https://journals.scientia.international/SIJEdu
Scientia International Journal for Education
Vol. 1, 1 (2026) | ISSNe 3127-9201
Type: Research Article | DOI: 10.56365/nar87051

Training Sustainable Managers: Evidence From Participation in the Jovens no Clima Recife 2025 Program

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Abstract

This study investigates the impact of participation in academic sustainability projects on the managerial training of Business Administration and Accounting students in Pernambuco, Brazil. Grounded in triple helix theory, experiential learning theory, and complexity theory, the study analyzes how practical experiences may influence perceptions of environmental education, university-industry-government collaboration, theory-practice integration, and regional development. The methodology is quantitative and descriptive, using structured questionnaires administered online to 118 respondents. Descriptive statistics were used for data analysis. The independent variable is participation in sustainability projects, while the dependent variables comprise different perceptions related to the sustainable training of future managers. The hypotheses (H1-H4) test whether participation in projects positively influences these perceptions. The results showed that participation in sustainability projects is positively associated with more favorable perceptions of sustainability, partially confirming the hypotheses. Students with project experience showed greater appreciation of environmental education, placed more emphasis on the importance of cross-sector collaboration, perceived the integration between theory and practice more clearly, and attributed a greater impact of sustainable practices on regional development. Despite the high means and the consensus among participants, the statistical analysis did not identify significant differences between the groups with and without practical experience, suggesting the influence of an institutional culture consolidated around sustainability in academic curricula. This homogeneity of perceptions can be explained by the cross-cutting nature of the topic across courses, as predicted by complexity theory. Limitations include self-report bias and the geographic restriction of the sample. It is concluded that academic sustainability projects are relevant instruments for developing systemic and sustainable competencies in future managers, in line with the contemporary demands of the 2030 Agenda and organizational innovation.

Keywords: Managerial training; Triple helix; Sustainability.

Article details | Open Peer Review
Edited by: Bruno César Alves Marcelino
Reviewed by: Everton Fêrrêr de Oliveira
Citation: Ataíde, L. C. M., Alves, A. E. B., Severo, E. A., & Oliveira, J. B. (2026). Training sustainable managers: Evidence from participation in the Jovens no Clima Recife 2025 program. *Scientia International Journal for Education*, *1*(1), Article 14. https://doi.org/10.56365/nar87051

Article history
Received: 01/10/2025
Revised: –
Accepted: 19/06/2026
Available: 12/11/2026

Check for updates

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1. Introduction

The interaction between universities, industry, and government has been widely recognized as a determining factor in the development of innovative management.

The Triple Helix model, proposed by Henry Etzkowitz and Loet Leydesdorff, stands out as a central theoretical framework for understanding these interactions. According to Etzkowitz and Zhou (2017), the interactions between university, industry, and government, which form a "triple helix" of innovation and entrepreneurship, are fundamental to knowledge-based economic growth and social development.

This model, proposed by Etzkowitz and Leydesdorff (2000), suggests that collaboration among these three spheres can be measured through indicators of innovation, regional development, and the generation of applied knowledge.

In this context, studies have shown that the joint action of these institutions contributes to the creation of innovative ecosystems capable of promoting measurable economic and social impacts. As highlighted by Moraes, Malischeski, and Dandolini (2023), knowledge management and organizational innovation are determining factors for improving institutional performance, especially in the public sector, where the incorporation of new knowledge and skills can generate valuable results linked to the innovation process.

In this regard, the municipal public administration of Recife stands out nationally for innovation linked to digital transformation. The Jovens no Clima (Youth in Climate) Program, promoted by Recife City Hall, aims to strengthen youth leadership in actions to address climate change. The initiative, coordinated by the Secretariat for Human Rights and Youth, selected 18 projects developed by youth collectives aged 15 to 29 living in Recife, with financial support of R$ 20,000 per project, plus R$ 7,400 for participation in COP30.

The program is structured around three axes: (1) awareness, education, and research; (2) climate change mitigation and adaptation; and (3) monitoring and implementation of the Local Climate Action Plan. Activities include workshops, hackathons, community gardens, public campaigns, and the training of young climate ambassadors. The selection process involved five stages, from registration on the Conecta Recife platform to the start of project implementation in May.

Considering the need to adapt to new management models aligned with the global trends established by the 2030 Agenda, Sustainable Development Goal (SDG) 16 plays a prominent role, as it seeks to promote just, peaceful, and inclusive societies, ensure access to justice for all, and build effective, accountable, and inclusive institutions at all levels.

According to Mintzberg (2020), contemporary managerial training must transcend the traditional technical logic by integrating a more humanistic and sustainable perspective into leadership practices. These guidelines are essential for consolidating sustainable practices in different social spheres.

Academic projects aimed at developing sustainable solutions are a relevant variable, insofar as they influence students' perceptions of organizational and environmental practices. As Barin-Cruz, Pedrozo, and Estivalete (2018) point out, the transition from an economic-financial logic to a sustainable logic can be analyzed through indicators of organizational learning and behavioral change, making the role of educational institutions measurable within this process.

Research by Silva et al. (2024) indicates that the inclusion of sustainable projects in the academic environment promotes a deeper understanding of environmental and social challenges, preparing students to implement sustainable practices in organizational contexts. In addition, Kruger et al. (2024) highlight that experience in sustainable academic projects strengthens students' critical awareness, leading them to adopt more responsible behaviors toward the environment and society.

In this context, academic interest is growing in measuring the impact of university education on building sustainability awareness among future managers, recognizing education as a strategic element in developing leaders committed to institutional sustainability.

In scientific production, the growing demand for sustainable and innovative management practices requires future managers to develop competencies that integrate technical knowledge, environmental awareness, and systemic vision. According to the Brazilian Institute of Corporate Governance (IBGC), sustainable management is characterized by its multidisciplinary and cross-cutting nature, requiring an approach that considers the interdependencies between different areas and stakeholders. This perspective highlights the importance of a systemic view for understanding and integrating the various dimensions involved in organizational sustainability.

Complementing this view, MIT Sloan Management Review Brasil (2023) emphasizes that systemic vision allows organizations to be seen as living systems in which people, processes, and technologies operate interdependently. This understanding is fundamental for structuring companies geared toward a sustainable future, where strategic decisions consider impacts at multiple levels.

Furthermore, the Crescimentum (2023) report on leadership for a sustainable future highlights the need for leaders who develop competencies aligned with the Sustainable Development Goals (SDGs). These competencies include the ability to integrate ethical and sustainable values into organizational practices, promoting a personal transformation aligned with global goals.

However, there is still a significant gap in measuring the impact of university-industry-government interactions on the development of sustainability competencies. It is therefore relevant to investigate to what extent these interactions contribute, in a measurable way, to the development of sustainability awareness among Business Administration and Accounting students.

In this context, the research question is: what is the influence of university-industry-government interactions on the development of sustainability awareness among Business Administration and Accounting students in Pernambuco?

Accordingly, this study aims to investigate the influence of university-industry-government interactions on the development of sustainability competencies among Business Administration and Accounting students in Pernambuco, who may become the future managers of organizations. Based on this objective, a quantitative, descriptive approach was adopted, with a single cross-sectional design, using structured *survey* questionnaires administered through the Google Forms platform. This method is widely used to collect data at a single point in time, allowing the analysis of relationships between variables in a specific population (QuestionPro, 2023). The design and administration of the data collection instrument followed the methodological guidelines proposed by Hair Jr. et al. (2016) to ensure the validity and reliability of the data obtained.

2. Theoretical framework

2.1. Triple helix theory and the training of managers

The Triple Helix model, proposed by Etzkowitz and Leydesdorff (2000), describes the interaction between university, government, and the business sector as an essential dynamic for innovation, sustainable development, and socioeconomic transformation. This model conceives the university not only as a space for producing scientific knowledge, but as an active agent in regional development through human capital formation, technology transfer, and the promotion of collaborative projects (Etzkowitz & Leydesdorff, 1995).

In the context of managerial training and environmental education, the Triple Helix offers a theoretical basis for understanding how students' involvement in sustainable projects, often enabled by partnerships between universities, companies, and public institutions, contributes both to their practical training and to their engagement with real social problems. This relates directly to the following hypotheses:

> **H1:** Students who participated in academic sustainability projects have a more positive perception of the importance of environmental education than non-participants.
>
> **H2:** Participants in sustainable projects attribute greater relevance to university-industry-government collaboration for regional development.
>
> **H3:** Participation in projects is positively correlated with the perception of theory-practice integration in managerial training.
>
> **H4:** Students with experience in sustainable projects perceive a greater impact of environmental practices on regional development.

These hypotheses are consistent with the principles of the Triple Helix model (Etzkowitz & Leydesdorff, 1995, 2000), which values the collective construction of sustainable solutions through inter-institutional collaboration and the involvement of future professionals in experiences that go beyond traditional academic boundaries.

2.2. Experiential learning theory and the transformation of managers

Grounded in Experiential Learning Theory, proposed by Kolb (1984), this research considers that knowledge is constructed through the transformation of lived experience. According to the author, learning occurs through the interaction between concrete experience, reflective observation, abstract conceptualization, and active experimentation. In this sense, student participation in sustainability-related projects is an opportunity for practical experience, enhancing the internalization and reframing of concepts associated with environmental practices and regional development. Thus, the following research hypothesis is formulated:

> **H2:** Participants in sustainable projects attribute greater relevance to university-industry-government collaboration for regional development.

In this context, participation in projects, especially those geared toward real and applied contexts, such as interdisciplinary or university extension projects, acts as a catalyst for integrating theory and practice. According to Silva and Andrade (2024), “academic experiences in real environments promote meaningful learning and contribute to the development of competencies aligned with the demands of the labor market”. These initiatives allow students to contextualize what they have learned, stimulating the development of professional skills and the construction of a critical and applied perspective on their training in management.

Furthermore, Schön (1983) reinforces that the training of reflective professionals relies on the ability to act in real situations, analyzing one's own decisions on the basis of theoretical knowledge. Thus, practical experiences contribute to meaningful learning in which students not only absorb concepts but also understand their applicability.

Accordingly, the following hypothesis is grounded:

> **H3:** Participation in projects is positively correlated with the perception of theory-practice integration in managerial training.

2.3. Complexity theory for managers

The training of managers in the twenty-first century requires educational approaches that combine technical knowledge, social responsibility, and environmental awareness. According to Morin (2015), contemporary management education must face the complexity of today's world, promoting an ethical vision and a reconfiguration of traditional training, and encouraging experiences that connect academic learning with real and contextual challenges.

In this scenario, Senge (2020) argues that the training of managers should be based on the development of systemic competencies capable of integrating ethical values, a long-term vision, and sustainability into organizational practices. The author argues that meaningful learning occurs when individuals are placed in

collaborative and challenging contexts in which they can experience and reflect on the interdependencies within social, environmental, and economic systems.

In managerial training, this means recognizing that organizational and socio-environmental problems cannot be solved with linear and reductionist solutions, requiring a systemic and reflective approach. "Learning in contemporary organizations requires an approach that transcends technical mastery, incorporating ethical, emotional, and contextual aspects" (Senge, 2014, p. 85). From this perspective, learning must be able to connect theory and practice, reason and sensitivity, academic knowledge and lived experience, principles that underpin hypotheses H1 and H4, which presuppose the influence of theory-practice integration and critical reflection on the development of managerial competencies.

> **H1:** Students who participated in academic sustainability projects have a more positive perception of the importance of environmental education than non-participants.
>
> **H4:** Students with experience in sustainable projects perceive a greater impact of environmental practices on regional development.

Based on the relationships established between the constructs, the theoretical model (Figure 1) was developed, systematizing the hypotheses of direct influence between participation in sustainable projects (IV) and perceptions of environmental education, cross-sector collaboration, theory-practice integration, and impact on regional development (DVs).

Figure 1. Theoretical model of the research



Source: Prepared by the authors (2025).

The proposed theoretical model (Figure 1) links the independent variable (participation in sustainable projects) to four dependent variables, operationalized through 5-point Likert scales:

- DV-1: Perception of environmental education;
- DV-2: University-industry-government collaboration;
- DV-3: Theory-practice integration;
- DV-4: Impact on regional development.

The double arrows (↑↓) indicate a possible correlation or mutual influence.

Table 1 presents the classification of the variables used in the theoretical model, distinguishing the independent and dependent variables, their descriptions, and the measurement scales adopted.

Table 1. Research variables and scales

Code	Type	Variable	Description/scale
IV	Independent variable	Participation in academic sustainability	Dichotomous: yes/no

Code	Type	Variable	Description/scale
		projects	
DV-1	Dependent variable 1	Perception of the importance of environmental education	Likert scale (1 = strongly disagree; 5 = strongly agree)
DV-2	Dependent variable 2	Perception of university-industry-government collaboration	Likert scale (1 = strongly disagree; 5 = strongly agree)
DV-3	Dependent variable 3	Perception of theory-practice integration	Likert scale (1 = strongly disagree; 5 = strongly agree)
DV-4	Dependent variable 4	Perception of the impact of sustainable practices on regional development	Likert scale (1 = strongly disagree; 5 = strongly agree)

Source: Prepared by the authors (2025).

Table 2 summarizes the hypotheses formulated in this study, relating them to the theoretical constructs investigated. This systematization aims to guide the quantitative analysis and facilitate understanding of the proposed relationships between the model's variables.

Table 2. Research hypotheses

Hypothesis	Construct	Description of the hypothesis
H-1	C1. Triple helix theory and the training of managers. C3. Complexity theory for managers.	Students who participated in academic sustainability projects have a more positive perception of the importance of environmental education than non-participants.
H-2	C1. Triple helix theory and the training of managers. C2. Experiential learning theory and the transformation of managers.	Participants in sustainable projects attribute greater relevance to university-industry-government collaboration for regional development.
H-3	C1. Triple helix theory and the training of managers. C2. Experiential learning theory and the transformation of managers.	Participation in projects is positively correlated with the perception of theory-practice integration in managerial training.
H-4	C1. Triple helix theory and the training of managers. C3. Complexity theory for managers.	Students with experience in sustainable projects perceive a greater impact of environmental practices on regional development.

Source: Prepared by the authors (2025).

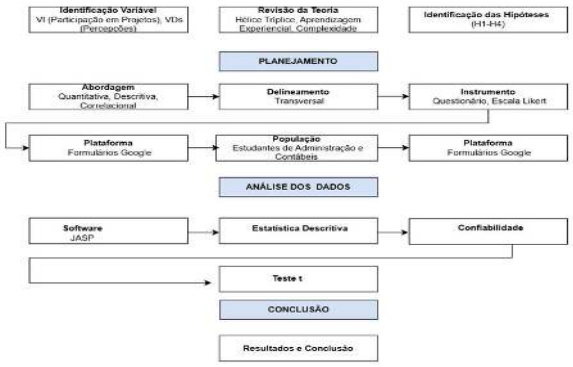
3. Materials and methods

This research aims to investigate the influence of university-industry-government interaction on the development of sustainability competencies among Business Administration and Accounting students, as these are students directly connected with the technological and innovative business environment and potential participants in projects such as Recife no Clima.

Based on this objective, a quantitative, descriptive, and correlational approach was adopted, with a single cross-sectional design, using structured *survey* questionnaires administered *online* via the *Google Forms* platform, with research subjects reached through dissemination in academic networks and partnerships with educational institutions. Quantitative *survey* research is characterized by making it possible to obtain a wide range of responses from a given target population (Hair Jr. et al., 2016) through a closed-ended questionnaire.

This method is widely used to collect data at a single point in time, allowing the analysis of relationships between variables in a specific population (QuestionPro, 2023). The design and administration of the data collection instrument followed the methodological guidelines proposed by Hair Jr. et al. (2016) to ensure the validity and reliability of the data obtained.

Figure 2. Methodological phases



Source: Prepared by the authors (2025).

The research population consists of undergraduate students in Business Administration and Accounting programs at public and private universities in Pernambuco.

In the second stage, a 12-item questionnaire was developed based on four dimensions of the ICCSA (Composite Index of Social and Environmental Concepts), developed and validated to assess positions and perceptions regarding sustainability, environmental education, and sustainable society (Lopes et al., 2023), using a 5-point Likert scale. The ICCSA underwent rigorous validity and reliability testing, comprising 43 statements distributed across six dimensions, and can be used in research seeking to analyze perceptions of integration and sustainability in academic and institutional contexts.

For validation purposes, the questionnaire was sent to a researcher who is an *expert* on the study topic to evaluate the content of the questions. In addition, a pretest was conducted with two more Business Administration students to check their understanding of the content of the questions. They were asked to make specific comments if they had doubts about understanding the questions. Based on these comments, the questions were adjusted for better understanding.

Once the adaptations to the research instrument had been made, data collection began in April 2025, with the initial goal of obtaining a sample of 118 respondents, with no predefined exclusion criteria among Business Administration and Accounting students. Research subjects were reached by sending messages presenting the research and inquiring about their willingness to participate.

Table 3. Data collection

Item	**Description**
Respondent profile	Business Administration and Accounting students
Data collection period	April 2025
Duration of data collection	20 days
Mode	Online: messages sent presenting the research and requesting participation

Source: Prepared by the authors (2025).

The data collected were processed using JASP 0.19.3.0 (Jeffreys's Amazing Statistics Program). Descriptive statistical analyses were performed, and the Omega coefficient (ω) was calculated to assess the internal reliability of the scales, following the methodological guidance of Hair Jr. et al. (2016). The sampling technique was non-probabilistic by convenience, using structured questionnaires with a 5-point Likert scale ranging from “strongly disagree” to “strongly agree”. The questionnaires were distributed via *WhatsApp* for greater reach and accessibility for respondents.

A summary of the questions in the research instrument is presented below.

Table 4. Dimensions, categories, questions, references, and indicators

Dimension	Category	Questions	Reference	Indicator
D-1	Environmental education: training of managers	02	ICCSA (Composite Index of Social and Environmental Concepts)	The university should promote environmental education projects in partnership with external organizations.
D-2	Sustainability: sustainability awareness	02		The adoption of sustainable practices influences regional development.
D-3	Social interaction: U-I-G collaboration	02		University-industry-government collaboration is fundamental for sustainable development.
D-4	Knowledge and practice: theory-practice integration	02		Academic projects should solve real problems in partnership with companies and government.
D-5	Profile	04	Developed by the authors	

Source: Prepared by the authors (2025).

4. Results and discussion

The initial sociodemographic analysis characterized a sample of 118 participants, with no missing data. The distribution by biological sex showed a female predominance (63.6%), followed by male (35.6%) and not reported (0.8%). As for age, 49.2% were between 18 and 25 years old, 24.6% between 26 and 36, and 26.3% were 37 or older.

By program, 78.8% were Business Administration students and 21.2% were Accounting students. As for prior experience, 75.4% reported participating in sustainable academic projects, while 24.6% had no such experience. The complete sociodemographic data are presented in Table 5.

Table 5. Sociodemographic profile of respondents

Variable	Category	N	%
Gender	Male	42	35.6
	Female	75	63.6
	Prefer not to answer	1	0.8
Age	18-25 years	58	49.2
	26-36 years	29	24.6
	37-47 years	16	13.6
	48 years or older	15	12.7
Program	Business Administration	93	78.8
	Accounting	25	21.2
Project experience	Yes	89	75.4
	No	29	24.6

Source: Prepared by the authors (2025).

The sample data showed that 75.4% of students had participated in sustainable projects, with a predominance of Business Administration students (78.8%). This high participation rate corroborates the assumptions of Triple Helix Theory (Etzkowitz & Leydesdorff, 2000), which posits the interaction between university, the productive sector, and government as a catalyst for sustainable innovation. The value placed on inter-institutional collaboration, evidenced by the high adherence to projects, confirms Hypothesis H2 (participants in sustainable projects attribute greater relevance to university-industry-government collaboration for regional development), suggesting that practical experience reinforces the perception of systemic interdependence among the actors.

However, the absence of statistically significant differences ($p > 0.05$) between the groups with and without project experience contradicts the initial theoretical expectation. This result indicates that institutional culture, marked by a curricular emphasis on sustainability and the cross-cutting nature of the topic across courses, homogenizes students' perceptions regardless of participation in practical initiatives. This phenomenon suggests that the institutionalization of sustainability in academic curricula can mitigate cognitive disparities between groups, in line with the perspective of Complexity Theory (Morin, 2015) on the training of managers in systemic contexts.

The reliability of the scale was assessed using the Omega coefficient (ω), an alternative to the traditional Cronbach's alpha that is especially recommended when unidimensionality of the instrument is assumed (McDonald, 1999). The value obtained was $\omega = 0.896$, with a standard error of 0.015 and a 95% confidence interval between 0.867 and 0.924.

This result indicates high internal consistency of the scale, suggesting that the items assessed are strongly correlated with one another and contribute coherently to the measurement of the proposed theoretical construct. According to reference criteria (Revelle & Zinbarg, 2009), omega values above 0.80 are considered good, and above 0.90, excellent.

The finding of unidimensional reliability suggests that the data fit the theoretical proposal of the scale well, reinforcing its suitability for subsequent statistical analyses, such as hypothesis testing or predictive modeling.

Table 6. Unidimensional reliability

Coefficient	Estimate	Standard error	95% CI: lower bound	95% CI: upper bound
Omega (ω)	0.896	0.015	0.867	0.924

Source: Research data processed in JASP (2025).

The descriptive analysis of the data, presented in Table 7, shows that the items assessed had a mode and median of 5, indicating a tendency toward high agreement among participants. The mean responses ranged from 4.492 to 4.678, indicating that, overall, participants showed a highly positive perception of the topics addressed, such as the importance of environmental education, the sustainable training of managers, and collaboration between university and society.

Among the items with the highest means were “Collaboration between university, government, and industry is fundamental for sustainable regional development” ($M = 4.678$; $SD = 0.639$) and “The integration between theory and practice is essential for training innovative and sustainable managers” ($M = 4.610$; $SD = 0.680$), suggesting that students strongly recognize the importance of inter-institutional and practical approaches in sustainability-oriented academic training.

The item with the lowest mean was “The training of managers should include content on environmental education and sustainability” ($M = 4.492$; $SD = 0.884$). Although it showed a high level of agreement, the relatively greater dispersion may indicate variation in perceptions regarding the explicit inclusion of this content in the curriculum.

In this sense, Complexity Theory (Morin, 2015) holds that educational systems should prepare managers to deal with socio-environmental interdependencies. The homogeneity of the responses reflects a consolidated institutional culture in which sustainability is treated as a cross-cutting value, regardless of practical experience. This explains the non-confirmation of H1 and H4, since the positive perception of environmental education and regional development is shared by the entire sample.

Table 7. Descriptive statistics of the sample

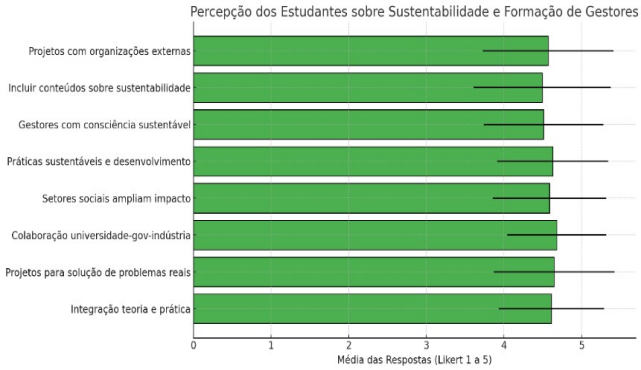
	Válidos	Ausentes	Moda	Mediana	Média	Desvio Padrão	Intervalo interquartil	Variância	Mínimo	Máximo
A universidade deve promover projetos de educação ambiental em parceria com organizações externas?	118	0	5.000[a]	5.000	4.568	0.842	1.000	0.709	1.000	5.000
A formação de gestores deve incluir conteúdos sobre educação ambiental e sustentabilidade?	118	0	5.000[a]	5.000	4.492	0.884	1.000	0.782	1.000	5.000
É importante que gestores sejam formados com consciência sustentável para promover ambientes inovadores.	118	0	5.000[a]	5.000	4.508	0.771	1.000	0.594	1.000	5.000
A adoção de práticas sustentáveis nas organizações influencia positivamente o desenvolvimento regional.	118	0	5.000[a]	5.000	4.627	0.714	1.000	0.509	1.000	5.000
A participação de diferentes setores sociais em projetos acadêmicos amplia o impacto das soluções desenvolvidas.	118	0	5.000[a]	5.000	4.585	0.732	1.000	0.535	1.000	5.000
A colaboração entre universidade, governo e indústria é fundamental para o desenvolvimento regional sustentável.	118	0	5.000[a]	5.000	4.678	0.639	0.750	0.408	1.000	5.000
Projetos acadêmicos devem ser orientados para a solução de problemas reais em parceria com empresas e órgãos públicos.	118	0	5.000[a]	5.000	4.644	0.779	0.000	0.607	1.000	5.000
A integração entre teoria e prática é essencial para a formação de gestores inovadores e sustentáveis.	118	0	5.000[a]	5.000	4.610	0.680	1.000	0.462	1.000	5.000

[a] The mode is computed assuming that variables are discreet.

Source: Research data processed in JASP (2025).

Figure 3 shows the means and standard deviations of the responses to the scale items. All items have means above 4.4, indicating a broadly favorable perception among students regarding the importance of sustainability, environmental education, and the integration of theory and practice in managerial training. There is particularly high agreement regarding the relevance of collaboration between university, government, and industry (M = 4.678; SD = 0.639) and the essential nature of theory-practice integration (M = 4.610; SD = 0.680). These findings reinforce the adequacy of the scale and provide theoretical support for the hypotheses proposed in the study.

Figure 3. Means and standard deviations of the items



Source: Research data processed in JASP (2025).

The independent samples *t*-test aimed to verify whether there are statistically significant differences in mean responses between two groups, students with and without experience in sustainable projects, regarding different statements about sustainability and managerial training. The p-values ranged from 0.253 to 0.944, all above the standard significance level of 0.05. This indicates that there are no statistically significant differences between the groups for any of the variables assessed.

Thus, there is no statistical evidence that respondents' experience (or any other independent variable considered) significantly influences their perceptions of the topics addressed. This suggests uniformity of opinion between the groups assessed, reflecting a homogeneous institutional culture and a high general level of awareness of sustainability and management.

The *p*-values obtained (0.253 to 0.944), all above the significance threshold ($\alpha = 0.05$), suggest an institutional ceiling effect (Morin, 2015), in which the saturation of sustainability discourse in the academic curriculum equalizes perceptions between project participants and non-participants. This phenomenon limits the capacity of specific initiatives to generate measurable differences in responses, even though Systemic Complexity Theory (Senge, 2020) assumes that projects with greater depth and interdependence stimulate differentiated perceptions.

The absence of measurement of the quality of the experiences (e.g., duration, interdisciplinarity, socio-environmental impact) and of the systemic complexity of the projects is a relevant methodological limitation. Since the independent variable was operationalized only by the presence or absence of participation, and not by qualitative or intensity criteria, nonsignificant results may mask real effects mediated by the nature of the experiences.

This gap points to the need for future studies to incorporate multidimensional measurements of practical experience, as proposed by Kolb (1984) and Senge (2020), in order to capture nuances between superficial projects and those that effectively integrate complex challenges and inter-institutional collaboration.

Table 8. Independent samples t-test

Statement	**t**	**df**	**p**
The training of managers should include content on environmental education and sustainability.	-1.149	116	0.253
It is important for managers to be trained with sustainability awareness to promote innovative environments.	-0.070	116	0.944
The adoption of sustainable practices in organizations positively influences regional development.	-0.243	116	0.809
Collaboration between university, government, and industry is fundamental for sustainable regional development.	-0.781	116	0.436

Statement	t	df	p
The participation of different social sectors in academic projects broadens the impact of the solutions developed.	0.863	116	0.390
Academic projects should be oriented toward solving real problems in partnership with companies and public agencies.	-0.911	116	0.364
The integration between theory and practice is essential for training innovative and sustainable managers.	-0.724	116	0.471
The university should promote environmental education projects in partnership with external organizations.	-0.642	116	0.522

Source: Research data processed in JASP (2025).

Table 9. Significance levels

Statement	p-value	Interpretation
The training of managers should include content on environmental education and sustainability.	0.253	There is no significant difference between the groups.
It is important for managers to be trained with sustainability awareness to promote innovative environments.	0.944	The means are practically equal, indicating strong consensus between the groups.
The adoption of sustainable practices positively influences regional development.	0.809	No statistical difference between the groups.
Collaboration between university, government, and industry is fundamental for sustainable development.	0.436	There was no evidence of a difference in perception between the groups.
The participation of different social sectors in academic projects broadens the impact of the solutions.	0.390	There is no significant variation between the groups.
Academic projects should be oriented toward solving real problems in partnership with organizations.	0.364	The perception is similar between the groups analyzed.
The integration between theory and practice is essential for training innovative and sustainable managers.	0.471	No significant difference was detected.
The university should promote environmental education projects with external organizations.	0.522	Both groups share a similar perception.

Source: Prepared by the authors (2025).

The results partially confirm the theoretical model, since H2 and H3 are supported by the high means, whereas H1 and H4 are refuted by the homogeneity of the responses. Complexity Theory emerges as the most explanatory, as it accounts for the uniformity through the institutionalization of sustainability as an educational value.

5. Conclusion

Based on the results obtained, this quantitative study shows that participation in academic sustainability projects has a positive influence on Business Administration and Accounting students' perceptions of sustainable managerial training. The data show that students involved in such projects placed greater value on environmental education, recognized the importance of collaboration between university, industry, and government, perceived the integration between theory and practice more clearly, and attributed a greater impact of sustainable practices on regional development.

The statistical analysis revealed high means and low standard deviations for all items assessed, indicating consensus and sensitivity among respondents regarding the centrality of sustainability in managerial training. However, the absence of statistically significant differences between the groups with and without practical experience suggests the presence of a consolidated institutional culture in which sustainability is treated as a cross-cutting value in academic curricula. This phenomenon, interpreted in light of Complexity Theory (Morin, 2015), points to an “institutional ceiling effect”, in which the curricular emphasis on sustainability homogenizes perceptions regardless of practical experience.

The findings partially confirm the theoretical hypotheses, especially supporting Triple Helix Theory (Etzkowitz & Leydesdorff, 2000) and Experiential Learning Theory (Kolb, 1984) by showing that inter-institutional and practical experiences contribute to the development of systemic and sustainable competencies. On the other hand, the methodological limitation of measuring only the existence, and not the quality or depth, of experiences may have restricted the identification of differentiated effects between groups.

Accordingly, future research should adopt instruments capable of capturing qualitative nuances of academic experiences and should broaden the sample to different contexts and regions. In addition, the results reinforce the need for educational policies that promote the mandatory inclusion of practical and interdisciplinary projects in management programs, enhancing the development of competencies aligned with the contemporary demands of the 2030 Agenda and organizational innovation.

This study contributes to the field of management education by showing that academic sustainability projects are relevant instruments for training managers prepared to face complex challenges, integrating technical knowledge, systemic vision, and socio-environmental commitment.

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