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Advancing Sustainability through Teacher Educators

Abstract

Education for Sustainable Development (ESD) plays a vital role in addressing global challenges. This paper adapts Vukelić's Teacher Action Competence in ESD model to teacher educators, focusing on key dimensions: content and pedagogical content knowledge, value ESD, ascription of responsibility, self-efficacy, and intention to implement ESD. It emphasizes self-efficacy as a key factor in translating sustainability knowledge into instructional practice. By modelling action competence, teacher educators influence teachers' engagement with sustainability and instructional practice. Implications for higher education institutions and theory are discussed.

Keywords

Teacher education, sustainability, action competence

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Nachhaltigkeit durch Lehrkräftebildung vorantreiben

Zusammenfassung

Bildung für nachhaltige Entwicklung (BNE) spielt eine zentrale Rolle bei der Bewältigung globaler Herausforderungen. Dieser Beitrag adaptiert ein Modell der Handlungskompetenz von Lehrkräften für Lehrende in der Lehrkräftebildung mit dem Fokus auf vier Dimensionen: fachliches und fachdidaktisches Wissen, Wertschätzung von BNE, Zuschreibung von Verantwortung, Selbstwirksamkeit und Umsetzungsabsicht von BNE. Besonderes Augenmerk liegt auf der Selbstwirksamkeit als Schlüsselfaktor dafür, dass Nachhaltigkeitskompetenzen in der Unterrichtspraxis wirksam werden. Durch das Modellieren von Handlungskompetenz beeinflussen Lehrende in der Lehrkräftebildung das Engagement von Lehrkräften für Nachhaltigkeit sowie deren pädagogisches Handeln. Die Implikationen für Hochschulen und theoretische Weiterentwicklungen werden diskutiert.

Schlüsselwörter

Lehrkräftebildung, Nachhaltigkeit, Handlungskompetenz

1 Introduction

Over the past century, human activities have contributed to global challenges, including health crises and environmental degradation, that pose serious threats to human well-being and global sustainability (UNESCO, 2024). In response, sustainable development has emerged as a guiding framework for transformative action. It calls for significant shifts in thinking, behavior, and societal structures, and requires the cultivation of values, competences, and attitudes that support long-term sustainability. In this regard, education plays a pivotal role in enabling these shifts by fostering critical reflection and empowering individuals to contribute to sustainable futures. As Vare and Scott (2007) argue, embedding sustainable development into education is essential for driving meaningful transformation. This is further reflected in the increasing efforts of higher education institutions to integrate sustainability across their operations, highlighting the sector's role in advancing sustainable development.

Within this context, *Education for Sustainable Development* (ESD; Hobusch and Froehlich, 2021) positions educators, and particularly *teacher educators* (TEs), as key agents in promoting sustainability within the educational ecosystem (Raberger et al., 2024). While substantial research has explored the role of teachers in ESD, little attention has been paid to exploring the competences of TEs in leading sustainability actions (Dittrich et al., 2024). Existing research highlights the complexity of developing ESD competences as well as limitation of current approaches. For instance, the project, *A Rounder Sense of Purpose*, emphasizes that university teachers would need interconnected competences in ESD that require continuous critical reflection and could not be developed by short-term staff training (Scherak & Rieckmann, 2020). This gap is particularly significant given the multiplier effect TEs have through their influence on future generations of teachers. Altogether, it reinforces the need for a better understanding of TE's competences toward ESD. Hence, this paper aims to adapt an existing Action Competence Model for ESD in the context of TEs and propose a research agenda that strengthens the sustainability impact of higher education institutions.

2 The Role of TEs in ESD

TEs play a critical role in advancing the global sustainability agenda. By shaping future teachers' understanding of sustainability and influencing their pedagogical practices, TEs equip teachers with the skills and knowledge to foster transformative change through their classrooms (Anderson, 2017). While the importance of TEs has been increasingly recognized in educational research and policy, their role is still often overlooked (Koster et al., 2005).

In the context of ESD, it is essential to strengthen TEs' competences and refine their instructional practices. TEs' perceptions of ESD are crucial for its successful integration. Research shows that while TEs generally recognize the relevance of ESD (Liston & Devitt, 2020), there are varying levels of understanding and urgency regarding its implementation. For instance, Goller and Rieckmann (2022) found that TEs often hold divergent interpretations of ESD, with some viewing it through an environmental lens, while others focus more on the social dimensions of sustainability. This fragmented understanding can lead to inconsistent instructional practices and hinder the effective integration of sustainability into teacher education programs. Moreover, TEs act as multipliers. Their subjective theories, such as personal worldviews and teaching beliefs on sustainability, strongly influence how ESD competences are developed (Groeben & Scheele, 2000). Hence, the beliefs and approaches of TEs remain important but largely underexplored.

Ultimately, TEs are crucial in ensuring that students are exposed to and engage with the transformation processes necessary to achieve the *Sustainable Development Goals* (SDG; UNESCO, 2017). By equipping teachers with the required competences, knowledge, and values, TEs contribute to the systemic change in education, ensuring sustainability becomes a central aspect of education systems worldwide.

3 Teacher Action Competence in ESD

Over the past decades, several models of ESD action competence for teachers have been developed (Lohmann et al., 2021; Vare et al., 2019). For the purpose of this paper, the focus is on one of these models, *Teacher Action Competence in ESD*, and adapt it to the context of TEs (Vukelić, 2022).

Action competence is central to education, defined as the ability to act in complex situations in a reflective, goal-oriented, and responsible manner (Jensen & Schnack, 1997). It combines knowledge, skills, motivation, and values. In ESD, action competence is essential for driving transformative change and is understood as both an individual competency and a pedagogical principle. A model proposed by Vukelić (2022) called the Teacher Action Competence in ESD incorporates holistic competences required for successful implementation of ESD. The model explores the psychological foundations of teacher action competence in ESD, inspired by the framework of the *Norm Activation Model* (NAM; Schwartz, 1977), *Expectancy-Value Theory* (EVT; Eccles, 2005) and the *Theory of Planned Behavior* (TPB; Ajzen, 1991). TPB posits that an individual's behavior is determined by their intention to perform that behavior, which is then shaped by their attitudes toward the behavior and behavioral control (the belief of how successful one can perform a specific behavior). Perceived behavioral control is conceptualized as self-efficacy in educational contexts (Tschannen-Moran & Woolfolk Hoy, 2001). The model is illustrated below (see Fig. 1).

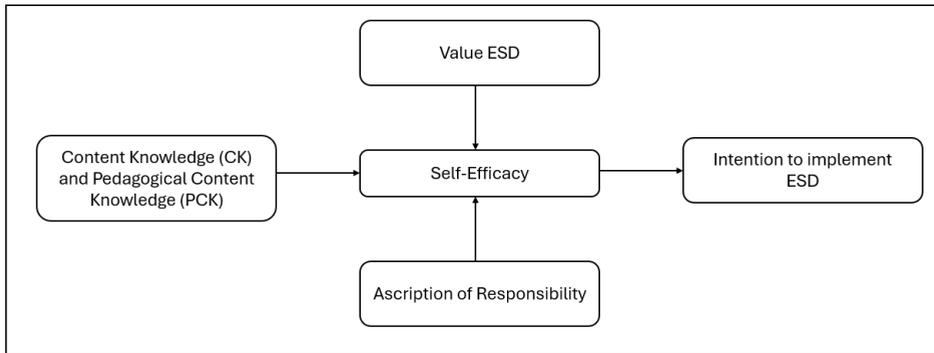


Fig. 1: Vukelić's Model of Teacher Action Competence in ESD (Vukelić, 2022, p. 189)

To effectively teach sustainability, teachers must have both *Content Knowledge* (CK) and *Pedagogical Content Knowledge* (PCK) to understand and convey the complex, interconnected nature of ecological, social, and environmental systems. However, research suggests that simply possessing knowledge about sustainable development does not necessarily lead to the implementation of ESD in practice (Kennelly et al., 2008; Liddy, 2012). Moreover, teachers' beliefs and attitudes toward ESD are crucial in shaping their engagement with the topic. When teachers recognize the value of ESD (*Value ESD*) and perceive sustainability as an essential aspect of their professional identity (*Ascription of Responsibility*), they are more likely to take ownership of the subject and integrate it into their teaching. For instance, studies conducted by Guangbao and Timothy (2021) and Thommen (2022) indicate that teachers' perceived value of ESD influences both their self-efficacy and intention to implement ESD in the classroom. Those who highly value ESD are more likely to feel capable of teaching it and to take responsibility for integrating them into their instructional practice. Constructivist teacher beliefs also further support this ascrip-

tion of responsibility, as teachers who see themselves as facilitators of learning, nurture student agency and critical thinking, both of which are strongly linked to ESD (UNESCO, 2017).

Central to this process is *Self-Efficacy*, which refers to teachers' belief in their ability to effectively teach sustainability content and use appropriate pedagogical approaches. Research shows that teachers who recognize the value of ESD and feel a sense of responsibility for addressing sustainability issues tend to report higher levels of self-efficacy (Vukelić & Rončević, 2019). This suggests that a mediating factor, such as self-efficacy, may play a key role in translating sustainability knowledge into instructional practices (Vukelić, 2022). Empirical studies corroborate this, showing that teachers who rate their sustainability knowledge highly also exhibit greater self-efficacy for teaching ESD (Malandrakis, 2018). Therefore, self-efficacy seems to mediate the connection between sustainability knowledge and its actual implementation in the classroom. This aligns with broader research in the field that identifies teacher confidence as a significant barrier to effective ESD implementation (Evans et al., 2013). In general, self-efficacy emerges as a critical construct in educational research, acting both as a predictor of teachers' intentions to engage with ESD and as a mediator.

The *Intention to Implement ESD*, which reflects a teacher's preparedness to take tangible steps towards ESD, is directly influenced by self-efficacy and indirectly by factors such as knowledge, pedagogical skills, the perceived value of ESD, and ascription of responsibility. These interconnected elements highlight the importance of a comprehensive approach to teacher training in ESD that addresses not only the knowledge teachers acquire but also their beliefs and sense of capability in implementing sustainability in their instructional practices.

Crucially, while this model has provided valuable insights into the action competence of teachers, it has not yet been extended to or systematically applied in the context of TEs. Given that TEs play a key role in shaping the beliefs, knowledge, and practices of future teachers, the absence of research on their own action competence in ESD represents a significant gap in the literature. Understanding how the

dimensions of the model manifest in TEs is essential for ensuring that ESD is meaningfully integrated into teacher education programs. While a broader gap exists regarding TE's action competence in ESD, this paper focuses on the foundational step to develop a model specifically for TEs. This lays the groundwork for future studies to investigate the practical implications of TE's action competences in ESD.

4 Reconceptualizing Action Competence in ESD for TEs

The reconceptualization proposed in this section represents the author's theoretical contribution. Vukelić's (2022) model of Teacher Action Competence in ESD offers important implications for the design of teacher education programs. The choice of this model as the conceptual reference is considered. Compared to broader ESD competence models, which often highlight the importance of ESD knowledge and skills, Vukelić's model explicitly integrates psychological constructs such as self-efficacy, perceived value of ESD, ascription of responsibility, and intention to implement ESD. This enables a thorough elucidation of why ESD knowledge and skills do not always translate into instructional practices. This makes it then particularly suitable for the adaptation to the context of TEs, whose influence extends beyond individual classrooms to institutional processes.

Central to the model is the concept of self-efficacy, which is proposed as a key determinant of whether teachers effectively implement ESD into their instructional practices. While components such as knowledge and skills, perceived value of ESD, and ascription of responsibility are foundational, they do not directly prompt and drive action on their own. Instead, these elements contribute to enhancing self-efficacy, which in turn, strengthens teachers' intention to integrate ESD meaningfully. This underscores the importance of exploring how self-efficacy can be nurtured to ensure that theoretical understanding translates into instructional practice.

Research by Tschannen-Moran and Hoy (2007) identifies four principal sources of self-efficacy: mastery experiences, vicarious experiences, social persuasion, and emotional interpretation. Among these, vicarious learning, which refers to observing capable role models, has proven especially influential (Tschannen-Moran & Hoy, 2007). This highlights the critical role of TEs. As mentors and role models, TEs can profoundly shape teachers' confidence in their ability to teach sustainability. By exemplifying effective ESD teaching strategies and demonstrating confidence, TEs not only convey knowledge but also cultivate the skills, beliefs, and attitudes needed to integrate ESD in real-world classrooms. Given the powerful influence of vicarious experiences, the role of TEs becomes especially significant. As the primary professional models for teachers, their ability to embody action competence in ESD directly shapes how future teachers themselves perceive their own capacities. Therefore, to fully utilize the potential of this model, it is essential to apply its core dimensions not only to teachers but also to TEs. This section explores how this model can be adapted to support TEs in the context of ESD.

TEs do more than deliver knowledge; they model professional beliefs, attitudes, and instructional practices. When TEs engage in reflective, future-oriented pedagogy, demonstrate confidence, and embrace sustainability as inherent to the teaching profession, they enable teachers to develop not only a conceptual understanding of ESD but also a personal belief in their ability to enact it. Given the influence of vicarious experiences, the role of TEs must be reconsidered, not merely as transmitters of ESD content, but as co-constructors of action competence within the teacher education ecosystem. To fully leverage Vukelić's model, it is crucial to extend its application beyond teachers and recontextualize its dimensions within the TEs themselves.

The adapted framework retains the three-predictor structure: CK and PCK, value ESD, and ascription of responsibility, of which is mediated by self-efficacy and leading to intention to implement ESD, while also capturing the broader competencies required of TEs to promote ESD in teachers effectively.

In here, the dimension of CK and PCK remains in line with the original framework from Vukelic's model (2022). However, the CK and PCK extend to include transdisciplinary thinking and leadership in institutional transformation as its constitutive features. In this context, transdisciplinarity thinking in ESD is in line with Mochizuki and Yarime (2016), of which refers to fostering epistemic change and shift of worldview through active collaboration with various stakeholders. It highlights creating new knowledge across disciplines through creative collaboration. Moreover, sustainability-related CK, in the context of TEs, would necessarily involve transdisciplinary perspectives that integrate ecological, social, and economic dimensions, while PCK at the level of TEs involve the ability to lead and design effective learning environments, curricula, and professional development opportunities for prospective teachers, which would then contribute to institutional transformation (leadership in institutional transformation).

TE's internalization of the belief that ESD is essential to responsible teaching and the value of ESD in the society is a powerful driver for sustained engagement. Their *Ascription of Responsibility* and perceived *Value of ESD* not only shape their own teaching but also influence their advocacy within institutions. Moreover, TEs play a key role in shaping the professional identity of teachers (Cuadra-Martínez, 2023). While research on this influence is still emerging, TEs occupy a unique position in the education system. Unlike teachers, TEs focus on teaching how to teach, developing pedagogy for teacher education, and contributing to educational research. This places them in a position of epistemic leadership, where their beliefs and values are communicated through their modelling of what it means to be a teacher. TEs' beliefs about teaching as a discipline shape their interactions with teachers and influence how they engage with ESD (González-Vallejos, 2018). By fostering a mindset that challenges inherited views of teaching, TEs enable teachers to engage in deeper reflection, thereby strengthening their action competence and preparing them to navigate complex challenges (Cuadra-Martínez, 2023).

Self-efficacy in TEs encompasses confidence not only in teaching sustainability knowledge but also in influencing the teacher education landscape. Given their roles in curriculum development, TEs need a strong belief in their capacity to enact and lead change across multiple levels in the education system. However, research highlights subtle differences in self-efficacy between teachers and TEs. For example, they tend to diverge in self-efficacy in bureaucratic control. Teachers tend to report lower self-efficacy in this domain compared to TEs. This may reflect the pressure teachers face to meet standardized performance metrics, in which TEs, often removed from school operations, may not comprehend (Leshem, 2008; Peltier et al., 2018). This suggests that TEs' self-efficacy is most robust when backed with contextual awareness. Establishing strong connections with schools and understanding the pressures teachers face help ensure that their confidence is not idealized.

TEs' *intention to implement ESD* involves more than integrating sustainability into teacher education coursework. It reflects an active effort to reshape teacher education towards future-oriented and systemic change. TEs influence institutional practices by embedding ESD principles across programs and involvement in policy discourse. These actions show teachers that sustainability is not a topic to be taught, but a professional commitment. It therefore reflects an active effort to reshape teacher education towards systemic change. To move from intention to practice, higher education institutions should create opportunities for TEs to work directly with ESD initiatives. Addressing this gap between theory and practice ensures that ESD principles are not only investigated conceptually but also in real-world educational contexts.

By reframing this action competence model for ESD to TEs, it then provides a potentially impactful framework in both the professionalization of TEs in the context of ESD, as well as in embedding ESD in teacher education programs. Thus, building action competence in TEs is not supplementary to ESD implementation, instead, it is foundational to its transformative potential.

5 Discussion and Implications

As the role of TEs in advancing ESD becomes increasingly significant, understanding how to integrate sustainability into teacher education has never been more important. In a time of unprecedented global challenges, equipping teachers with the competence, confidence, and commitment to address sustainability in the classroom is essential for achieving the aims of ESD. While the Action Competence framework proposed by Vukelić (2022) offers valuable conceptual insights into how teachers embody action competence in ESD, its application remains in the early stages.

From a theoretical perspective, this paper contributes to ESD literature by extending Vukelić's (2022) action competence model beyond the level of teachers to TEs as institutional actors. By reconceptualizing self-efficacy not only as confidence in classroom teaching but also as confidence in shaping teacher education, the model links more granular psychological dispositions with systemic changes at the institutional level. Validating and refining Vukelić's model across varied contexts can contribute to a more comprehensive theoretical framework for ESD, particularly by addressing aspects often overlooked in current literature, such as professional beliefs on ESD and the formation of this belief. While research has emphasized content knowledge and pedagogical approaches (e.g., Akstrand & Chang, 2020; Forsler et al., 2024; Nousheen et al., 2024), there is a clear gap in understanding how teachers come to see ESD as professionally meaningful and relevant. Since perceived value of ESD and ascription of responsibility are upstream drivers in the Action Competence model, examining these factors could enhance existing theories of teacher professional identity in ESD. Additionally, incorporating psychological and institutional factors offers the potential to link individual-level motivations with systemic changes. This granular understanding will directly inform how teacher education programs can embed ESD competences more effectively into instructional practices.

From a teaching and learning perspective, the model highlights that ESD in teacher training require learning environments that go beyond mere transmission of knowledge but also supporting motivational and psychological resources such as the ESD-related beliefs and self-efficacy. For universities, this implies that they are

uniquely positioned to lead ESD integration, yet doing so requires significant structural shifts. They must move beyond curriculum adjustments to foster environments that support TE's development of ESD-related competences. This includes investing in professional development opportunities, supporting innovation in pedagogy, and aligning institutional goals with the wider sustainability agenda. Universities also need to prioritize research infrastructure that empirically test the impact of ESD interventions (Froehlich et al., 2023; Reidl et al., 2023). Given the complexity of higher education systems, it is essential to examine how institutional contexts influence TE's capacity to lead curriculum transformation. Supporting TEs in these roles is then vital to embedding ESD and ensuring that sustainability is an integral element of teacher education.

In conclusion, this work is significant because without well-equipped TEs who can model, teach, and advocate for sustainability, efforts of existing ESD implementations will remain fragmented. Advancing both conceptual understanding and institutional preparedness is then key to achieving the transformative potential of ESD.

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