



Advancing Sustainability Competences in Teacher Education Through Reflective Practices: Introducing a Concept

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Abstract. This paper introduces research focused on advancing Sustainable Development Goal 4 (SDG4) (UN, 2015) within teacher education, which investigates how reflective practices, supported by vignettes (Agostini et al., 2024) and the Socratic method (Delić & Bećirović, 2016; Schiller, 2008), can foster sustainability competences grounded in SDG4 principles among pre-service teachers. The planned research is based on a participatory, qualitative design and is applied in a Bachelor's-level teacher education course in Austria, where about 15 students participate. The research is structured in four phases: (1) an introductory lecture, (2) vignette writing and analysis with support of the Socratic method, (3) qualitative, semi-structured individual interviews, and (4) cross-analysis of the vignettes, interviews and a reflection tool. The approach aligns with the four key areas of competence development identified by GreenComp (Bianchi et al., 2022) and provides a transferable model for integrating GreenComp into teacher education, supported by vignettes and the Socratic method.

Keywords: Reflective practice, Socratic method, Sustainable Development Goal 4 (SDG4), sustainability competence, teacher education, vignettes.

1 Introduction

Preparing teachers to play a role in society's development is crucial. Kraler and Worek (2022) acknowledge that teachers are responsible for imparting knowledge, values, and norms to future generations. Teachers can influence a student's long-term well-being, academic progress, and later contributions to society (Education Commission [EC], 2019; International Commission on the Futures of Education [ICFE], 2021). In addition, Dhaka (2024) states that teachers (and higher education) play fundamental roles in achieving the Sustainable Development Goals (SDGs) introduced in Agenda2030 (United Nations [UN], 2015). Since teachers are important for Agenda2030, the research aims to investigate and advance reflective practice theories regarding Sustainable Development Goal 4 (SDG4) principles during teacher education by applying vignettes and the Socratic method (Delić & Bećirović, 2016; Schiller, 2008). The Socratic method originated around 470 B.C. with the Athenian philosopher Socrates (Delić & Bećirović, 2016). It enhances dialogue by encouraging critical thinking and reflection

through carefully crafted, open-ended questions in which the facilitator speaks minimally, primarily to guide the discussion, thereby prompting participants to examine their assumptions, explore alternative perspectives, and deepen their understanding (Delić & Bećirović, 2016; Schiller, 2008). The Socratic questioning method will be integrated by using its principles of questioning and dialogue to deepen participants' engagement with the reflective process, particularly regarding SDG4 principles. These principles include quality, inclusivity and equity, and lifelong learning while supporting sustainability, in the way Grobler (2022) interpreted the concept of quality education in the SDG context. Therefore, it is important to investigate teachers' reflective practices by focusing on SDG4 principles to support the progress of the SDGs.

Sustainability is considered a societal objective that involves the environmental, economic, and social aspects that support people, prosperity, peace and partnership in sustainable growth, while preserving the planet. For the purpose of this study, sustainability means "prioritising the needs of all life forms and of the planet by ensuring that human activity does not exceed planetary boundaries" (Bianchi et al., 2022, p. 12) with a specific focus on SDG4 principles. Therefore, in this context, it is essential to cultivate a sense of sustainability in future teachers during teacher education. SDG4 is labelled as quality education, which is multifaceted and varies according to context and perspective (Grobler, 2024; Unterhalter, 2019). It can be connected to the quality concept, which encompasses adherence to standards and expectations, the delivery of excellence, and alignment with stakeholder needs (Crosby, 1979; Harvey & Green, 1993). Quality education is pivotal to achieving sustainability by equipping individuals with the necessary skills and awareness to drive societal progress.

Furthermore, the SDG4 principles (Grobler, 2022; 2024; in press) of equity and inclusivity emphasize the importance of accessible education for all, regardless of age, gender, socioeconomic status, ethnicity or ability. These principles align with the vision of SDG4, which is to eliminate barriers and promote inclusive learning environments (UN, 2015). Lifelong learning extends education beyond formal settings, incorporating literacy, numeracy, and skill development throughout an individual's life. It supports adaptability to new knowledge and changing societal demands (Priyadarshini, 2020) and equips individuals to apply knowledge in various personal, social, and professional contexts, contributing to sustainable development and personal empowerment (Beeharry, 2021).

Vignettes can be described as descriptions simulating actual events (Skilling & Stylianides, 2020). Since vignettes support reflective practices, they will be used to investigate and advance theories of reflective practice and teacher professionalization based on SDG4 principles. They are also viewed as powerful tools in qualitative research, since they illustrate and investigate shared human experiences and interactions (Agostini et al., 2024). Vignettes can also support the professionalization of teachers (Agostini et al., 2023). They evoke imagination, critical thinking, and emotional responses, helping participants engage deeply with complex issues (Angelides et al., 2004; Jeffries & Maeder, 2005). Through this, vignettes can stimulate reflective practices. Reflection, in the context of teacher professionalization, involves a continuous process of self-assessment where teachers critically examine their practices, beliefs, and their effects on student learning (Larriee, 2008) and society.

Based on these concepts, the paper aims to introduce a theoretical foundation focused on advancing SDG4 (UN, 2015) within teacher education. It investigates how reflective practices, supported by vignettes (Agostini et al., 2024) and the Socratic method (Delić & Bećirović, 2016; Schiller, 2008) can foster sustainability competences grounded in SDG4 principles among pre-service teachers.

2 Research Description

The research is motivated by the global vision presented in Agenda2030 (consisting of 17 SDGs). The 17 SDGs also aim to improve life quality by focusing on people's well-being, the planet, prosperity without destruction, peace and partnership (Nikolova, 2019). The research aims to investigate and advance reflective practice theories regarding SDG4 principles during teacher education by applying vignettes and the Socratic method. Consistent with this aim, the study will use an empirical qualitative approach to answer the following research question: How does reflective practice regarding SDG4 principles influence teacher professionalization when applying vignettes and the Socratic methodology during teacher education?

The research will use convenience sampling by selecting students from a second-year Bachelor's course on learning and teaching within an inclusive educational framework. First, vignettes, the process of vignette writing and analysis, the SDG4 principles will be introduced during the first session of the course. The SDG4 principles on which education should be based (UN, 2015) will also be discussed. The teacher educator will then provide written vignettes reflecting the SDG4 principles during teaching/learning. This will be followed by pre-service teachers writing and analyzing vignettes on teaching, with guidance from the teacher educator. After that, vignettes will be written based on observations during the pre-service teachers' practical. The Socratic methodology of questioning will guide the vignette writing and analysis by structuring reflective prompts and group discussions to encourage participants to critically examine their observations, assumptions and decisions.

The research will employ a qualitative design within a participatory research approach where vignette research, reflection and semi-structured individual interviews will be conducted. Different reflection-level (e.g., descriptive, analytical, critical and meta-reflection) questions will guide these three data collection methods (based on e.g., Hatton & Smith, 1995; Brookfield, 1995; Moon, 1999/2004). For instance, meta-reflective responses question and critically analyze their reflective experiences and how they can advance their teaching and SDG4 through improved reflective practices. The responses from interviews, vignette activities and the reflection (based on Larrivee's (2008) reflective practice tool) will be thematically analyzed (Braun & Clarke, 2022) to gain additional insights. The study will not only examine reflective practice theories in relation to the principles of SDG 4 in the context of teacher education, but will also contribute to advancing these theories, thereby enhancing the significance of the research.

The researcher received departmental approval to conduct this research in the course at the university. The participants will obtain informed consent to sign, which will provide essential information about data protection and the use of research data. Participation in the study is entirely voluntary, and no harm will be caused to participants. The collected data is stored, transcribed, and analyzed anonymously, and the participants have the right to withdraw from the study at any time.

3 The Four Key Areas of Competence Development from *GreenComp*

GreenComp is an abbreviation for the European Sustainability Competence Framework. The term is a blended construct: The term ‘green’ refers to sustainability and environmental responsibility, while ‘comp’ is short for competences. Together, the name highlights the framework’s central aim of fostering sustainability competences that enable students of all ages to engage responsibly and effectively in the transition toward more sustainable societies (Bianchi et al., 2022; European Commission, 2022).

The research will focus on investigating and advancing reflective practice theories related to SDG4 principles during teacher education, developing the necessary competences for sustainability, hence this integration. Bianchi et al. (2022) discuss four key areas of competence development essential for sustainability: “Embodying sustainability values” (p. 17), “embracing complexity in sustainability” (p. 19), “envisioning sustainable futures” (p. 23) and “acting for sustainability” (p. 25). The first area of competence development encourages one to reflect on and challenge one’s own personal values to support equity and justice in society. These personal values can be challenged and transformed by reflecting and questioning knowledge acquisition, which should be assimilated and put into action. Bianchi et al. (2022, pp. 17–19) present practical examples, focusing on the domains of knowledge, skills and attitudes, on how this key area could be supported, namely by valuing sustainability, supporting fairness and promoting nature.

The second key area emphasizes the importance of equipping students with systemic and critical thinking skills. It encourages them to analyze how to improve information assessment and to question unsustainable practices. Additionally, it involves examining systems by recognizing interconnected elements and feedback loops between the environment, society and economy. Finally, it suggests framing challenges as sustainability issues, which aids in understanding the scope of various situations. It approaches competence development through systems thinking, critical thinking and problem framing with practical examples, with a focus on the domains of knowledge, skills and attitudes (Bianchi et al., 2022, pp. 19–22).

The third key area uses creative and cross-disciplinary methods to promote a mindset that supports a circular society and encourages students to imagine the future. By thinking practically and innovatively about the future, this key area focuses on futures literacy, adaptability and exploratory thinking with practical examples, with a focus on the domains of knowledge, skills and attitudes (Bianchi et al., 2022, pp. 23–25).

In the fourth key area students are encouraged to act on sustainability aspects by identifying and understanding political agency (the ability to shape a better collective future by encouraging political leaders to implement meaningful actions), collective action and individual initiative. Practical examples with a focus on the domains of knowledge, skills and attitudes are also listed (Bianchi et al., 2022, pp. 25–27).

4 Transferable Model for GreenComp Competence Integration in Teacher Education Using Vignettes and Socratic Method

The four key areas of competence development from GreenComp (Bianchi et al., 2022), could be integrated in teacher education supported by vignettes and the Socratic method during the pre-service teachers’ practical. The reflective practice cycle could include: (1) introductory lecture where each GreenComp areas and approaches to the integration are presented, (2) vignette writing and analysis (Agostini et al., 2023, 2024), (3) structured reflection encouraged by Socratic questioning (Delić & Bećirović, 2016; Schiller, 2008), (4) action planning where pre-service teachers commit to concrete sustainability actions tied to their reflections (Bianchi et al., 2022), and (5) replication and adaptation, where teacher educators adopt, tweak and embed these steps in their own contexts. These aspects all play a crucial role in the reflective practice cycle and could support the competence development of GreenComp in the teacher education context. The framework, along with examples, is provided in Figure 1.

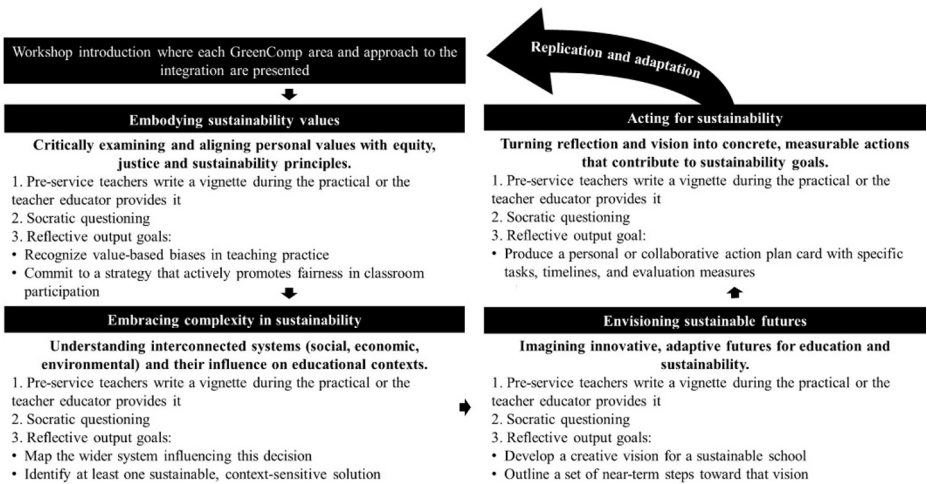


Fig. 1. Transferable Model for GreenComp (Bianchi et al., 2022) Competence Integration in Teacher Education Using Vignettes and the Socratic Method.

Following the introductory lecture, the first focus will be on critically examining personal values and aligning them with principles of equity, justice and sustainability. This includes recognizing biases that influence teaching as well as committing to fairness.

For example, a vignette from pre-service teachers' observations might show that boys are more often guided towards science, while girls get more encouragement in language-related subjects. By asking, "What implicit assumptions about gender and ability influence these choices?", pre-service teachers can identify biases rooted in values. The aim is to develop strategies to promote fairness and ensure all students are equally engaged and supported.

The second key area, which is embracing complexity in sustainability, helps to understand and manage interconnected social, economic and environmental systems—and how they affect educational settings. Sustainability in education is never isolated; it exists within broader systems that must be considered when making decisions. For example, a vignette might include a school's plan to introduce digital tablets for all students, a well-meaning initiative that still raises concerns about e-waste and affordability in the community. In this case, the key question is: "What factors beyond classroom learning should be considered before implementing this change?" The goal is to map the larger system affecting the decision and to identify at least one sustainable, contextually appropriate solution, ensuring educational innovation does not compromise long-term sustainability.

The third key area concerns envisioning sustainable futures by imagining innovative, adaptable scenarios for education and sustainability. This will foster creativity along with practical foresight. An example could be a rural school imagining what classrooms might look like in 2040 under a fully renewable energy grid. The key question—"What would teaching and learning look like in this future and what steps can we take now to get there?"—encourages both visionary thinking and practical planning. This process includes a creative vision for a sustainable school and identifying immediate steps to reach that vision and bridge the gap between aspiration and action.

The fourth key area, which is coined 'acting for sustainability' involves turning reflection and vision into concrete, measurable actions that support sustainability goals. Action is where intention translates into measurable change. For example, a teacher might consider starting a community garden project to teach about ecosystems and food security. By asking, "What resources, allies, and actions will make this idea happen?", pre-service teachers can develop actionable plans. The framework focuses on creating a personal or collaborative plan with specific tasks, timelines, and evaluation measures to ensure that sustainability goals are both ambitious and achievable.

5 Expected impact

There is a recognized necessity for the development of competences related to sustainability within higher education, with particular emphasis on teacher education. This research initiative aims to contribute to the principles of SDG4 (UN, 2015) by focusing on enhancing sustainability competences among preservice teachers through reflective practices, using vignettes (Agostini et al., 2024) and the Socratic method (Delić & Bećirović, 2016; Schiller, 2008). Additionally, the study seeks to examine and advance reflective practice theories related to SDG4 within teacher education. This represents a

foundational step toward future research and strategic implementation in teacher education settings, ultimately equipping preservice teachers to further develop these competences and advance goals aligned with SDG4 beyond 2030.

6 Conclusion

This paper introduces research aimed at advancing SDG4 (UN, 2015) within teacher education. It will explore how reflective practices, supported by vignettes (Agostini et al., 2024) and the Socratic method (Delić & Bećirović, 2016; Schiller, 2008), can promote sustainability competences based on SDG4 principles among pre-service teachers. The research is designed as a participatory, qualitative study conducted in a Bachelor's-level teacher education course. The approach aligns with the four key areas of competence development outlined in GreenComp (Bianchi et al., 2022), offering a transferable model for integrating GreenComp into teacher training, supported by vignettes and the Socratic method. This model could be implemented in practical subjects at teacher education institutions to help pre-service teachers develop awareness and understanding that, as future educators, they should prioritize sustainability in terms of people, prosperity, peace and partnership for sustainable growth, while protecting the planet. The next step involves implementing and refining this model for greater effectiveness.

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