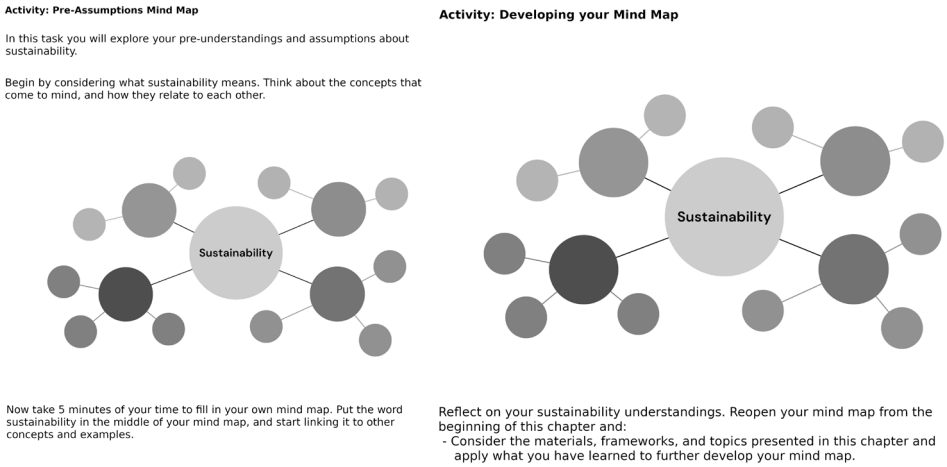

Figure 2: Mind maps before and after learning – Module 1

At the end of the learning module, there is a personal self-evaluation matrix available for learners to reflect on their learning.

This module was developed based on University of Helsinki's online courses: "*Sustainability starts with us*" for staff (the Centre for University Teaching and Learning (HYPE)); and the "*Sustainability course*" (SUST-001) for students (University of Helsinki).

2.2 Module 2: Sustainability Education Approaches

Module 2 introduces various frameworks for sustainability education. This module examines key transformations in sustainability education (Mochizuki, 2016) and introduces diverse pedagogical approaches (Papenfuss et al., 2019). Finally, the module explores sustainability implementation (Wals et al., 2024) that promotes sustainability-oriented teaching and learning.

Using a visualization, the module provides information about the prominent publications (e.g., *The limits of growth* by the Club of Rome), conferences, and educational concepts (e.g., 'Environmental Education' and 'Education for Sustainable Development') regarding sustainability education. Furthermore, the various features that characterize approaches to sustainability education are also introduced through a visualization (see Figure 3), highlighting both the prescriptive and open-ended features of sustainability education and the role of knowledge and action of various approaches.

Learners can check their understanding of the different approaches through three multiple choice questions. These questions invite learners to think about which approach fits best with a given description from frameworks and official documents on sustainability education. Moreover, using open questions and answer suggestions for inspiration, learners are stimulated to reflect on the consequences of the multitude of approaches to sustainability education.

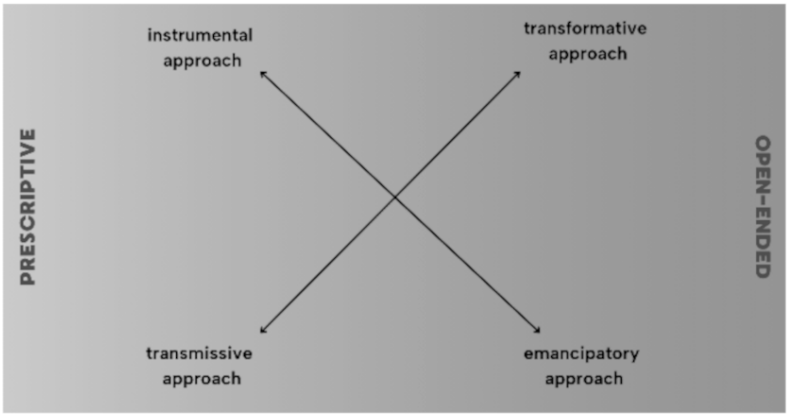

Figure 3: Pedagogical approaches – Module 2

Moreover, the module explains what it means to implement the *whole school approach*: a systemic redesign of the whole school to integrate sustainability and sustainability education into every aspect of school life (European Commission, 2023; Zachariou et al., 2024). Both the voices of students and creating opportunities for student engagement are described as key factors of the whole school approach to sustainabil-

ity (Bjønness et al., 2024). Seven open questions (e.g., about the professional development of staff) encourage learners to reflect on their specific context and the possibilities and challenges for implementing a whole school approach to sustainability.

2.3 Module 3: Sustainability Education Planning

Module 3 guides learners in applying the knowledge from modules 1 and 2 to their specific teaching context, with their own students. By guiding learners step-by-step, the module aims for students to plan effective and constructively aligned learning activities (Biggs & Tang, 2007).

The module starts with a self-evaluation in which learners are asked to rate their level of confidence in carrying out tasks related to planning a sustainability education learning activity (e.g., identifying local opportunities and challenges). What follows is an explanation of how to plan for sustainability education (see Figure 4). Concrete examples and aids for the formulation of and decision-making on (intended) learning outcomes, teaching and learning activities, and assessment are given. The examples are based on the work by the Centre for University Teaching and Learning, University of Helsinki (n.d.), and cover systemic thinking, futures thinking, consideration of values and ethics, interaction and cooperation skills, and strategic thinking and action.

ILO3 design redrawn by Robin Schaeverbeke (Faculty of Architecture KULeuven) from Biggs & Tang, 1999.

Figure 4: Key aspects for planning sustainability education – Module 3

To make this even more concrete, the four steps – (I) identifying local opportunities and challenges related to sustainability in the educational context, (II) setting learning outcomes, (III) defining learning method(s) to achieve the set objectives, and (IV) establishing strategies for the assessment – are all worked out for the example of waste management and recycling practices in a community or campus setting.

In addition to the multiple-choice questions at the end of the module, the learners are invited to evaluate their learning more qualitatively. They are invited to elaborate

upon a template presentation to work out a sustainability education activity, following the four steps that were previously explained. Using seven criteria (e.g., does the activity establish learning outcomes in three domains: cognitive, socio-emotional and behavioural), the learners can evaluate their own learning progress.

After completing all the three modules, learners are directed to a feedback page where they can share their reflections on the online course. Upon submitting their feedback, they can download a certificate of completion, which includes both confirmation of participation of the DLM and an overview of the key contents of all three modules.

4. Outlook

This course with three digital learning modules provides an open educational resource for institutions and associations in the educational sector, as well as for individual teachers, teacher students and teacher educators. Looking ahead, we expect the course "Sustainability Education" to contribute to developing educators' sustainability competencies, fostering future-oriented thinking, and strengthening their capacity to address the complexities and uncertainties related to teaching about the global sustainability crisis.

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