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Sustainability Education and Global Competence Development: An Integrated Conceptual Framework

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Abstract

As sustainability challenges and globalization continue to reshape higher education, cultivating students' global competence has become increasingly important. Although sustainability education is widely recognized as a key pathway for developing globally competent graduates, the underlying mechanisms remain insufficiently explored, limiting its effectiveness in practice. This study develops an integrated conceptual framework linking sustainability consciousness, sustainability thinking, and global competence among undergraduate students. Drawing on Transformative Learning Theory and Social Cognitive Theory, the framework conceptualizes sustainability consciousness as a value-oriented foundation and sustainability thinking as a cognitive mechanism supporting global competence development, with gender and academic major considered as contextual factors. By clarifying these relationships, this study provides a deeper understanding of how sustainability education contributes to students' competence development. The findings offer both theoretical and practical value by informing curriculum design, sustainability integration, and talent development strategies in higher education, thereby supporting educators, policymakers, and institutions in cultivating globally competent graduates.

Keywords: Sustainability Education, Sustainability Consciousness, Sustainability Thinking, Global Competence, Higher Education, Conceptual Framework

Introduction

In the context of accelerating globalization, climate change, social inequality, and geopolitical uncertainty, higher education institutions are increasingly expected to prepare students not only with disciplinary expertise but also with the competencies needed to navigate complex global challenges. Global competence has therefore emerged as a critical educational objective in the twenty-first century. It generally refers to individuals' capacity to understand global issues, appreciate diverse perspectives, communicate effectively across cultures, and take responsible action toward sustainable development. Classic frameworks, such as the OECD global competence framework, emphasize cognitive, socio-emotional, and behavioral dimensions as essential components of students' holistic development (OECD, 2018). Given the increasing complexity of global challenges, developing global competence is no longer

optional but essential for preparing graduates to function effectively in an interconnected and rapidly changing world.

Recent studies suggest that global competence is no longer viewed solely as an internationalization outcome, but increasingly as a core capability for addressing sustainability-related challenges. Higher education institutions are under growing pressure to align curricula with the United Nations Sustainable Development Goals (SDGs), particularly SDG 4, which emphasizes quality education and global citizenship. Sustainability education has thus become an important pathway for cultivating globally competent graduates capable of responding to interconnected ecological, economic, and social issues (Kjellgren & Richter, 2021; Novy et al., 2021). However, despite strong policy emphasis, many higher education institutions still face challenges in effectively integrating sustainability and global competence into teaching and learning practices, leading to a gap between policy expectations and actual student outcomes.

Sustainability education is widely recognized as an educational approach that equips learners with the knowledge, values, and skills needed to contribute to sustainable futures. Existing research has shown that sustainability-oriented pedagogies—such as project-based learning, experiential learning, and interdisciplinary collaboration—can foster students' systems thinking, critical thinking, interpersonal collaboration, and social responsibility, all of which are closely related to global competence (Desha et al., 2021; Krab-Hüsken et al., 2023; Membrillo-Hernández et al., 2023). These findings indicate that sustainability education can serve as an important foundation for developing students' ability to understand complexity, engage across cultures, and act responsibly in global contexts. Nevertheless, current approaches often emphasize curriculum design or teaching strategies, while paying insufficient attention to how students develop the internal awareness and cognitive capacities required to translate learning into competence.

However, despite increasing scholarly attention to sustainability education and global competence, the underlying mechanisms linking the two remain insufficiently understood. Much of the existing literature focuses on curriculum design, institutional strategies, or isolated competency outcomes, while limited research has examined how specific learner-level factors—such as sustainability consciousness and sustainability thinking—jointly contribute to global competence development. Sustainability consciousness, which includes individuals' sustainability-related knowledge, attitudes, and behaviors, reflects students' awareness and commitment to sustainability issues (Al-Nuaimi & Al-Ghamdi, 2022). Sustainability thinking, including systems thinking, critical thinking, and anticipatory thinking, represents higher-order cognitive abilities necessary for understanding and addressing complex sustainability challenges (Majadas Matesanz et al., 2023; Carrión et al., 2025).

Although these constructs are conceptually relevant to global competence, prior studies have rarely integrated them into a unified framework. In particular, there remains a lack of research that explains how sustainability consciousness may shape sustainability thinking and, in turn, enhance students' global competence. Furthermore, individual characteristics such as gender and academic major may influence how students engage with sustainability learning and global issues, yet their potential moderating role remains under-explored. This

gap limits both theoretical understanding and practical efforts to design effective sustainability-oriented education.

Understanding these relationships is particularly important for multiple stakeholders. For higher education institutions, it can inform curriculum design and pedagogical innovation aimed at cultivating globally competent graduates. For policymakers, it provides insights into how sustainability and internationalization agendas can be more effectively aligned. For students, it highlights the importance of developing both sustainability awareness and higher-order thinking skills to engage with complex global challenges. Therefore, examining the roles of sustainability consciousness and sustainability thinking is not only theoretically relevant but also practically significant.

To address these gaps, this study aims to develop an integrated conceptual framework that explains the relationships among sustainability consciousness, sustainability thinking, and global competence in higher education. Specifically, this study seeks to: (1) clarify the theoretical linkages between sustainability education and global competence development; (2) examine the roles of sustainability consciousness and sustainability thinking as key antecedents of global competence; and (3) explore the potential moderating effects of individual characteristics. By doing so, this study contributes to the literature on sustainability education and global competence by providing a theoretically grounded and practically useful framework for understanding how higher education can better prepare students to become responsible global citizens in an increasingly complex world.

Literature Review and Theoretical Foundation

Global Competence: Concept and Dimensions

Global competence has increasingly become a key objective in higher education, as universities are expected to prepare students to address global challenges such as climate change, inequality, and cultural diversity. The concept generally refers to individuals' capacity to understand global and intercultural issues, communicate effectively with people from diverse backgrounds, and act responsibly in an interconnected world (OECD, 2018). As a multidimensional construct, global competence is commonly understood to include cognitive, interpersonal, and personal dimensions.

Cognitive competence involves students' ability to acquire and critically evaluate knowledge related to global issues, understand interdependence, and engage in complex problem-solving. Interpersonal competence includes communication, empathy, collaboration, and intercultural sensitivity. Personal competence refers to self-awareness, ethical responsibility, adaptability, and reflective learning. Recent studies have emphasized that global competence development requires an integration of knowledge, attitudes, and behavioral dispositions rather than isolated skills (Medne et al., 2023; Alvero, 2025).

Medne et al. (2023), through a conceptual review of global and citizenship competence, highlighted that global competence should be viewed as a transversal capability encompassing critical awareness, intercultural understanding, and civic responsibility. Likewise, Alvero (2025) found that university students' global competence development depends on the coordinated enhancement of cognitive, socio-emotional, and behavioral

domains. These findings suggest that global competence is a holistic construct shaped by both educational experiences and internal learner characteristics.

Sustainability Consciousness: Concept and Dimensions

Sustainability consciousness has been widely recognized as an important learning outcome in education for sustainable development. It reflects individuals' awareness, values, and behaviors related to sustainability issues and is generally conceptualized as including sustainability knowingness, sustainability attitudes, and sustainability behaviors (Gericke et al., 2019).

Sustainability knowingness refers to individuals' understanding of sustainability-related issues, including environmental protection, social justice, and economic development. Sustainability attitudes involve values, beliefs, and emotional commitment toward sustainable development. Sustainability behaviors refer to actual actions that support sustainability in daily life. Together, these dimensions reflect learners' overall orientation toward sustainable living.

Recent research has shown that sustainability consciousness is associated with responsible citizenship, environmental stewardship, and ethical engagement. For example, Quyen et al. (2024) emphasized that sustainability-related awareness and values are critical for developing students' broader global and social competencies. Their study found that sustainability-oriented learning contributes to students' ability to connect local actions with global sustainability challenges.

Although sustainability consciousness has been widely discussed in sustainability education research, its role in promoting global competence has received limited direct attention. Given that both constructs emphasize responsibility, awareness of interconnected issues, and social engagement, sustainability consciousness may provide an important motivational and value-based foundation for global competence development.

Sustainability Thinking: Concept and Dimensions

Sustainability thinking is increasingly regarded as a core higher-order competency in education for sustainable development because it enables students to understand and respond to complex and uncertain sustainability challenges. It is commonly conceptualized as including systems thinking, critical thinking, and anticipatory thinking.

Systems thinking refers to understanding interconnections, feedback processes, and dynamic relationships among social, environmental, and economic systems. Critical thinking involves questioning assumptions, evaluating evidence, and considering multiple perspectives. Anticipatory thinking refers to the ability to envision future scenarios, assess long-term consequences, and plan for sustainable solutions.

Recent research has consistently shown that sustainability thinking is essential for addressing global challenges. For instance, Al-Ismaily et al. (2025) argued that sustainability-oriented curricula should cultivate systems thinking and transdisciplinary problem-solving to prepare students for future global challenges. Similarly, Giunti et al. (2025) found that future-oriented

education increasingly requires students to develop adaptive thinking, complex systems understanding, and anticipatory reasoning.

These findings suggest that sustainability thinking is closely related to global competence because both emphasize complexity awareness, future orientation, and responsible decision-making. However, the direct relationship between sustainability thinking and global competence remains underexplored in the higher education literature.

Individual Characteristics: Gender and Academic Major

Individual characteristics may influence students' learning processes and competence development in sustainability education. Among these characteristics, gender and academic major are particularly relevant in higher education settings.

Gender has been found to influence students' environmental concern, social values, and collaborative learning orientations. Existing research generally suggests that female students tend to report stronger empathy, sustainability concern, and prosocial attitudes than male students. These differences may affect students' sustainability consciousness and global competence development. Social role theory suggests that gendered socialization shapes individuals' interpersonal sensitivity and value orientation, which may influence learning outcomes.

Academic major may also shape students' sustainability learning opportunities and competence profiles. Students from humanities and social sciences may have more exposure to ethics, intercultural issues, and civic responsibility, whereas students from STEM fields may demonstrate stronger analytical and systems thinking abilities. Quyen et al. (2024) noted that disciplinary contexts significantly influence students' sustainability competency development.

Despite these insights, few studies have explicitly examined whether gender and academic major moderate the relationships between sustainability-related factors and global competence. Therefore, incorporating these variables may help explain variations in students' global competence development.

Theoretical Foundation

This study draws on three complementary theoretical perspectives: Transformative Learning Theory, Systems Theory, and Social Cognitive Theory.

Transformative Learning Theory explains how learners develop new perspectives through critical reflection and experiential learning. Mezirow (1997) argued that transformative learning occurs when individuals critically reassess their assumptions and reconstruct their frames of reference. Sustainability education often exposes students to complex and uncertain global challenges, which may stimulate reflective learning and perspective transformation.

Systems Theory emphasizes interdependence, complexity, and dynamic interactions within broader systems. In sustainability education, students are expected to understand the interconnected nature of environmental, social, and economic issues. This perspective

supports the role of sustainability thinking in helping students understand global complexity and uncertainty (Al-Ismaily et al., 2025).

Social Cognitive Theory highlights the reciprocal interaction among cognition, behavior, and environmental influences in learning processes (Bandura, 1986). According to this theory, learners' beliefs, values, and experiences jointly influence competence development. In this study, sustainability consciousness can be viewed as a cognitive-affective basis that shapes sustainability thinking and subsequently contributes to global competence development.

Taken together, these theories provide a strong conceptual foundation for explaining how sustainability consciousness and sustainability thinking may influence global competence among undergraduate students.

Development of the Conceptual Framework

Sustainability Consciousness and Global Competence

Sustainability consciousness provides an important conceptual foundation for understanding how students develop global competence in higher education. As a multidimensional construct, sustainability consciousness includes sustainability knowingness, sustainability attitudes, and sustainability behaviors (Gericke et al., 2019). These dimensions reflect students' understanding of sustainability issues, their value orientation toward sustainable development, and their willingness to engage in responsible action.

From a conceptual perspective, sustainability knowingness can support students' cognitive competence by enhancing their understanding of complex global challenges such as climate change, social inequality, and sustainable development. Students with stronger sustainability-related knowledge are more likely to recognize global interdependence and understand the broader consequences of local actions (Quyen et al., 2024).

Sustainability attitudes may contribute to the interpersonal and personal dimensions of global competence. Positive sustainability attitudes often reflect stronger empathy, ethical awareness, and a sense of responsibility toward collective well-being. These qualities are essential for respectful intercultural interaction and responsible global citizenship (Manca et al., 2020).

Sustainability behaviors can further reinforce students' sense of agency and practical engagement with sustainability challenges. Through active participation in sustainable practices, students may develop responsibility, adaptability, and confidence in addressing real-world issues, which are important elements of global competence (Gericke et al., 2019).

Taken together, sustainability consciousness can be conceptually understood as a value-based and motivational foundation that supports students' development of global competence.

Sustainability Thinking and Global Competence

Sustainability thinking is another important construct that may help explain global competence development. It refers to students' higher-order cognitive abilities to understand

and address sustainability-related challenges, and generally includes systems thinking, critical thinking, and anticipatory thinking.

Systems thinking enables students to recognize the interconnected nature of environmental, social, and economic systems. This ability helps learners understand the complexity of global challenges and the relationships between local and global processes (Kline et al., 2024). Such systemic understanding is closely aligned with the cognitive dimension of global competence.

Critical thinking supports students' ability to evaluate information, question assumptions, and consider multiple perspectives. In global learning contexts, these skills are essential for intercultural understanding, ethical reasoning, and informed decision-making (Cruz et al., 2023).

Anticipatory thinking emphasizes future-oriented reasoning and the ability to assess long-term implications of current decisions. In the context of global competence, students need to understand not only current global issues but also future sustainability risks and opportunities. Recent educational research suggests that future-oriented thinking is increasingly important in preparing students for uncertain global contexts (Giunti et al., 2025).

Therefore, sustainability thinking can be conceptually viewed as a cognitive pathway that supports students' ability to engage with global complexity and develop global competence.

The Relationship between Sustainability Consciousness and Sustainability Thinking

Sustainability consciousness and sustainability thinking are conceptually interconnected. Sustainability consciousness provides the knowledge base, values, and behavioral orientation that may foster deeper sustainability-related thinking processes.

Students who possess stronger sustainability awareness are more likely to reflect critically on sustainability challenges, question existing assumptions, and seek holistic solutions. Awareness of environmental and social issues often serves as an important trigger for reflective learning and deeper cognitive engagement (van Schalkwyk et al., 2019).

Moreover, sustainability attitudes and behavioral commitment may motivate students to participate in sustainability-related learning activities such as interdisciplinary collaboration, problem-solving, and experiential learning. These learning experiences are important for the development of systems thinking, critical thinking, and anticipatory thinking (Cruz et al., 2023).

Thus, sustainability consciousness can be conceptually positioned as an antecedent condition that supports the development of sustainability thinking.

Moderating Role of Individual Characteristics

Individual characteristics may influence how students engage with sustainability education and develop global competence. In this study, gender and academic major are included as important contextual factors in the conceptual framework.

Gender may shape students' sustainability-related values, learning engagement, and social responsibility. Previous research has shown that female students often demonstrate stronger environmental concern, empathy, and collaborative orientation, which may influence their sustainability consciousness and competence development (Manca et al., 2020).

Academic major may also affect students' exposure to sustainability-related knowledge and their learning experiences. Students in social sciences and humanities may have greater opportunities to engage with ethical, intercultural, and social justice issues, while students in science and engineering may be more likely to develop systems-oriented analytical skills (Quyen et al., 2024; Kline et al., 2024).

From the perspective of Social Cognitive Theory, individual characteristics interact with cognitive processes and learning environments to shape competence development (Bandura, 1986). Therefore, gender and academic major are conceptually relevant contextual factors that may influence the relationships among sustainability consciousness, sustainability thinking, and global competence.

In this study, these individual characteristics are incorporated into the conceptual framework to provide a more nuanced understanding of undergraduate students' global competence development.

Proposed Framework and Discussion

Proposed Integrated Conceptual Framework

Based on the literature review and theoretical foundations, this study proposes an integrated conceptual framework to explain how sustainability education may contribute to undergraduate students' global competence development. The framework positions sustainability consciousness as the foundational value-oriented construct, sustainability thinking as the cognitive mechanism, and global competence as the ultimate educational outcome. In addition, individual characteristics, including gender and academic major, are incorporated as contextual factors that may shape the strength of these relationships.

The proposed framework is illustrated as follows:

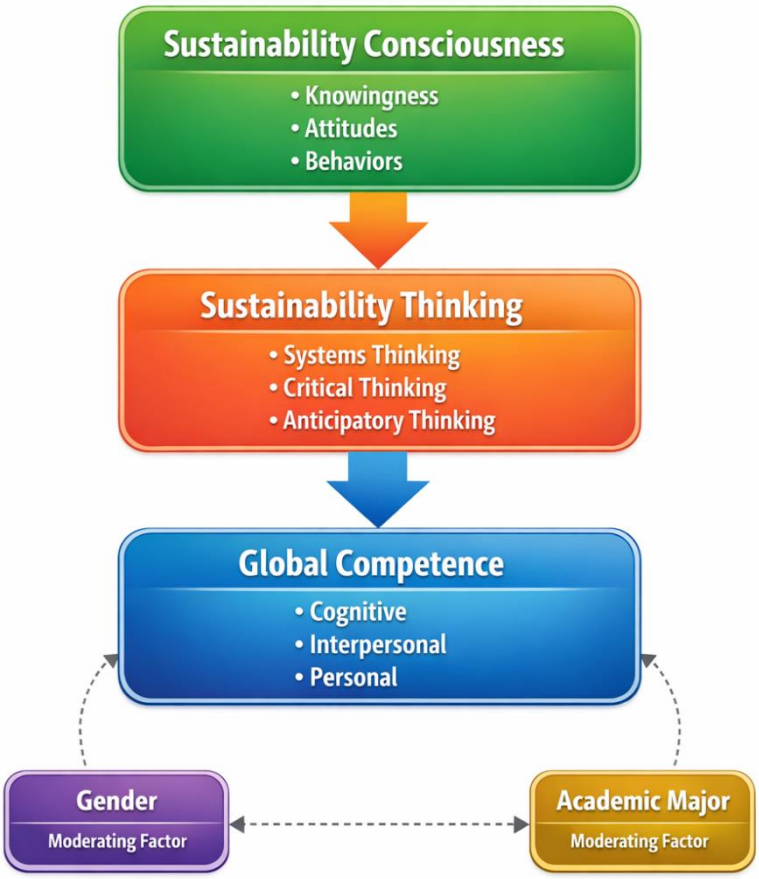

Figure 1 Proposed conceptual framework

This framework reflects the idea that sustainability consciousness provides students with awareness, values, and behavioral orientation toward sustainable development, which can facilitate the development of sustainability thinking. Sustainability thinking, in turn, supports students in understanding complexity, evaluating multiple perspectives, and making responsible decisions, thereby contributing to global competence.

Explanation of the Framework Logic

The logic of the proposed framework is grounded in the complementary roles of values, cognition, and context in higher education learning. Sustainability consciousness is positioned as the foundational construct because awareness and value orientation often precede deeper learning engagement. Students who are more aware of sustainability issues and more committed to sustainable values are more likely to engage in reflective learning, interdisciplinary inquiry, and socially responsible action (Gericke et al., 2019; Husic, 2024).

Sustainability thinking functions as the core cognitive mechanism in the framework. Sustainability-related challenges are inherently complex, uncertain, and interconnected. Students therefore need systems thinking to understand interdependencies, critical thinking to evaluate assumptions and evidence, and anticipatory thinking to consider long-term consequences. Recent research has emphasized that higher education must increasingly cultivate these competencies to prepare students for future uncertainty and global complexity (Frenk et al., 2022; Kline et al., 2024).

Global competence is conceptualized as the educational outcome that reflects students' ability to understand global issues, communicate across cultures, and act responsibly in diverse contexts. The framework suggests that global competence is not developed through international exposure alone, but through the integration of sustainability-related values, higher-order thinking, and reflective learning processes. This view aligns with recent internationalization research, which highlights that meaningful global competence development requires curriculum integration, interdisciplinary learning, and critical engagement rather than isolated international experiences (Wu et al., 2022).

Furthermore, gender and academic major are included as contextual moderators because students' backgrounds may influence their learning experiences, opportunities, and interpretations of sustainability-related education. This addition helps the framework better reflect the diversity of undergraduate learning pathways.

Theoretical Contributions

This study makes several theoretical contributions to the literature on sustainability education and global competence.

First, it contributes to the global competence literature by offering a sustainability-based explanatory framework. Existing studies have often focused on internationalization initiatives, study abroad, or intercultural communication, while paying less attention to sustainability-related internal mechanisms that support competence development. By integrating sustainability consciousness and sustainability thinking, this study broadens the theoretical understanding of how global competence can be cultivated in higher education (Wu et al., 2022).

Second, this study contributes to sustainability education research by extending its focus beyond sustainability literacy or environmental behavior. Previous studies have emphasized knowledge acquisition and isolated sustainability competencies, but fewer studies have examined how sustainability-related learning contributes to broader global capabilities. This framework provides a more comprehensive perspective by linking sustainability education to students' global cognitive, interpersonal, and personal development (Husic, 2024).

Third, this study enriches the application of Transformative Learning Theory, Systems Theory, and Social Cognitive Theory in higher education. The framework conceptually integrates values, cognition, and contextual influences, offering a more holistic explanation of students' learning and competence development in sustainability-related contexts.

Overall, the proposed framework helps bridge the gap between sustainability education and global competence research and offers a clearer conceptual basis for future empirical studies.

Practical Implications for Higher Education

The proposed framework also offers important practical implications for higher education institutions seeking to cultivate globally competent graduates.

First, universities should integrate sustainability education more systematically into undergraduate curricula rather than treating it as an isolated topic. Sustainability-related

content should be embedded across disciplines and connected to real-world global challenges. Recent research suggests that curriculum-wide sustainability integration is more effective than stand-alone courses in developing students' critical awareness and responsible action (Husic, 2024; Yıldızlı & Günaydın, 2025).

Second, higher education institutions should adopt more student-centered and transformative pedagogies. Project-based learning, interdisciplinary collaboration, experiential learning, and problem-based learning can provide students with opportunities to develop sustainability thinking and global competence simultaneously. Studies have shown that longitudinal and integrated curricular approaches significantly improve students' ability to understand complexity and engage in responsible action (Kline et al., 2024; Azzam et al., 2023).

Third, universities should strengthen local internationalization and inclusive global learning opportunities. Global competence should not depend solely on study abroad programs, which may not be accessible to all students. Instead, institutions should create more inclusive internationalized learning environments through virtual exchange, intercultural dialogue, collaborative projects, and locally embedded global learning activities (Wu et al., 2022).

Finally, higher education institutions should consider student diversity when designing sustainability and global competence programs. Tailored support for students from different majors and backgrounds may help ensure more equitable competence development.

In sum, this framework provides both a theoretical and practical basis for designing sustainability-oriented higher education strategies that foster globally competent graduates capable of addressing complex future challenges.

Conclusion and Future Research

This study developed an integrated conceptual framework to explain how sustainability education may contribute to the development of global competence among undergraduate students. Specifically, the framework positions sustainability consciousness as a foundational value-oriented construct, sustainability thinking as a core cognitive mechanism, and global competence as the key educational outcome. In addition, individual characteristics, including gender and academic major, were incorporated as important contextual factors that may shape students' learning experiences and competence development. By clarifying these relationships, the study provides a more structured understanding of how sustainability-related learning can support students' overall competence development.

The central argument of this study is that global competence should not be understood solely as an outcome of international exposure or intercultural interaction, but also as a broader educational capability grounded in students' sustainability-related values, awareness, and higher-order thinking. In the context of increasing global uncertainty, climate change, and social inequality, sustainability education provides an important pathway for helping students develop the knowledge, dispositions, and competencies needed to engage responsibly with global challenges (Husic, 2024; Frenk et al., 2022). This perspective highlights the growing importance of integrating sustainability-oriented learning into higher education systems.

The proposed framework makes several important theoretical contributions. First, it extends the global competence literature by introducing sustainability consciousness and sustainability thinking as key explanatory constructs. Existing studies on global competence have often focused on internationalization strategies, mobility programs, or intercultural learning, while paying less attention to sustainability-related internal mechanisms that support competence development (Wu et al., 2022). By linking sustainability education with global competence, this study provides a more holistic and process-oriented understanding of undergraduate students' competence development.

Second, this study contributes to sustainability education research by moving beyond traditional discussions of sustainability literacy or isolated sustainability competencies. The framework highlights that sustainability education should be viewed as a transformative process that supports students' global awareness, ethical responsibility, critical reflection, and future-oriented problem-solving. This perspective responds to recent calls for higher education to adopt more integrated and socially responsive approaches to sustainability learning (Husic, 2024), and emphasizes the role of internal cognitive and value-based processes in shaping learning outcomes.

Third, the study offers practical implications for curriculum design and talent development in higher education. For higher education institutions, the framework provides a useful reference for integrating sustainability education into curriculum design and teaching practices. Universities are encouraged to embed sustainability-related content across disciplines, promote interdisciplinary and experiential learning, and create more inclusive opportunities for global learning. For policymakers, the findings offer insights into how sustainability education and global competence development can be better aligned within higher education strategies. For students, the framework highlights the importance of developing both sustainability awareness and higher-order thinking skills to effectively engage with complex global challenges. Curriculum-wide sustainability initiatives, student-centered pedagogies, and local internationalization strategies may help students develop both sustainability-related competencies and global competence (Azzam et al., 2023; Yıldızlı & Günaydın, 2025).

Despite these contributions, this study has several limitations that also point to future research directions. First, as a conceptual study, the proposed framework requires empirical validation to examine the strength and direction of the proposed relationships. Future studies may employ quantitative methods, such as structural equation modeling, to test the relationships among sustainability consciousness, sustainability thinking, and global competence.

Second, future research could expand the scope of explanatory variables by considering additional contextual and psychological factors, such as international learning experience, digital learning engagement, environmental identity, and institutional support. These variables may provide a more comprehensive understanding of how students develop global competence in different educational settings.

Third, future studies could broaden the sample scope by conducting cross-regional or cross-cultural comparative research. Differences in educational systems, institutional

environments, and cultural contexts may influence how sustainability education shapes students' competence development. Comparative studies across countries or university types would help improve the generalizability and applicability of the proposed framework.

Finally, future research may adopt mixed-methods or longitudinal designs to better understand the dynamic processes of students' competence development over time. Such studies would provide deeper insights into how sustainability education contributes to the formation of globally competent graduates in different educational contexts.

Overall, this study provides a theoretically grounded and practically relevant framework for understanding the relationship between sustainability education and global competence development. More importantly, it offers a useful reference for educators, policymakers, and higher education institutions seeking to design effective sustainability-oriented educational strategies and to cultivate graduates capable of addressing complex global sustainability challenges.

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