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Scientific articles

La sustentabilidad en los programas educativos en las instituciones de educación superior: un enfoque cuantitativo

Sustainability in educational programs in higher education institutions: a quantitative approach

Sustentabilidade em programas educacionais em instituições de ensino superior: uma abordagem quantitativa

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Resumen

La presente investigación indaga la incorporación de contenidos y principios de sustentabilidad en los programas de educación superior, mediante un enfoque cuantitativo. Este estudio indica la importancia de la presencia de contenidos y estrategias pedagógicas asociadas al desarrollo sustentable.

Se utilizan instrumentos de recolección de información para identificar el tema de la sostenibilidad en los programas educativos y realizar el análisis de los datos obtenidos.

En las Instituciones de Educación Superior (IES), los temas de sustentabilidad deben reconocerse como una dimensión necesaria, tanto en la gestión académica como administrativa. Su incorporación exige una perspectiva sistemática que permita profundizar en los procesos, políticas, principios, y competencias que se integren en los programas de estudio y se reflejen no sólo en el discurso sino también en la práctica institucional.

La responsabilidad social de las IES, implica formar profesionales con principios respecto a los temas de sustentabilidad, deben desplegar todos los esfuerzos para responder a las necesidades de una sociedad que priorice su actuar en la protección del ambiente y el cuidado de los recursos, así como la búsqueda y el logro de la calidad de vida y la equidad social.

Los resultados dan cuenta de los avances desiguales en la integración de la sostenibilidad, con supremacía en los enfoques disciplinares y la escasa transversalidad curricular, por lo que se propone fortalecer políticas institucionales que permitan mejorar la incursión de estos temas y articular los objetivos del desarrollo sostenible con los programas educativos de la educación superior.

Palabras clave: desarrollo sostenible, educación superior, programas educativos, sustentabilidad.

Abstract

This research investigates the incorporation of sustainability content and principles into higher education programs using a quantitative approach. This study indicates the importance of including content and pedagogical strategies associated with sustainable development.

Data collection instruments are used to identify the theme of sustainability in educational programs and to analyze the data obtained.

In Higher Education Institutions (HEIs), sustainability issues must be recognized as a necessary dimension in both academic and administrative management. Their incorporation requires a systematic perspective that allows for a deeper understanding of the processes, policies, principles, and competencies integrated into study programs and reflected not only in discourse but also in institutional practice.

The social responsibility of HEIs implies training professionals with principles regarding sustainability issues. They must make every effort to respond to the needs of a society that prioritizes environmental protection and resource conservation, as well as the pursuit and achievement of quality of life and social equity. The results show uneven progress in integrating sustainability, with a predominance of disciplinary approaches and limited curricular cross-cutting, therefore it is proposed to strengthen institutional policies that allow for better inclusion of these topics and to link the objectives of sustainable development with the educational programs of higher education.

Keywords: sustainable development, higher education, educational programs, sustainability.

Resumo

Esta pesquisa investiga a incorporação de conteúdo e princípios de sustentabilidade em programas de ensino superior utilizando uma abordagem quantitativa. Este estudo indica a importância da inclusão de conteúdo e estratégias pedagógicas associadas ao desenvolvimento sustentável.

Instrumentos de coleta de dados são utilizados para identificar o tema da sustentabilidade em programas educacionais e para analisar os dados obtidos.

Nas Instituições de Ensino Superior (IES), as questões de sustentabilidade devem ser reconhecidas como uma dimensão necessária tanto na gestão acadêmica quanto na administrativa. Sua incorporação requer uma perspectiva sistêmica que permita uma compreensão mais profunda dos processos, políticas, princípios e competências integrados aos programas de estudo e refletidos não apenas no discurso, mas também na prática institucional.

A responsabilidade social das IES implica a formação de profissionais com princípios relacionados a questões de sustentabilidade. Elas devem envidar todos os esforços para responder às necessidades de uma sociedade que prioriza a proteção ambiental e a conservação de recursos, bem como a busca e a conquista da qualidade de vida e da equidade social. Os resultados revelam um progresso desigual na integração da sustentabilidade, com predominância de abordagens disciplinares e limitada integração interdisciplinar. Portanto, propõe-se o fortalecimento de políticas institucionais que aprimorem a inclusão desses temas e alinhem os Objetivos de Desenvolvimento Sustentável aos programas de ensino superior.

Palavras-chave: desenvolvimento sustentável, ensino superior, programas educacionais, sustentabilidade.

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Introduction

Studying and understanding sustainability issues requires a systematic analysis from social and economic perspectives, involving educational institutions interested in interdisciplinary and cross-cutting work.



programs and the inclusion of sustainability should foster the development of knowledge and skills in students that establish sustainable relationships with the environment and, consequently, with responsible decision-making, where in the near future a work performance in accordance with the principles of sustainable development can be observed. “The sustainable development approach should be strengthened in higher education institutions and outside the classroom. Fortunately, the educational authorities of many States are working in this direction. Leal Filho, W. (2009).

The irresponsible exploitation of environmental resources affects the global population, creating a need to integrate sustainable development into higher education programs in order to implement strategies and take actions that positively impact society and combat the problem at its root causes.

The inclusion of sustainability as a dimension of training in higher education should generate the development of knowledge and skills so that professionals trained in these institutions establish sustainable relationships with their environment and, consequently, responsible decision-making by the directors of the HEIs, a job performance and institutional management in accordance with the principles of sustainable development.

In recent years, sustainability has demanded action from all sectors of society, especially the education sector. The 2030 Agenda requires a commitment from 193 countries to an action plan that benefits people, the planet, and prosperity, with the aim of strengthening justice and sustainable development. In this context, education is the essential path to transforming societies toward equitable, egalitarian, and sustainable models.

Sustainability issues currently play a central role in the development of higher education institutions (HEIs), driving the promotion of sustainable principles and the Sustainable Development Goals (SDGs). These educational programs highlight the socioeconomic, political, and environmental challenges present in different contexts. Therefore, universities have a responsibility to educate informed citizens, foster critical thinking, and cultivate a culture of sustainability within society.

Integrating sustainable development topics into higher education programs not only represents a central responsibility to promote sustainable principles, but also a challenge to train professionals who are aware of environmental and socioeconomic problems, with critical thinking and a culture of sustainability that can be replicated for future generations.

In this context, these institutions play a strategic role, not only as generators of knowledge, but also as educators of critical, responsible citizens committed to their

environment. Despite this global recognition, a gap persists between institutional discourse and the concrete implementation of education for sustainability in educational programs.

This research analyzes the integration of sustainability into university curricula through a quantitative approach that identifies areas for improvement, strengths, and pedagogical strategies for incorporating these topics. The study is based on the application of a data collection instrument to a representative sample, aiming to generate useful evidence for academic decision-making.

The aim is to examine the incorporation of sustainability into the educational programs of higher education institutions (HEIs), through data analysis, and to evaluate the degree of implementation of sustainable strategies in the curricula, the perception of students and teachers on the importance of environmental education, as well as the impact of these initiatives on professional training and institutional development.

Problem statement

Currently, sustainability issues have gained importance in national and international discourse on education, but their integration into higher education institution (HEI) programs remains limited. Some universities have made commitments to promote sustainable development, although these are not always substantively reflected in their curricula, methodologies, strategies, or evaluation systems.

This creates a contradiction between the social function of universities in training students committed to the challenges of the present day and the educational reality that still maintains fragmented and disconnected traditional practices regarding socio-environmental problems. Therefore, it is relevant to investigate:

To what extent do educational programs integrate the principles of sustainability?

What aspects related to sustainability are included in the study programs?

How are environmental awareness and social responsibility topics promoted in curricula?

What skills related to these topics are promoted in the different academic programs?

What teaching methods, learning methods, and forms of assessment are used to promote a sustainable culture?

Methodology

This study employs a descriptive quantitative approach, as it sought to measure, analyze, and describe phenomena using numerical data obtained through a structured instrument. According to Hernández, Fernández, and Baptista (2014), the quantitative approach is characterized by being sequential, structured, and grounded in objectivity. This approach allowed for the identification of trends and relationships among the variables of interest, ensuring the reliability of the results.

The instrument used for data collection was subjected to expert judgment validation with contradictory evidence in higher education sustainability, achieving a content validity index of 0.89. A pilot test was conducted to ensure the clarity of the items and the internal reliability of the questionnaire, obtaining a Cronbach's alpha coefficient of 0.91. The study is focused on identifying and analyzing the degree of incorporation of sustainability topics that appear in higher education programs, as it allows obtaining measurable data, systematizing them, and establishing relationships between variables related to the topic of study.

Research design

A non-experimental, cross-sectional design was used, as the study variables were not manipulated and data collection occurred at a single point in time. This design allows for determining the current state of sustainability integration in higher education institution (HEI) educational programs.

The research design used is a non-experimental and cross-sectional design since no study variables were manipulated and the information was collected at a single point in time, which allows obtaining the current state of the integration of sustainability issues in the educational programs of the IES.

Population and sample

The population covered by the study consisted of: teachers, academic directors and students belonging to public sector higher education institutions.

The sample was taken from 4 public universities in the state of Durango. It consisted of 171 participants, including:

65 university teachers

92 students

14 managers, including administrative and academic directors.

The participating higher education institutions included technological universities with educational offerings in areas such as science, engineering, and education.

Data collection instrument

The questionnaire that was applied consists of 35 items organized into dimensions:

Dimension 1. Presence of sustainable content in curricula

Dimension 2. Competencies for sustainability: cognitive, affective and attitudinal

Dimension 3. Sustainable teaching methodologies used in education

Dimension 4. Evaluation strategies focused on learning outcomes in sustainability.

Dimension 5. Institutional perception of the importance of sustainability.

A 5-point Likert scale was used, where 1 is strongly disagree and 5 is strongly agree. The instrument used for data collection was validated by two experts in statistical analysis with contradictory findings in higher education sustainability, achieving a content validity index of 0.89. A pilot test was conducted to ensure the clarity of the items and the internal reliability of the questionnaire, obtaining a Cronbach's alpha coefficient of 0.91.

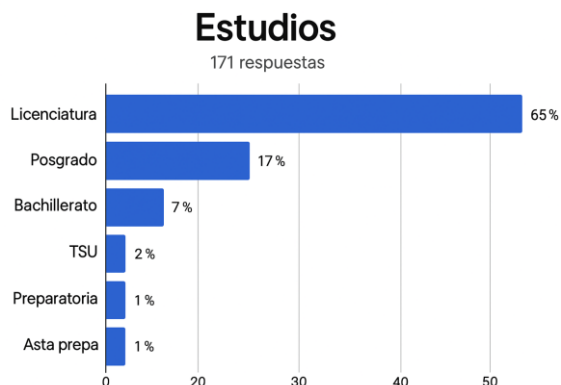
Procedure

The questionnaire was administered and data collected virtually using electronic forms over a period of six weeks. The data were then processed and analyzed using IBM SPSS Statistics version 27. Descriptive analyses and inferential tests were applied; most of the items were designed to identify perceptions, habits, and knowledge about sustainability in study plans and programs.

Results

For the study, students, faculty, and administrators from public universities were surveyed, with a total of 171 participants. A structured questionnaire and statistical analysis were used to identify perceptions, levels of knowledge, and the impact of sustainability education, across all educational levels, from high school to postgraduate. This is shown in the following figure.

Figure 1. Educational level of the respondents for this study.

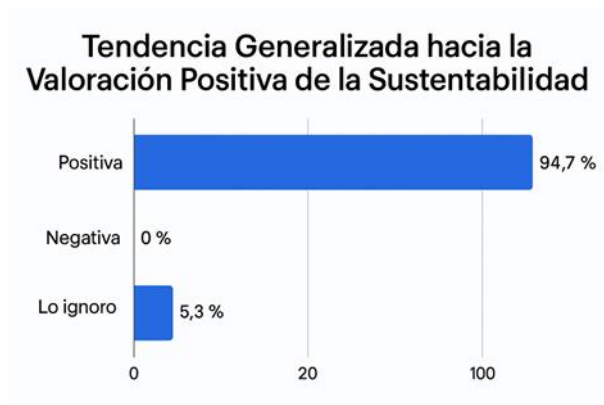


Source: *Own elaboration*

The gender distribution shows that **71%** of the analyzed population is male, while **29%** is female.

The results show a trend towards a positive assessment of sustainability among the participants, although with variations in terms of knowledge level, academic level, personal habits and institutional actions.

Figure 2. Level of positive assessment of sustainability



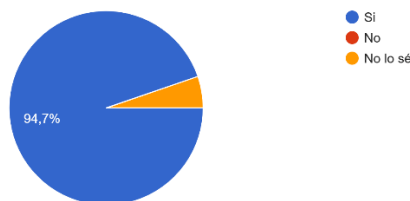
Fountain: Original work

In the analysis of the importance attributed to biodiversity for the economy, respondents gave an average score of 8.6 on a scale of 1 to 10, demonstrating a high degree of awareness regarding the interdependence between natural systems and economic processes. Regarding the level of knowledge about climate change, an average of 8.3 was

obtained, indicating a clear understanding of the problem, and 94% of respondents believe that sustainability issues should be included in higher education institution curricula.

Figure 3. Assessment of the level and application of sustainability in the institution.

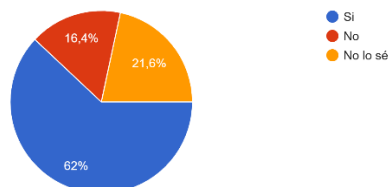
11) ¿Considera que la sustentabilidad puede aplicarse en su institución?
171 respuestas



Fountain: Original work

Figure 4. Conception of the application of sustainability in the institution.

12) ¿Cree que la universidad es sustentable?
171 respuestas

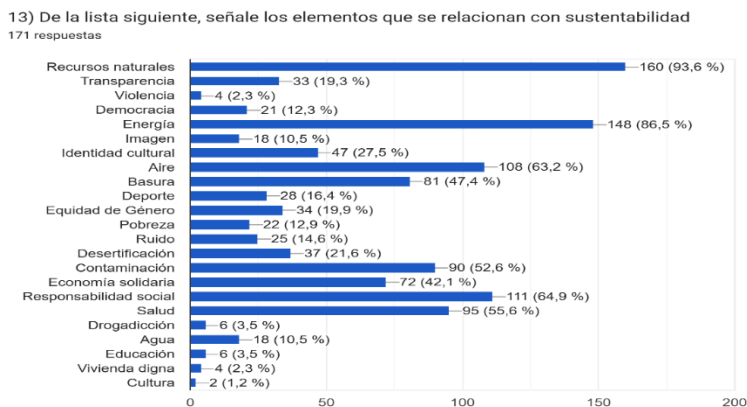


Fountain: Original work

In the item concerning the impact of consumption habits on climate change, the surveyed population gave an average rating of 7.4, indicating a moderate to high awareness of the relationship between individual lifestyle and environmental consequences. This perception does not always translate into consistent action; the frequency of purchases of biodegradable or organic products averages 6.2, reflecting a partial adoption of sustainable habits—that is, these habits are not yet consistent.

In the item referring to the elements related to sustainability, the following data were obtained as shown in the following graph, the element with the highest percentage was natural resources, 93.6% energy, 86.5% social responsibility 64.9%, air 63.2%, pollution 52.6% and health with 55.6%.

Figure 5. Elements related to sustainability.



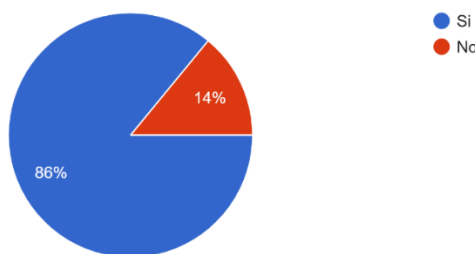
Fountain: Original work

Regarding the item of the practice of separating solid waste in the domestic sphere, it reached an average of 7.8%, while in the institutional environment, the frequency with which energy expenditure is monitored in university facilities obtained a slightly lower average of 7.1, which points to a greater consistency of sustainable habits at home than in the academic work environment.

Regarding the training required on sustainability issues, 86% of university students mentioned that training is required, while 14% did not consider it to be really necessary, as shown in the following graph.

Figure 6. Assessment of the level and application of sustainability in the institution.

43) ¿Consideras que un cambio en la universidad hacia la sustentabilidad requiere capacitación para involucramiento de todos los actores universitarios?
171 respuestas



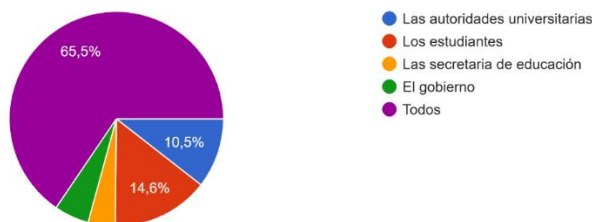
Source: Own elaboration

In the item on the recognition of hidden costs in the products we consume, whether environmental, social or economic, the average was 7.6, which gives us evidence of a growing sensitivity towards the indirect impacts of consumption.

Regarding the question of which actors should take action to promote a culture of sustainability in universities, the prevailing opinion is that all actors—authorities, students, academics, the community, and society at large—should be involved in promoting a culture of sustainability (65.5%). Secondly, 10.5% believe that university authorities have a responsibility to carry out promotional activities. Regarding whether they would like to participate in sustainable projects, the trend was positive, with a range of 5 to 10, as shown in Figures 7 and 8.

Figure 7. Agents who must take action on sustainability and participation in sustainable projects

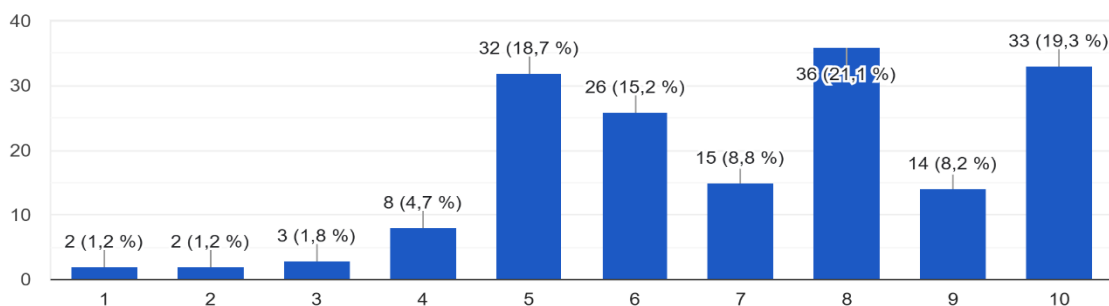
41) ¿Quiénes deben llevar a cabo acciones para fomentar una cultura de sustentabilidad?
171 respuestas



Fountain: Original work

Figure 8. Interest in participating in sustainability initiatives and sustainable projects

36) ¿Qué tanto le gustaría participar en un proyecto o actividad, sobre desarrollo sustentable que tenga en cuenta la relación entre factores ambientales, sociales y económicos de la universidad?
171 respuestas



Fountain: Original work

The people involved in this study showed a high interest in learning about sustainable development topics with an average of 8.9, which allows us to identify an area of opportunity to implement educational strategies within the institutions.

The results reinforce the need to take advantage of the existing interest and positive attitude of the university community to strengthen sustainability-related issues in public policies, curricula, and institutional practices. Areas of opportunity can also be identified in the transformation of actions toward sustainable attitudes that can be carried out in a concrete way.

University students, as a community committed to transforming society, cannot ignore that sustainability issues are no longer a marginal concern, but have become a central element of global development. In this context, universities have an unavoidable responsibility to educate citizens capable of critical thinking, ethical action, and active contribution to building a more just and sustainable society.

Discussion

Sustainability has become a central theme in global development, addressing the need to balance economic growth, social equity, and environmental preservation. Universities, as institutions for education and knowledge generation, play a vital role in promoting sustainability through their educational work, research, and the implementation of sustainable practices within their institutions; hence the importance of promoting policies that encourage these practices and have a direct impact on society.

Meadows, Meadows, Randers and Behrens (1972) warn that the limits to economic and population growth are conditioned by the finite capacity of natural resources, which poses a critical scenario for humanity if sustainability measures are not adopted.

The results obtained in this study allow for a critical reflection on the current state of sustainability in higher education institutions, particularly with regard to the perception, knowledge, and individual and collective practices of university actors. Rockström et al. (2009) argue that humanity must operate within safe planetary boundaries to ensure the stability of the Earth system and avoid irreversible risks to human well-being.

The results show a favorable disposition towards sustainability values and issues, as well as an interest in learning and participating in actions related to sustainable development issues.

Authors such as Tilbury (2011) and Leal Filho, Raath, Lazzarini, Vargas, de Souza, Anholon, et al. (2018) point out that one of the main challenges in the field of higher education lies not only in the generation of awareness, but in the institutional capacity to translate that awareness into educational programs coherent, active methodologies, and evaluation processes oriented towards social transformation. This study observes a gap between the perceived level of knowledge and the effective incorporation of sustainable practices, both at the individual and institutional levels. "...To enhance sustainability in curricula, faculty should develop collaborative approaches, discuss how to redesign their own disciplines, and understand the epistemology and multicultural vision of sustainability, both as a topic and as a field of educational research." Leal Filho, W., Raath, S., Lazzarini, B., Vargas, VR, de Souza, L., Anholon, R., et al. (2018).

Participants express an understanding of the relationship between biodiversity, the economy, and climate change, and acknowledge the implementation of these values in their consumption habits. However, specific practices such as purchasing organic products or saving energy in university spaces show lower levels of implementation, which coincides with studies conducted by (Cebrián G. 2020), where it is noted that the internalization of sustainable values does not necessarily guarantee a change in behavior.

The interest shown by the university community in learning more about sustainable development represents a strategic opportunity for higher education institutions (HEIs) to continue implementing strategies to address this area more deeply and diligently. This premise reinforces the call to include sustainability across educational programs in a cross-cutting manner, not as an isolated or optional subject, but as an integrating axis that supports the development of professional, social, and ethical competencies. The study confirms that the curricular approach must be accompanied by an organizational culture that promotes coherence between the institutions' discourse and what actually occurs in daily practices.

The respondents expressed an interest in continuing to learn more about sustainable development from a theoretical perspective. The results align with the approach of education for sustainable development, which emphasizes training agents of change capable of addressing the challenges of our time through the development of critical, analytical, systemic, and action-oriented thinking. Consequently, it is essential that higher education institutions take steps to implement more participatory and interdisciplinary educational models that promote topics related to sustainability.

Conclusion

This research has shown that there is a high degree of awareness and interest in sustainability issues among all university stakeholders, although significant challenges remain regarding the effective integration of these issues into the educational programs of higher education institutions. The quantitative approach used identified positive perceptions, knowledge, and favorable attitudes toward these practices; however, a gap was also observed between these factors and the specific implementation of actions within the academic environment.

Sustainability must cease to be a topic addressed only through sporadic actions and become an important cross-cutting theme in curriculum design; it must also be part of institutional management and pedagogical practices.

Higher education institutions (HEIs) are builders of human capital and generators of knowledge; therefore, they also have the social responsibility to lead transformative processes by training professionals with critical awareness who are committed to the challenges of sustainable development. For this reason, it is essential to include sustainability topics in university programs to train citizens capable of addressing the environmental, economic, and social challenges that today's society demands.

Through research and institutional action, universities must play a fundamental role in building a more hopeful and sustainable future; they have an obligation to train professionals with a vision committed to sustainability. Including these topics in study programs allows young students to be aware of the environmental impact of various activities, as well as the efficient use of resources and the implementation of sustainable solutions in their respective areas.

Recommendations

This study shows that higher education institutions (HEIs) have a favorable environment for incorporating sustainability more systematically, deeply, and effectively into their educational programs. Therefore, to achieve this, it is essential to implement cross-cutting strategies, train faculty in education for sustainable development (ESD), establish evaluation indicators, foster an institutional culture committed to sustainable development, and promote research on these topics to assess the real impact of implemented actions on students' holistic education. Consequently, sustainability should be incorporated as a cross-cutting competency in all higher education programs, faculty training in education for

sustainable development should be strengthened, evaluation mechanisms and institutional indicators should be established to measure the real impact of sustainable strategies, and the active participation of the entire university community in environmental, economic, and social projects aligned with the Sustainable Development Goals should be encouraged.

Finally, it is necessary to continue with research that delves deeper into the evolution of the integration of sustainability into programs and points out the actions taken to move towards truly sustainable educational models that have an impact on society.

Future Lines of Research

Future university research on this topic should help move beyond social awareness of sustainability to concrete actions. It is not enough for students and faculty to recognize the importance of the issue; sustainability must become an integral part of every educational program and be present in all areas of learning.

It is necessary to investigate how curricula can integrate sustainable competencies in a practical and meaningful way, and how teacher training can transform academic spaces that promote responsible habits committed to the future of our planet.

It is essential to create clear indicators that allow us to measure the real impact of these strategies, both on student training and institutional management. Another aspect that deserves attention is the gap between what we think and what we do. Although there is a positive attitude toward sustainability, this enthusiasm has yet to be translated into tangible projects and actions within universities. Understanding the reasons for this gap will be essential for designing more effective solutions.

Finally, future research should follow up with graduates and institutional projects to understand how they apply what they have learned in their professions and communities. Pedagogical innovation, the use of new technologies, and learning from international experiences will be essential allies in advancing toward educational models that not only talk about sustainability but also live it and transmit it with real impact on society.

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