

## Critical Review of a Sustainability Principles Course at a Chilean Public University

FERNANDO VERA<sup>1</sup><sup>1</sup>University of the Basque Country, Spain <https://orcid.org/0000-0002-4326-1660>correspondence email: [fernandovera@rediie.cl](mailto:fernandovera@rediie.cl)**Article history:**

Received: 11/28/2024

Revised: 2/10/2025

Accepted: 17/03/2025

**Keywords:***Sustainability**Active learning**Transformational change**Transversal competencies**Higher education***Abstract**

Sustainability is a fundamental pillar in 21st-century higher education, and its integration into academic programs remains a key challenge for universities. This paper critically analyzes the curriculum of a Sustainability Principles Course at a public Chilean university. It argues that addressing sustainability through standalone mandatory courses taught by specialists does not effectively transfer knowledge to professional practice, as it fails to encourage its active application across different curricular spaces. Conversely, an integrative approach proves to be more effective in embedding sustainability into higher education, thereby fostering transformational changes in professional training and the application of sustainable principles in the workplace. The study concludes with recommendations for integrating sustainability into curricula.

## Introduction

Sustainability is a multidimensional concept encompassing economic, social, environmental, and ethical dimensions (Eizenberg & Jabareen, 2017; González et al., 2021; Purvis et al., 2019). It involves balancing development and resource conservation to meet present needs without compromising future generations. Its integration into higher education curricula is crucial for developing professionals committed to sustainable development. However, there is an ongoing debate about the most effective way to incorporate sustainability into academic programs (Tejedor et al., 2019; Vera, 2017; Vera, 2024a). Some institutions opt for standalone courses led by specialists, while others adopt a holistic approach, embedding sustainability as a transversal competency across different curricular areas. While standalone courses provide in-depth knowledge, an integrative model fosters interdisciplinary thinking and long-term engagement. This paper compares both approaches, arguing in favor of the integrative model and proposing strategies for its effective implementation in higher education, including faculty training, active learning methodologies, and institutional policies.



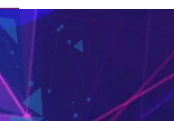
Higher education serves as the fundamental driver of sustainability, acting as a primary means of communication and the foundation for developing a sustainability mindset (Bataeineh & Aga, 2023; Obrecht et al., 2022; Sánchez-Carrillo et al., 2021; Žalėnienė & Pereira, 2021). This reinforces the notion that Higher Education institutions (HEIs) function not only as centers of learning but also as drivers of meaningful societal transformation (Bui et al., 2024). This concept entails a systemic approach to understanding that goes beyond technical knowledge and the mere comprehension of the principles underlying a healthy ecosystem and a thriving society. Moreover, it fosters the ability to analyze complex interactions between the environment, economy, and society, promoting critical and interdisciplinary thinking. This, in turn, enables responsible decision-making for long-term sustainable development. Through transformative learning processes, individuals can develop skills, attitudes, and values essential for addressing global challenges (Vera, 2024b). Therefore, embedding sustainability in educational curricula ensures that future generations are equipped to drive positive change in an increasingly interconnected world.

By focusing on management ethics, entrepreneurship, environmental studies, systems thinking, and self-awareness, the sustainability mindset encourages us to transcend fragmented and conventional approaches to both management and education. It promotes a more comprehensive and integrated framework that aligns with the principles of sustainable development (De Paula Arruda Filho et al., 2019; Vera, 2022; Vera, 2024a). A central pillar of this mindset is systems thinking, widely recognized as a crucial competency for grasping the full complexity of sustainability challenges. Systems thinking allows for the examination of dynamic relationships between environmental, social, and economic systems. This comprehensive analysis supports more thoughtful, ethical, and impactful decision-making across professional, academic, and institutional contexts, ultimately contributing to transformative societal change.

Sustainability encompasses three fundamental dimensions—environmental, social, and economic (Kaimovs & Skarupins, 2024), which are interconnected and mutually dependent to ensure equitable and long-lasting development. According to UNESCAP (2015), Individuals and the societies they inhabit are influenced by the economy that supports their livelihoods and enhances their quality of life, while simultaneously shaping that very economy. Additionally, ecosystems play a crucial role by providing essential services that sustain both economic systems and human well-being. In this sense, systems thinking becomes a crucial tool, as it allows sustainability to be approached holistically, facilitating an in-depth analysis of the interactions among the various components that shape sustainable development.

To address this topic, the following research questions are proposed:

1. What professional competencies does this course develop in students?
2. What learning methodologies are implemented in this course?
3. How does this course connect with other curricular components within the study program?





### *Educational Approaches to Sustainability*

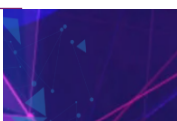
According to Abo-Khalil (2024), many universities have integrated sustainable practices into their operations, research activities and teaching methodologies. However, despite these efforts, the rapid pace of societal change presents a significant challenge for the education sector. Academia plays a crucial role in promoting sustainable decision-making, making it essential for educational systems to continue evolving (Filho et al., 2020; Membrillo-Hernández et al., 2021). Otherwise, there is a risk of perpetuating behaviors and practices that do not contribute to sustainable development, underscoring the urgency of adapting education to current and future challenges.

Understanding how students perceive sustainability is crucial for enhancing its integration into higher education curricula and learning experiences. Research indicates that students' perceptions significantly influence not only their interest and engagement with sustainability-related content, but also their capacity to apply sustainability principles in real-world contexts (Gonella et al., 2024; Guerra et al., 2024). For instance, Segalàs et al. (2010) discovered that students tended to associate sustainability primarily with technological aspects, while often overlooking its equally vital social and attitudinal components. This limited perspective highlights the urgent need to design and implement educational approaches that present sustainability as an inherently multidimensional concept, encompassing environmental, social, and economic dimensions in an interconnected and holistic manner across academic disciplines.

Furthermore, fostering sustainable thinking among students requires integrating sustainability as a transversal competence, employing strategies similar to those used for critical thinking development. This involves implementing classroom activities and experiences that enable students to:

- Enhance higher-order cognitive skills, promoting analytical, critical thinking, reasoning and problem-solving.
- Cultivate attitudes of commitment, initiative, and leadership, encouraging proactive engagement with sustainability challenges.
- Engage in active learning environments, such as challenge-based learning (CBL), project-based learning, and experiential learning, incorporating competency-based assessment to ensure not only knowledge acquisition but also the development of civic and ethical responsibility.

In the author's opinion, to effectively integrate sustainability into higher education, institutions must adopt interdisciplinary and experiential learning approaches that go beyond theoretical knowledge. This includes active learning strategies, such as problem-based learning, community engagement, and collaborative projects, which enable students to apply sustainability concepts in real-world contexts. Moreover, faculty development programs are essential to equip educators with the skills to incorporate sustainability principles into their teaching methodologies. By embedding sustainability across curricula and fostering critical thinking, ethical responsibility, and innovation, Higher Education Institutions (HEIs) can better prepare graduates to address environmental and social challenges in an increasingly complex global landscape.



Additionally, student knowledge of sustainable development significantly improved when courses adopted a community-focused, constructive, and active-learning approach (Martínez-Casanova et al., 2021; Vera, 2022). Their research highlights how hands-on experiences, real-world problem-solving, and collaborative projects enhance students' understanding of sustainability beyond theoretical concepts. By engaging with communities and addressing practical sustainability challenges, students develop a deeper awareness of the social, environmental, and economic dimensions of sustainable development. These findings emphasize the importance of evolving pedagogical methods that prioritize experiential learning, interdisciplinary collaboration, and critical reflection. Implementing these approaches allows students to not only acquire knowledge, but also cultivate essential skills such as systems thinking, ethical decision-making, and innovation, ultimately fostering a more comprehensive, critical, and transformative understanding of sustainability (Caniglia et al., 2020; Vera, 2024b).

Following the perspective of Caniglia et al. (2021), the pluralistic and integrated approach proposed firmly rejects technocratic solutions that tend to oversimplify the complex challenges of sustainability. Rather than relying solely on technical or linear responses, this approach emphasizes the vital role of both individual and collective learning processes as essential drivers for the transformation toward more sustainable societies. It acknowledges that socio-environmental problems cannot be effectively addressed without a deep understanding of their human, cultural, and contextual dimensions. Therefore, it advocates for a more inclusive, participatory, and critical vision of learning—one that values diverse forms of knowledge, lived experiences, and perspectives in the pursuit of long-term, just, and sustainable solutions.

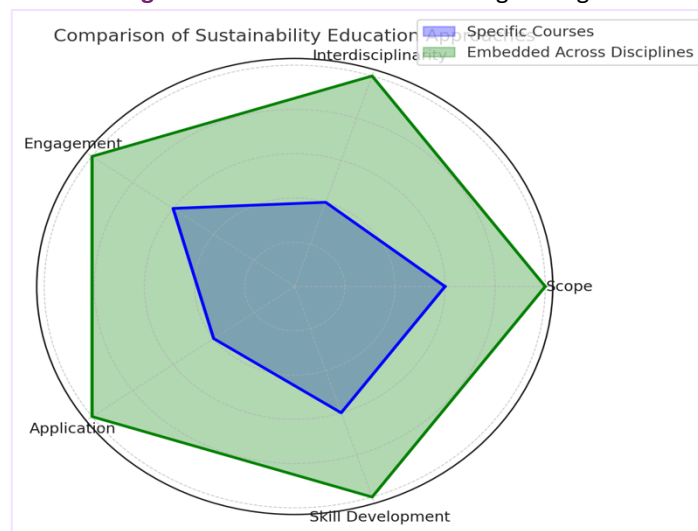
From a similar standpoint, Shrivastava et al. (2020) argue that achieving meaningful social and environmental transformation on a global scale necessitates a fundamental rethinking of sustainability science, positioning it as a genuinely transdisciplinary enterprise. This transformation implies moving beyond the confines of isolated academic disciplines to embrace a more integrative approach that brings together scientific, local, experiential, and indigenous forms of knowledge. By fostering inclusive and sustained collaboration among scholars, practitioners, policymakers, and community stakeholders, sustainability science becomes better equipped to navigate the complexity, uncertainty, and interconnectedness of real-world sustainability challenges. Ultimately, this approach enhances the capacity to co-create solutions that are not only context-specific and ethically grounded but also socially just, adaptable, and sustainable over time.

In this line, a study on the integration of sustainability in higher education by Vera (2022) revealed key findings regarding curriculum design. The results indicate that sustainability should be embedded into the curriculum through specialized courses taught by experts ( $M=2.6781$ ;  $SD=0.536$ ). However, when participants were asked whether sustainability should be integrated transversally across the curriculum rather than through isolated courses, the level of agreement was significantly higher ( $M=4.778$ ;  $SD=0.536$ ). This contrast underscores the need for a more comprehensive pedagogical approach, moving beyond discipline-specific instruction toward an interdisciplinary model. Embedding sustainability across various subjects fosters a broader, systemic understanding, equipping students with the competencies to apply sustainable principles in diverse professional and societal contexts.



Vera (2022) argues that the best approach is to consider sustainability as a core competency, integrating both technical and generic skills that foster attitudinal change. This perspective establishes sustainability as a guiding principle in higher education, ensuring its integration across multiple courses rather than being confined to isolated subjects. The comparison of sustainability education approaches (Figure 1) highlights the advantages of embedding sustainability across disciplines using active learning methodologies such as Project-Based Learning (PBL), Service-Learning (SL), and problem-solving in real-world contexts. Unlike specialized courses that offer limited scope and application, a transversal approach fosters greater engagement, interdisciplinarity, and skill development.

**Figure 1:** Courses vs. active learning strategies



**Source:** Own elaboration.

By embedding sustainability as a cross-cutting competency within higher education curricula, HEIs enable students to cultivate a comprehensive and forward-thinking understanding of the multifaceted challenges facing today's world. This approach moves beyond viewing sustainability as a standalone topic or elective subject and instead integrates it as a fundamental dimension across disciplines, pedagogies, and institutional practices (Dmochowski et al., 2016; Vera, 2017; Vera, 2024a). In doing so, students are not only exposed to environmental concepts, but also learn to critically engage with economic, social, cultural, and ethical dimensions of sustainability. This comprehensive exposure fosters an ability to analyze pressing global challenges—such as climate change, resource depletion, social inequality, and biodiversity loss—from multiple perspectives, enhancing their critical thinking and systems-based reasoning.

Developing sustainability as a transversal skill empowers students to engage with real-world problems using interdisciplinary knowledge and tools. For instance, a student in engineering may learn to design technologies with lower environmental impacts, while a business student might explore strategies for fostering inclusive and regenerative economies. Likewise, students in social sciences and humanities can contribute by critically examining the cultural narratives and value systems that shape our interactions with nature and with each other.

Furthermore, this competency-based approach ensures that sustainability is not treated as an isolated subject or academic silo, but rather as a fundamental element of education, encouraging long-term behavioral shifts and fostering responsible decision-making across diverse fields (Figure 2).

**Figure 2:** Sustainability as a competency in higher education



Source: Own elaboration.

In this regard, UNESCO's Education for Sustainable Development (ESD) initiative stands out as the most comprehensive global approach, as it is both holistic and transformative (UNESCO, 2019). ESD aims to develop competencies among students at all educational levels, ensuring a broad and impactful integration of sustainability principles. By incorporating sustainability into curricula, ESD fosters critical thinking, ethical decision-making, and the ability to address real-world challenges (Marouli, 2022; Vera, 2022). It also needs interdisciplinary methodologies to promote critical reflection on the ethical implications of modern socio-economic systems and to equip learners with the skills needed to imagine and contribute to a more sustainable society. Thus, it encourages interdisciplinary collaboration and promotes experiential learning, allowing students to engage in meaningful projects that contribute to sustainable development. As a result, ESD plays a crucial role in preparing individuals to navigate complex global challenges.

In essence, ESD represents UNESCO's educational response to the urgent and dramatic challenges facing the planet. Human activities have collectively altered Earth's ecosystems to such an extent that our own survival is at risk due to increasingly irreversible changes. Addressing global warming before it reaches catastrophic levels requires a holistic approach that integrates environmental, social, and economic issues (Sahoo et al., 2023). This means fostering sustainable practices across all sectors, promoting interdisciplinary education, and equipping future generations with the knowledge and skills necessary to mitigate climate change and ensure long-term global sustainability.



Conversely, a fragmented approach to sustainability in higher education—through standalone courses or workshops, typically within environmental, economic, or social sciences—provides only isolated knowledge without fostering transformative change among students (Filho et al., 2018; Vera, 2017; Vera, 2024a). Such an approach is often disconnected from other disciplines, limiting its applicability across professional contexts. Moreover, sustainability is frequently perceived as an additional subject rather than a core pillar of undergraduate education (Vera, 2022; Vera, 2024a). This perception leads to minimal knowledge transfer to professional practice due to the lack of active application across different curricular areas. Without a more integrated and interdisciplinary strategy, students may struggle to develop a comprehensive understanding of sustainability, reducing their ability to implement meaningful, long-term solutions in real-world scenarios.

Unfortunately, this approach fails to fully integrate sustainability as a cross-cutting competency throughout the curriculum—an essential principle of competency-based education. Without engaging the entire faculty in implementing active learning methodologies centered on sustainability, universities risk missing the opportunity to cultivate a comprehensive understanding and effective application of sustainability principles among students (Vera, 2024a). This limitation hinders educational impact and prevents the establishment of a truly institutionalized culture committed to sustainable development.

## Materials and Methods

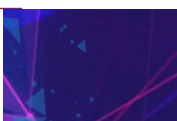
### *Research Approach and Design*

This study is developed under a qualitative approach with a documentary review design. This method involves analyzing various types of documents, such as books, newspaper articles, academic journal articles, and institutional reports (Morgan, 2022). It allows for a critical and systematic analysis of bibliographic sources, regulations, and academic documents relevant to sustainability in higher education. The documentary review is justified as an appropriate strategy for identifying trends, theoretical approaches, and methodological models implemented in the teaching of sustainability in different university contexts.

### *Unit of Analysis*

The "Course on Principles of Sustainability" is a mandatory course within the Personal and Social Development Program, aimed at undergraduate students from various disciplines at a public university in Chile. Its purpose is to provide conceptual and methodological foundations on sustainability, promoting its application in both the personal and professional spheres of students.

The course is mandatory and delivered in person, with a total workload of 72 hours, evenly divided into 36 theoretical hours and 36 practical hours, in accordance with the Credit Transfer System-Chile (4 CTS-Chile). Implemented since 2019, this course may represent an additional academic workload, as students are required to complete a final project. This project demands significant effort and time, potentially impacting their performance in other required courses. However, it also provides an opportunity to apply theoretical knowledge in practical contexts.





### *Inclusion and Exclusion Criteria*

The selection of the Course on Principles of Sustainability for analysis was based on specific inclusion and exclusion criteria to ensure the study's relevance and alignment with its objectives, as explained below:

#### *Inclusion Criteria:*

- The course must be a compulsory component of the curriculum, ensuring its accessibility to all students within the Personal and Social Development Program at the university.
- The course must be designed for students from various disciplines, promoting a broad and integrative approach to sustainability.
- The course must have a structured and documented program, including clear learning objectives, a defined methodological framework, and an established assessment system.
- Only course iterations offered since 2019 are considered, ensuring the analysis is based on a stable and well-established version of the curriculum.
- The course must be delivered face-to-face, adhering to the 72-hour workload division (36 theoretical and 36 practical hours).

#### *Exclusion Criteria:*

- Sustainability-related courses that are optional or exclusive to specific disciplines are excluded to maintain focus on an interdisciplinary, compulsory offering.
- Versions of the course that underwent significant curricular modifications (such as shifts to online/hybrid formats or major content changes) are excluded to ensure comparability.
- Courses implemented under pilot programs, temporary adaptations, or short-term educational initiatives are not included in the analysis.
- Any course lacking a formal syllabus or official curricular approval is excluded, as the study relies on structured programmatic analysis.

By applying these criteria, the study ensures that the selected Course on Principles of Sustainability represents a consistent and standardized educational experience, allowing for a meaningful evaluation of its impact on sustainability education in higher education.

## Results

The "Course on Principles of Sustainability" represents an effort to integrate sustainability into undergraduate education. Below is a critical analysis of the program from various key dimensions:

- This course is part of the Personal and Social Development Program (PPS), indicating that sustainability is approached as a complementary aspect of education rather than a core component of students' disciplinary training. Although the graduation profile declares sustainability as an institutional hallmark, its application within the curricular structure remains limited.

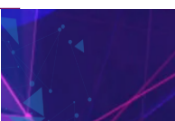


- The course combines theory and practice through debates, case analysis, essays, and fieldwork. However, it is unclear whether Project-Based Learning (PBL), Service-Learning (SL) or other active learning methodologies are employed to enable the real application of sustainability principles in diverse professional contexts.
- While the course develops a generic competency related to sustainability, its impact on professional practice may be limited, as there is no direct connection to real-world problems within students' specific disciplines. A more effective approach would require greater integration with students' areas of specialization.
- The assessment system includes reading controls, essays, case analysis, and final projects. However, it primarily focuses on conceptual evaluation rather than the practical application of sustainability through projects or interventions in real-world environments.
- The course includes field trips and identification of local problems, which is a strength. However, to achieve a greater impact, it is recommended that these activities be integrated with service-learning projects, where students can design and implement sustainable solutions in communities or industries.

Table 1 compares the integration of sustainability in an *ad hoc* course versus its integration through active learning methodologies, embedded transversally across an entire academic program. This comparison highlights the differences in scope, depth of learning, and long-term impact on students' competencies, emphasizing the advantages of a holistic and interdisciplinary approach to sustainability education.

**Table 1:** Course vs. Transversal Active Learning Methodologies

Comparison criteria	Course	Transversal active learning methodologies
Methodological approach	Based on the combination of theory and practice within a specific course through debates, case analysis, essays, and field trips.	Active learning methodologies are implemented across various subjects to integrate sustainability throughout the curriculum.
Curricular scope	Limited to a single course within the academic program.	Incorporated into multiple courses and disciplines, fostering a holistic understanding of sustainability.
Interdisciplinarity	Focused primarily on developing competencies within the course itself, without necessarily connecting to other disciplines.	Encourages the integration of different disciplines, allowing students to address sustainability from diverse perspectives.
Practical application	Includes specific activities such as debates and case analysis, culminating in a sustainability action proposal.	Uses active learning methodologies like problem-based learning (PBL), service-learning, design thinking, and interdisciplinary projects to solve real-world sustainability issues.
Student autonomy	Emphasizes autonomy with teacher supervision but within a structured course.	Promotes the progressive development of autonomy across different levels and subjects through methodologies such as participatory action research.





Comparison criteria	Course	Transversal active learning methodologies
Impact on learning	Encourages students to reflect on their role in sustainability, but its impact may be limited to the course's scope.	Generates a more comprehensive education, where sustainability becomes an integral component throughout the student's academic journey.
Assessment of learning	Not clearly defined in the proposal, although essays and critical analyses are included.	Transversal rubrics can be designed to assess sustainability competencies continuously across different subjects.
Field experiences	Includes field trips for the observation and analysis of environmental issues.	Can incorporate professional internships focused on sustainability, interdisciplinary fieldwork, and long-term community projects.
Sustainability as a Transversal Competency	Sustainability is addressed in a specific course.	Becomes a core transversal component of education, integrated into institutional culture and student decision-making.

**Source:** Own elaboration.

As observed, this workshop course is a valuable strategy for raising awareness among students about the importance of sustainable development. However, its impact is limited to a single curricular space. In contrast, the implementation of transversal active learning methodologies allows sustainability to become a key competency, fostering continuous, interdisciplinary, and real-world applied learning in students' professional training.

Based on the document review of the course program 'Introduction to Principles of Sustainability,' we now respond to the research questions posed in this study.

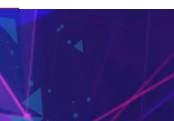
### 1. *What professional competencies does this course develop in students?*

The course develops the generic competency of "Commitment to the economic, environmental, and social sustainability of actions." This means that students are expected to integrate sustainability principles and social responsibility into their disciplinary field, contributing to economic development, scientific advancement, and social equity.

### 2. *What learning methodologies are implemented in this course?*

The course employs an integrated workshop methodology, combining theory and practice in a continuous and inseparable manner. Key learning methodologies include:

- Guided reading and discussion (debates)
- Case analysis
- Essay writing
- Field visits (field trips)
- Final Integration Project





### 3. How does this course connect with other curricular components within the study program?

This course is part of the Personal and Social Development Program (PPS) and contributes to the graduation profile by developing sustainability as a transversal institutional value. It integrates environmental and gender perspectives, aligning with the university's broader commitment to responsible citizenship and sustainable development. It connects with the academic training of undergraduate students by promoting reflection on professional practices and decision-making within a sustainability framework.

However, addressing sustainability solely through a stand-alone course does not effectively foster a sustainable mindset among students. On the contrary, research indicates that integrating sustainability transversally throughout the entire study program—via specifically designed learning outcomes and active learning strategies—is a more effective approach. This holistic model enhances student engagement and relieves them from the additional workload associated with fulfilling the academic demands of a mandatory course, treating sustainability instead as an integral and meaningful part of their educational experience.

## Discussion

The findings of this study contribute to the ongoing debate on the most effective strategies for integrating sustainability into higher education curricula. The analysis of the Sustainability Principles Course at a Chilean public university revealed key challenges associated with addressing sustainability through a standalone, mandatory course taught by specialists. While such courses provide foundational knowledge, they often fail to embed sustainability as a transversal competency across the curriculum, thereby limiting its practical application in professional settings.

One of the main limitations of ad hoc sustainability courses is their compartmentalization, which confines sustainability education to a single curricular space. As a result, students may perceive sustainability as an isolated subject rather than an essential cross-disciplinary competency. This is consistent with previous research (Segalàs et al., 2010; Myers & Beringer, 2010), which found that students often associate sustainability primarily with technological aspects while overlooking its social and attitudinal dimensions. This narrow perspective underscores the need for educational strategies that foster a more comprehensive and interdisciplinary understanding of sustainability.

In contrast, the study highlights the benefits of a transversal and competency-based approach, which integrates sustainability into various courses across an academic program. By embedding sustainability into different disciplines and employing active learning methodologies such as Project-Based Learning (PBL), Service-Learning (SL), and real-world problem-solving, students develop critical thinking skills and interdisciplinary knowledge. This approach enhances students' ability to transfer sustainability principles into their professional practice, making them more capable of addressing complex sustainability challenges in diverse work environments.



Moreover, the study reaffirms the role of faculty engagement in the effective implementation of sustainability education. Without adequate faculty training and institutional support, sustainability remains a secondary component of the curriculum rather than a fundamental educational pillar. Universities that successfully integrate sustainability across programs adopt interdisciplinary collaboration, experiential learning, and continuous assessment as core strategies, ensuring that sustainability competencies are effectively developed and applied.

The comparison between the standalone course model and the transversal integration model also aligns with broader discussions in sustainability education. International frameworks, such as UNESCO's Education for Sustainable Development (ESD), advocate for holistic, interdisciplinary approaches that prepare students to navigate real-world sustainability challenges. This study's findings reinforce the importance of shifting from passive learning structures to competency-based, experiential education, which fosters transformational change in both academic and professional domains

Specifically, this study critically evaluated the Sustainability Principles Course at a Chilean public university, highlighting the limitations of addressing sustainability through a standalone, mandatory course. The findings suggest that while such courses provide foundational knowledge, they fall short in ensuring the practical application of sustainability principles across different academic and professional contexts.

A key shortcoming of the ad hoc course model is its lack of interdisciplinary integration, which restricts students from developing a holistic understanding of sustainability beyond their immediate field of study. Additionally, passive learning approaches limit the development of essential competencies such as critical thinking, problem-solving, and real-world application of sustainability principles.

In contrast, a transversal and active-learning-based integration of sustainability within the curriculum fosters deeper engagement and long-term retention. Embedding sustainability concepts into various courses across an academic program promotes interdisciplinary collaboration, enhancing students' ability to apply these principles in diverse professional settings.

Thus, the study reinforces the need to move beyond isolated sustainability courses toward an approach that incorporates active learning methodologies and ensures sustainability is a core competency throughout the curriculum.

Ultimately, the effectiveness of sustainability education depends on how well it is integrated into the broader academic experience. Universities that embrace a holistic and cross-disciplinary approach will be better equipped to produce graduates capable of driving meaningful environmental, social, and economic change in their respective fields. This requires not only the inclusion of sustainability in curricula but also the alignment of institutional culture, teaching methodologies, and assessment practices. Such integration ensures that sustainability becomes a lived value, influencing decision-making and professional practice beyond the classroom.



## Conclusions

This study critically analyzed the Sustainability Principles Course at a Chilean public university, highlighting its strengths and limitations in fostering sustainability competencies among students. While the course represents an important institutional effort to integrate sustainability into undergraduate education, its standalone format limits its impact and effectiveness in preparing students for real-world sustainability challenges. A more integrated, interdisciplinary, and competency-based approach is recommended to enhance the development of meaningful, transferable skills aligned with the complex demands of contemporary sustainable development.

The findings suggest that embedding sustainability as a transversal competency across multiple courses is a more effective approach than restricting it to a single, specialist-led course. The comparison between standalone courses and transversal integration demonstrates that active learning methodologies such as Project-Based Learning (PBL), Service-Learning (SL), and problem-solving in real-world contexts foster deeper engagement, interdisciplinary collaboration, and practical application of sustainability principles.

Moreover, the study reaffirms the importance of faculty training and institutional support in sustainability education. Without a coordinated and strategic effort to integrate sustainability throughout the curriculum, its role remains marginal, limiting students' ability to apply sustainable principles across diverse professional contexts. Faculty need both the knowledge and pedagogical tools to embed sustainability meaningfully into their teaching. Institutional leadership, in turn, must foster a culture of sustainability that is reflected in policies, resources, and long-term academic planning.

Ultimately, this research supports the need for a paradigm shift in sustainability education. Moving beyond isolated courses toward a competency-based, interdisciplinary approach ensures that students acquire the skills, knowledge, and attitudes necessary to address complex sustainability challenges. Universities must prioritize holistic curriculum integration, foster collaborative and inclusive learning environments, and implement continuous assessment strategies to ensure long-term retention and real-world application of sustainability competencies. Such transformation is essential to empower graduates to become responsible, ethical professionals capable of driving systemic change in a rapidly evolving global context.

By adopting these changes, higher education institutions can play a transformative role in shaping future professionals committed to sustainability, capable of implementing innovative solutions that contribute to a more sustainable and equitable society. This transformation requires not only curricular reform, but also institutional alignment, faculty engagement, and the creation of learning environments that foster critical thinking, collaboration, and social responsibility. In doing so, universities become key drivers of change, empowering graduates to act as ethical leaders and agents of positive impact in their communities and beyond.



## Recommendations

Based on the findings of this study, it is evident that a standalone sustainability course is insufficient to ensure the effective integration of sustainability principles into higher education. To foster long-term learning and practical application, universities must adopt a more comprehensive approach that embeds sustainability transversally across curricula and promotes active learning methodologies.

The following recommendations aim to enhance the integration of sustainability education, ensuring that students acquire interdisciplinary competencies, critical thinking skills, and hands-on experience. These strategies will help institutions equip future professionals with the knowledge and abilities needed to address complex sustainability challenges in real-world settings:

- HEIs should embed sustainability as a cross-cutting competency in multiple courses rather than confining it to a single, specialist-taught course. This ensures that students engage with sustainability across various disciplines and professional contexts.
- Sustainability education should incorporate Project-Based Learning (PBL), Service-Learning (SL), and problem-solving in real-world contexts. These methods enhance students' ability to apply sustainability principles in practice, fostering a transformative learning experience.
- Sustainability challenges are inherently multidimensional. Universities should promote collaborative courses and projects involving multiple faculties, ensuring that students from different disciplines work together to develop comprehensive sustainability solutions.
- Professors across all disciplines should receive professional development in sustainability teaching methodologies. This will help integrate sustainability effectively into their courses and ensure active, competency-based learning approaches are applied.
- Institutions should establish clear learning outcomes and assessment tools to measure students' competency development in sustainability. This will ensure accountability and continuous improvement in sustainability education.

By adopting these recommendations, universities can ensure that sustainability education goes beyond theoretical knowledge, fostering meaningful professional training and ensuring that students graduate with the skills needed to drive sustainable change in their respective fields. This includes the ability to think critically, act ethically, collaborate across disciplines, and respond effectively to complex environmental and social challenges within real-world professional and community contexts.

### Note:

- In accordance with the Artificial Intelligence Usage Policy of *Revista Electrónica Transformar/Transformar Electronic Journal*, we employed artificial intelligence tools, specifically ChatGPT-4o, to enhance the clarity, coherence, and readability of complex texts. This AI-assisted approach was used to refine the structure and language of manuscripts while maintaining the original meaning and academic rigor of the content. This methodology aligned with ethical guidelines on AI-assisted writing, ensuring that human expertise remained central to content validation and decision-making. The integration of artificial intelligence in scholarly writing demonstrates its potential as a support tool for academic editing while reaffirming the importance of authorial responsibility in the final output.



## References

- Abo-Khalil, A.G. (2024). Integrating sustainability into higher education challenges and opportunities for universities worldwide. *Heliyon*, 10(9), 1-13. <https://doi.org/10.1016/j.heliyon.2024.e29946>
- Bataeineh, M. a& Aga, O. (2023), Integrating sustainability into higher education curricula: Saudi Vision 2030. *Emerald Open Research*, 1(3), 1-13. <https://doi.org/10.1108/EOR-03-2023-0014>
- Bui,H.T.M., Tung Bui, T. & Binh Thai Pham,B.T. (2024). The role of higher education in achieving sustainable development goals: An evaluation of motivation and capacity of Vietnamese institutions. *The International Journal of Management Education*, 22(3), 101088. <https://doi.org/10.1016/j.ijme.2024.101088>
- Caniglia, G., Luederitz, C., Wirth, T., Fazey, I., Martín-López, B., Hondrila, K., König, A., Wehrden, H., Schöpke, N., Laubichler, M., & Lang, D. (2020). A pluralistic and integrated approach to action-oriented knowledge for sustainability. *Nature Sustainability*, 4, 93 - 100. <https://doi.org/10.1038/s41893-020-00616-z>
- De Paula Arruda Filho, N., Hino, M., & Beuter, B. (2019). Including SDGs in the education of globally responsible leaders. *International Journal of Sustainability in Higher Education*. <https://doi.org/10.1108/IJSHE-01-2019-0032>.
- Eizenberg, E., & Jabareen, Y. (2017). Social Sustainability: A New Conceptual Framework. *Sustainability*, 9, 68. <https://doi.org/10.3390/SU9010068>
- Filho, L., Eustachio, J., Caldana, A., Will, M., Salvia, A., Rampasso, I., Anholon, R., Platje, J., & Kovaleva, M. (2020). Sustainability Leadership in Higher Education Institutions: An Overview of Challenges. *Sustainability*. <https://doi.org/10.3390/su12093761>
- González, A., Martín, J., Vaca-Tapia, A., & Rivas, F. (2021). How Sustainability Is Defined: An Analysis of 100 Theoretical Approximations. *Mathematics*. <https://doi.org/10.3390/MATH9111308>
- Guerra, A., Jiang, D., & Du, X. (2024). What does it mean to be engaged? The engagement of student engineers with sustainability: a literature review. *International Journal of Sustainability in Higher Education*. <https://doi.org/10.1108/ijshe-06-2023-0237>.
- Kaimovs, M., & Skarupins, A. (2024). INTEGRITY OF VARIOUS ASPECTS OF SUSTAINABILITY. *Economics & Education*. <https://doi.org/10.30525/2500-946x/2024-2-1>
- Marouli, C. (2021). Sustainability Education for the Future? Challenges and Implications for Education and Pedagogy in the 21st Century. *Sustainability*. <https://doi.org/10.3390/SU13052901>
- Martínez Casanovas, M., Buil-Fabregá, M., & Ruíz-Munzón, N. (2021). Higher education: the best practices for fostering competences for sustainable development through the use of active learning methodologies. *International Journal of Sustainability in Higher Education*, 23(3), 703–727. <https://doi.org/10.1108/ijshe-03-2021-0082>
- Membrillo-Hernández, J., Lara-Prieto, V., & Caratozzolo, P. (2021). Sustainability: A Public Policy, a Concept, or a Competence? Efforts on the Implementation of Sustainability as a Transversal Competence throughout Higher Education Programs. *Sustainability*. <https://doi.org/10.3390/su132413989>
- Morgan, H. (2022). Conducting a Qualitative Document Analysis. *The Qualitative Report*. <https://doi.org/10.46743/2160-3715/2022.5044>
- Obrecht, M., Feodorova, Z., & Rosi, M. (2022). Assessment of environmental sustainability integration into higher education for future experts and leaders.. *Journal of environmental management*, 316, 115223 . <https://doi.org/10.1016/j.jenvman.2022.115223>



- Sahoo, S., Das, A., Samanta, S., & Goswami, S. (2023). Assessing the Role of Sustainable Development in Mitigating the Issue of Global Warming. *Journal of process management and new technologies*. <https://doi.org/10.5937/jpmnt11-44122>
- Sánchez-Carrillo, J., Cadarso, M., & Tobarra, M. (2021). Embracing higher education leadership in sustainability: A systematic review. *Journal of Cleaner Production*, 298, 126675. <https://doi.org/10.1016/j.jclepro.2021.126675>
- Segalàs, J., Ferrer-Balas, D. & Mulder, K.F. (2010). What do engineering students learn in sustainability courses? The effect of the pedagogical approach, *Journal of Cleaner Production*, 18(3), 275-284. <https://doi.org/10.1016/j.jclepro.2009.09.012>
- Shrivastava, P., Smith, S., O'Brien, K., & Zsolnai, L. (2020). Transforming Sustainability Science to Generate Positive Social and Environmental Change Globally. *One Earth (Cambridge, Mass.)*, 2, 329 - 340. <https://doi.org/10.1016/j.oneear.2020.04.010>
- Tejedor, G., Segalás, J., Barrón, Á., Fernández-Morilla, M., Fuertes, M., Ruiz-Morales, J., Gutiérrez, I., García-González, E., Aramburuzabala, P., & Hernández, À. (2019). Didactic Strategies to Promote Competencies in Sustainability. *Sustainability*. <https://doi.org/10.3390/SU11072086>
- UNESCAP (2015). *Integrating the three dimensions of sustainable development: A framework and tools*. <https://www.unescap.org/publications/integrating-three-dimensions-sustainable-development-framework-and-tools>
- UNESCO (2019). *UNESCO: Education for Sustainable Development (ESD)*. <https://unfccc.int/sites/default/files/resource/2%20UNESCO.pdf>
- Vera, F. (2017). Cambio paradigmático: Un análisis crítico de la sostenibilización curricular en la educación superior chilena. *Revista Akademia* 16(1), 53-73. <https://revistas.ugm.cl/index.php/rakad/article/view/137>
- Vera, F. (2022). La perspectiva de docentes sobre la infusión de la sostenibilidad en el currículo de la educación superior. *Transformar*, 3(2), 17-37. <https://www.revistatransformar.cl/index.php/transformar/article/view/57>
- Vera, F. (2024a). Infusion of sustainability into higher education institutions: Case of a sustainable campus network in Chile. *Transformar*, 5(1), 4-12. <https://revistatransformar.cl/index.php/transformar/article/view/113>
- Vera, F. (2024). Reimagining Higher Education: The Necessity for Transformational Change. *Transformar*, 5(3), 23-35. <https://revistatransformar.cl/index.php/transformar/article/view/133>
- Žalėnienė, I., & Pereira, P. (2021). Higher Education for Sustainability: A Global Perspective. *Geography and Sustainability*. <https://doi.org/10.1016/J.GEOSUS.2021.05.001>
- Dmochowski, J., Garofalo, D., Fisher, S., Greene, A., & Gambogi, D. (2016). Integrating Sustainability across the University Curriculum. *International Journal of Sustainability in Higher Education*, 17, 652-670. <https://doi.org/10.1108/IJSHE-10-2014-0154>