

Students' Perceptions of Sustainability Mindset Change in Higher Education

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Abstract

This study aims to determine students' perceptions about changes in their mindset and behaviour because of what they have learned in their undergraduate program. The Gioia methodology was applied to a group of university graduates. The analysis reveals that university education in sustainability generates impacts in three interconnected dimensions: formative (cognitive changes in awareness, perspective, and personal responsibility), pedagogical (experience and project-based learning as drivers of meaningful internalization), and attitudinal (gradual adoption of values indicating a shift toward deeper change at the behavioral and identity levels). Universities must prioritize systemic integration of sustainability across curricula, emphasizing experiential and interdisciplinary elements to amplify formative and pedagogical impacts while nurturing attitudinal shifts.

Keywords: Sustainability; Higher Education

1. Introduction

Climate change is one of the most pressing issues of our time, with far-reaching impacts on ecosystems, human health, and economic stability. The consequences of climate change are already evident, manifesting in rising global temperatures, increased frequency of extreme weather events, and significant threats to biodiversity and human livelihoods (Nabi et al., 2024). The urgency to address climate change stems from its multifaceted impacts, which include the exacerbation of poverty, social instability, and economic disruptions (Ardila Echeverry et al., 2025; Moss, 2016).

Sustainability education, often termed Education for Sustainable Development (ESD), is a multidisciplinary and transformative field aimed at equipping learners to address complex

environmental, social, and economic challenges (Gericke, 2025). It integrates diverse disciplines to promote critical thinking, systems thinking, and action-oriented competencies, emphasizing transformative learning beyond traditional content acquisition.

Higher education institutions (HEIs) are uniquely positioned to lead the fight against climate change through their multifaceted roles in education, research, operations, and community engagement (Berchin et al., 2018). By integrating sustainability into their core missions and modeling best practices, HEIs can significantly contribute to global climate action and inspire the next generation of leaders to take decisive action (Berchin et al., 2018; Elsayed et al., 2025).

To guide the study, a research question was formulated to explore how university students perceive changes in their sustainability-related mindset and behaviors resulting from their academic education, thereby providing insight into the perceived impact of higher education on sustainability-oriented learning and practice.

2. Theoretical framework

Although a universally agreed-upon definition of sustainability has yet to be established, the concept has progressively expanded to encompass three core dimensions: social, economic, and environmental sustainability. Sustainability defines as satisfying the needs of current and future generations, depending on appropriate circumstances of human, natural, and economic capital to provide for human welfare (Hajian & Jangchi Kashani, 2021). Early scholarly work predominantly emphasized the environmental dimension, often treating it as more salient than the social and economic aspects; however, over time, increasing attention has been directed toward the latter two dimensions, leading to a more balanced understanding of sustainability (Erguvan, 2024).

Holistic approaches are essential to address interconnected dimensions and manage trade-offs effectively, as sustainability has become a central concern in higher education amid complex environmental, social, and economic challenges. Universities are increasingly recognized as key actors in advancing the Sustainable Development Goals (SDGs) through education, research, and community engagement (Song et al., 2025). The integration of sustainability into university curricula is not only a response to external policy pressures but also a strategic opportunity to prepare graduates for leadership in a rapidly changing world (Song et al., 2025; Zizka & Varga, 2021). These initiatives position education as a catalyst for societal transformation and climate action, with sustainability education increasingly seen as essential for preparing learners to navigate a rapidly changing world (Bauer & Morlock, 2026; Hofman-Bergholm, 2018; Perkins et al., 2018).

Sustainability in education refers to the systematic integration of environmental, social, and economic dimensions of sustainable development into educational curricula, pedagogy,

institutional policies, and campus operations. This approach aims to equip learners with the knowledge, skills, values, and agency necessary to address complex global challenges such as climate change, resource depletion, and social inequity (Aghajani et al., 2025; Alenezi & Alanazi, 2024; Wardat & AlAli, 2025). Sustainability in education is reinforced by the United Nations Sustainable Development Goals, particularly SDG 4 (Quality Education), which call for transformative educational practices (Aghajani et al., 2025; Alenezi & Alanazi, 2024).

3. Methods

The Gioia methodology (Gioia et al., 2013) is an inductive qualitative approach designed to build theory from data with high rigor and transparency. It structures analysis in three levels: first-order concepts (participants' own terms), second-order themes (researcher interpretations), and aggregate dimensions (theoretical categories), ensuring traceability between raw data and conceptual insights. An intergenerational comparison was conducted using the Gioia methodology.

The qualitative responses from the Gen2024 and Gen2025 cohorts were analyzed separately and classified according to the previously defined aggregate dimensions: formative impact, pedagogical impact, attitudinal impact, and diffuse impact. For each generation, the frequency of occurrence of each dimension was calculated, allowing for an examination of the distribution of student discourse and its relative emphasis on different types of impact.

This study was conducted with the participation of eighth-semester students enrolled in the B.A. in Strategy and Business Transformation (BBA) program at Tecnológico de Monterrey. The questionnaire was administered to graduating students in June 2024 and June 2025. This level of sample ensures representativeness in terms of diversity of graduates on different campuses. This procedure transforms the qualitative analysis into a systematic comparative exercise by incorporating a quantitative layer that enhances methodological rigor. In doing so, it not only identifies dominant conceptual patterns but also assesses their relative weight across cohorts.

4. Results

The descriptive analysis shows consistently high perceived sustainability mindset change in both cohorts. Gen2024 reported a mean score of 8.52 out of 10 ($SD = 1.37$), while Gen2025 reported a mean score of 8.28 ($SD = 1.53$). In both cases, the median was high, suggesting that most students perceived a meaningful transformation in their sustainability-related mindset and behavior. Moreover, 84.5% of Gen2024 and 75.7% of Gen2025 rated their perceived change at 8 or above.

The ecological intelligence scale also showed favorable results. Gen2024 obtained a mean score of 4.04 out of 5, while Gen2025 obtained a mean score of 3.92. Reliability analysis indicated

acceptable internal consistency for Gen2024 (Cronbach's $\alpha = 0.756$) and moderate internal consistency for Gen2025 (Cronbach's $\alpha = 0.649$). See Table 1.

Table 1. Statistical indicators

Indicator	Gen2024	Gen2025
Valid responses (n)	84	202
Mean perceived change (1–10 scale)	8.52	8.28
Standard deviation	1.37	1.53
Median	9	8.5
% with score ≥ 8	84.50%	75.70%
Mean ecological intelligence (1–5 scale)	4.04	3.92
Cronbach's alpha (12 items)	0.756	0.649

Own elaboration, with research data, 2025

The separation between Gen2024 and Gen2025 was developed, and the frequency of each Aggregate Dimension was calculated. The results obtained are shown in Table 2.

Table 2. Comparison of Gen24 and Gen25

Generation	Aggregate_dimension	Frequency
Gen2024	Attitudinal Impact	1
Gen2024	Diffuse Impact	54
Gen2024	Formative Impact	19
Gen2024	Pedagogical Impact	10
Gen2025	Attitudinal Impact	2
Gen2025	Diffuse Impact	238
Gen2025	Formative Impact	53
Gen2025	Pedagogical Impact	28

Own elaboration, with research data, 2025.

When removing "Diffuse Impact" (which is typical methodological noise in an initial coding), the strong dimensions remain which are:

Gen2024

- Formative impact: 19
- Pedagogical impact: 10
- Attitudinal Impact: 1

Approximate proportions:

- Formative $\approx 63\%$
- Pedagogical $\approx 33\%$
- Attitudinal $\approx 4\%$

In Gen 2024, the discourse was centered on "it made me more conscious" and "I learned things," indicating cognitive and academic change, but almost nothing related to identity. Two out of

three mentions focus on educational impact. Pedagogical impact accounts for one out of three references, confirming methodological relevance. Attitudinal impact appears only once, indicating a virtually non-existent internalization of identity in this cohort. In empirical terms, Gen2024 discourse is 18 times more cognitive than attitudinal, confirming that the educational effect lies almost exclusively in the realm of learning and not of being.

Gen2025

Approximate proportions:

- | | |
|--------------------------|-----------------------------|
| • Formative impact: 53 | •Formative $\approx 64\%$ |
| • Pedagogical impact: 28 | •Pedagogical $\approx 34\%$ |
| • Attitudinal Impact: 2 | •Attitudinal $\approx 2\%$ |

In this cohort, the structure remained the same, but the volume increased, and the pedagogical language became more stable: projects, experience, and practical application. The percentage structure remains almost identical to Gen2024 (variations < 1 pp); the formative impact grows +179% in absolute frequency (from 19 to 53). However, the pedagogical impact grows by +180% (from 10 to 28) and the attitudinal impact doubles but still represents less than 3% of the total. Although the relative weight of the attitudinal impact decreases slightly (-1 pp), its persistence and absolute doubling indicate the beginning of processes of internalization of values, still in an early phase.

4. Discussion and Conclusion

The analysis shows that university sustainability education generates impacts across three interconnected dimensions: formative (shifts in awareness, perspective, and responsibility), pedagogical (experiential and project-based learning as drivers of internalization), and attitudinal (emerging value adoption and behavioral change). These findings align with the field's shift toward holistic, transformative approaches centered on experiential learning and engagement (Song et al., 2025; Zizka & Varga, 2021). For example, the formative impact—seen in students' increased sense of responsibility and broader perspectives—aligns with literature emphasizing higher education's role in fostering sustainability through cognitive transformation and critical environmental awareness, positioning universities as key actors in preparing students to address complex challenges such as climate change with innovative, solutions-oriented approaches, as noted by Berchin et al., (2018) and Elsayed et al., (2025).

The strong pedagogical dimension, linked to practical projects and experiential methodologies, supports the evidence that innovative pedagogies, such as those incorporated into whole-institutional approaches (WIAs), are effective in developing not only knowledge but also practical skills and reflective abilities, in accordance with (Bauer & Morlock, 2026; Hofman-Bergholm, 2018; Perkins et al., 2018).

At the same time, the emergence of attitudinal impact, though less dominant, points to processes of value internalization and a transition from mere "learning about" to "being for" sustainability. This suggests progressive consolidation of a reflective culture, consistent with transformative education frameworks that aim to move beyond surface-level awareness toward committed, long-term behavioral shifts (Wardat and AlAli, 2025). The comparison between Gen2024 and Gen2025 shows a stable three-dimensional model, with the latter cohort demonstrating greater discursive clarity—especially in pedagogical terms—indicating growing maturity in how students articulate and apply their learning. Such patterns reinforce the idea that university initiatives yield cumulative effects, strengthening a culture of applied sustainability learning over time (Gericke, 2025).

Universities should integrate sustainability across curricula through transformative pedagogy and strong leadership, while expanding access via contextualized content, technology, and coordinated efforts across academia, policy, and society to scale impact and enhance long-term resilience.

The Gioia methodology strengthened analytical rigor and enabled cohort comparison, confirming the robustness of the formative, pedagogical, and attitudinal structure. In both Gen2024 and Gen2025, formative impact remains dominant, followed by pedagogical gains from experiential learning, while attitudinal shifts—though less frequent—signal emerging internalization of sustainability-oriented values.

Future research should pursue longer-term longitudinal tracking and refine the mixed Gioia methodology across diverse, multicultural samples to better capture emerging sustainability competencies and values.

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Appendix

Questionnaire used (Okur-Berberoglu, 2020).

- 1.- I get my full water bottle while leaving home.
- 2.- I wonder about increasing of cancer events in industrial areas.
- 3.- Degenerated environmental conditions can cause negative effect on mental health.
- 4.- What a pity!, people think that technology can solve every problem, although technology cannot produce one-grams of organic honey.
- 5.- The reflection of environmental problems can be seen at the same time, in succession, and more than one area.
- 6.- I try to pattern people who have positive ecologic behavior in my social life.
- 7.- I prefer to buy local vegetables and fruits.
- 8.- I believe that one of the ways of fighting obesity is environmental education.
- 9.- I have remorse to know some goods I buy, are produced by exploitation of human work.
- 10.- One of the reasons of immigration of rural people is the job lost due to global firms.
- 11.- Global firms prevent local producers to have profit.
- 12.- People, to immigrate to another place, are cheaper laborer sources for big companies.
- 13.- Using a scale of 1 to 10, how much do you think your mindset and behavior regarding sustainability have changed as a result of what you learned during your professional career? (Where 1 is not at all, and 10 is completely)
14. Please provide a reason or explanation for your previous answer.

For questions 1 through 12, a Likert scale was used:

1. *Completely agree*; 2. *Partly agree*; 3. *Not sure*; 4. *Partly disagree*; 5. *Completely disagree*

*An ordinal scale from 1 to 10 was used for question 13.

*Question 14 was an open-ended question.