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ALEXIS PAPATHANASSIS

The management of sustainability initiatives in higher education institutions and its role in shaping students' sustainability-related attitudes and behaviours

Abstract

Research background and purpose: This study explores how the management of sustainability initiatives in higher education institutions (HEIs) influences students' awareness and engagement in sustainable development. We investigate the role of university-led, curricular and extracurricular, actions in shaping students' sustainability-related attitudes and behaviours. The study addresses two fundamental research questions: How do higher education institutions (HEIs)' initiatives and curricular' activities affect students' sustainability-awareness levels? And how do they potentially impact students' engagement with sustainable practices and behaviour?

Design/methodology/approach: The research reflects the application of methodological triangulation, integrating both quantitative and qualitative research methods. The research was carried out using the CAWI and PAPI techniques. Two types of non-random selection were used: accidental/convenience sampling, and quota sampling. Derived from the literature review, a total of five independent variables were identified, which were included in one package called "University Initiatives Activating Involvement in Sustainability (UIASS)" and 23 dependent variables (DV), which were divided into two groups.

Findings: The findings aim to inform the management and design of educational frameworks and institutional policies, promoting responsible citizenship and active participation in sustainability efforts. A number of recommendations have also been prepared for HEIs, which may have a real impact on increasing students' engagement in sustainability. These activities are based on the effective management and promotion of student engagement programs in the field of sustainability. The results of the study showed that students who were actively encouraged to engage in sustainable activities were more willing to get involved and initiate various activities in this area.

Value added and limitations: Graduates whose awareness of environmental issues has been effectively shaped through activities initiated by HEIs are more likely to act as responsible consumers and potential leaders in advancing sustainable development. The research is cross-sectional and does not track the long-term impact of sustainable development management activities at HEIs on students' attitudes and engagement. The research is also limited by the deliberate selection of the sample and its size, so the conclusions drawn are not a basis for generalizations, but the analysis has revealed patterns that are worth further investigation.

Keywords: *sustainable management, higher education, students' behaviour*
JEL Classification: M10, M14, L21, D22, Q01

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1. Introduction

In the era of climate threats caused by strong environmental pollution, numerous institutions introduce restrictive regulations to minimise the negative impact on the natural environment. The United Nations developed 17 Sustainable Development Goals, SDGs (United Nations, 2015), which constitute a universal guideline for environmentally responsible, socially just and economically justified business activity. Also, the European Commission (EC, 2019) introduced the European Green Deal, and the European Parliament regulations on corporate sustainability reporting aimed at defining a framework to facilitate sustainable investment (EP&C, 2022).

Research on the factors determining the sustainability-related attitudes and behaviours of various social groups has been experiencing noticeable attention in recent years; partly due to the growing public awareness of the negative impact of human activity on the natural environment. The catastrophic effects of climate change (Gerber et. al., 2013; IPCC, 2019), manifested in unprecedented weather phenomena such as devastating hurricanes, flash floods or dramatic droughts, underline the urgency for decisive action. An important social group are students, as they are likely to become those leading and responsible for shaping the future society and the labour market. Their attitudes and behaviours can have a significant impact on long-term social and environmental changes. Arguably, management of sustainability within Higher Education Institutions (abbr. HEIs) plays a crucial role in shaping students' attitudes and promoting desired behaviours with regard to sustainability. Indeed, HEIs possess a wide range of options and opportunities for effective pro-environmental education and the demonstration of effective practices in this domain.

Higher education institutions (HEIs) worldwide are increasingly implementing sustainability-related initiatives, organizational solutions, and teaching and training activities targeted at students (Ankareddy et al., 2025; Urbano et al., 2025; Buckner & Zhang, 2024). Unfortunately, research still remains limited as to whether and how these institutional actions translate into increased awareness, the shaping of attitudes, and students' actual engagement in pro-environmental activities (Puertas et al., 2023; Grunwald et al., 2025; Hassan & Ahmad, 2025). This constitutes the research gap that the authors aim to address, at least in part, through the present study.

Despite the extensive body of literature on sustainability in higher education, most available studies focus primarily on analyses of curricula (Vargas-Merino et al., 2024; Serafini et al., 2022; Young, 2024) and on individual-level factors that determine students' attitudes and behaviours (Leal Filho et al., 2023; Tam, 2025). Far fewer empirical studies link sustainability management at the institutional level (e.g., policies, governance arrangements, and student-engagement initiatives) to student-level outcomes, both in terms of attitudes (Puertas et al., 2023; Grossmann et al., 2025; Teh, 2025) and participation in sustainability-related activities (Ankareddy et al.,

2025; Grunwald et al., 2025). As a result, it is still unclear which HEI-initiated actions are most effective in building student engagement and through what mechanisms this influence occurs. To address this research gap, this paper examines how the management of sustainability initiatives and actions undertaken by HEIs shapes students' attitudes and supports their engagement in sustainability, whilst deriving guidelines and recommendations for HEI authorities in this context. This can be translated into two primary research objectives:

G1. Assessment of the impact of the HEI initiatives activating involvement in sustainability on students' attitudes and awareness on sustainability
G2. Assessment of the impact of the HEI initiatives activating involvement in sustainability on students' engagement in sustainability.

Furthermore, research questions and research hypotheses were also formulated, which served as premises for constructing the research model (Fig. 1). In order to gain deeper insights into the motivations, barriers, and experiences of students and lecturers associated with education for sustainability, combining quantitative and qualitative methods (triangulation) is recommended (Eriksson et al., 2022).

The first part of the paper reviews current research on the students' attitudes and behaviours in the field of sustainability, as well as on the factors that affect their pro-ecological behaviour. Then, the management of activities undertaken by HEIs to shape appropriate students' attitudes and behaviours towards sustainability is presented.

On the basis of the literature review, five independent variables and 23 dependent variables were derived and organized in a conceptual model (hypotheses) for our empirical research. The research assumptions and methodology are subsequently detailed, followed by a presentation and discussion of the research results. Finally, practical implications for HEIs are derived, ending with limitations and recommendations for future research.

This study contributes to the development of knowledge in management and public management theory, with particular emphasis on sustainability-related aspects in higher education institutions (HEIs). The analysis focuses on HEIs' pro-environmental actions as a response to strong regulatory pressures. This provides an institutional perspective and is reflected in HEIs' efforts to formalize sustainability policies and practices and to embed ("institutionalize") them within their organizations (Scott, 2014). In addition, drawing on the concept of organizational legitimacy, we show that incorporating sustainability into HEIs' strategies is not merely a matter of "good practice," but a necessary managerial mechanism that matters to stakeholders (Miotto et al., 2026). Finally, we address the attitude–behaviour gap by examining how students' attitudes influence their behaviour and actions, in order to explain why strong student declarations do not necessarily translate into consistent pro-environmental behaviours.

2. Theory and literature review

Currently, various activities are undertaken by HEIs to promote a climate-friendly lifestyle, pro-ecological attitudes and behaviours in society. These activities are initiated both by HEI authorities and by students themselves. The HEI objectives and tasks concerning pro-ecological management in line with the principles of sustainable development, are usually featured in formally communicated strategy documentation, which often contains dedicated sections addressing sustainability-related objectives (e.g. UWM, 2015).

Taking into account the assumptions of institutional theory, organizations, including HEIs, in response to restrictive regulations and regulatory pressure, become increasingly similar to one another in terms of operational functions as well as standards and procedures. Moreover, a phenomenon of imitation and following industry leaders also emerges, with their practices treated as examples of good practice (Scott, 2014). With regard to sustainability, HEIs undertake various environmental initiatives which, on the one hand, may be imposed top-down and, on the other hand, may represent bottom-up efforts of different stakeholder groups within the organization. In turn, legitimacy theory assumes that organizations strive to obtain social approval for their actions (Miotto et al., 2026). In the case of HEIs, this relates both to students and staff. Sustainability goals and tasks embedded in HEIs' strategies provide legitimacy and constitute a solid foundation for long-term development; they are perceived by the community not as one-off events and may shape desirable pro-environmental attitudes and behaviours within the academic community (Di Tullio & Rea, 2025).

According to the theory of planned behaviour, intentions and behaviours, for example those of students, are determined not only by attitudes and norms, but psychological and organizational barriers are also important (Kollmuss & Agyeman, 2002). Consequently, managing student engagement should combine institutional policies with instruments that strengthen their involvement, in line with the stakeholder approach in strategic management (Ackermann et al., 2024).

They also create dedicated research units dealing with sustainable management (Academic Forum, 2022). HEIs are establishing, for example, so-called Green Offices, such as the University of Warsaw (Poland) (UW, 2023). That is why it is so important to introduce compulsory subjects into the curricula of schools and universities, promoting po-environmental attitudes and consumption behaviours, while educating on the effects of irresponsible resource management. Already, some HEIs are publishing ESG reports, such as Harvard University (USA) (Harvard University, 2023). Another example, the University of Edinburgh (Scotland), has implemented an ESG-based investment policy (University of Edinburgh, 2023). HEIs are also joining forces and developing international co-operations within the scope of sustainability-projects. To create and maintain a positive image, HEIs also undergo certification audits as to confirm that

their management practices comply with sustainability principles. The education of young people is the best place to start building social responsibility for the state of the environment, and arguably more effective than issuing orders and introducing restrictive regulations. Numerous studies are conducted around the world on issues related to the activities of HEIs in the field of shaping pro-ecological attitudes and behaviours of the academic community.

Our literature review has shown that they focus on key areas, such as: waste management (Cogut et al., 2019; Falsini, 2019) and recycling on university campuses (Hamón et al., 2020), green transport (Cogut et al., 2019), pro-environmental education and behavioural training (Ali & Anufriev, 20202; Mohammadi et al., 2023; Rosak-Szyrocka & Knop, 2023; Helak, 2021). A lot of research also concerns sustainability management, building an organizational culture aligned with the goals of sustainable development (Mohammadi et al., 2023; Hamón et al., 2020; Hübscher, et. al., 2022), as well as barriers to sustainability innovation (Ávila et. al., 2019) in the HEI context. These studies tend to follow mainstream social science research approaches, based on surveys and content analysis of secondary material. Research conducted by Rosak-Szyrocka and Knop (2023) and Alm et. al. (2022) showed that HEIs' initiatives for sustainable and the inclusion of SDGs-related issues in education programs are positively perceived by students. As many as 76% of respondents declared that they are proud of the fact that their institutions are actively committed to sustainable management, and 68.6% were actively participated in the corresponding pro-ecological activities. In addition, Hamón et. al. (2020) noted that science students exhibit greater awareness of recycling and ecological behaviour. On the other hand, as Ali & Anufriev's research (2020) showed in other universities, despite strenuous efforts and the introduction of various initiatives for sustainability significant weaknesses persisted in the management of sustainability, the level of student awareness in this area remained unsatisfactorily low. Of course, this can be attributed to a number of reasons, ranging from insufficient communication and inadequate adaptation of the university's offer to the needs of students, to the social and cultural norms in force in a given country. Ali and Anufriev (2020) while highlighting inadequate communication on the part of university authorities as the primary cause for low student awareness, also showed that university initiatives tend to improve student engagement. This was also confirmed by the research of Hamón et al. (2020), who showed an increase in students' awareness of sustainable management resulting from appropriate actions by university authorities (Alm et al., 2022). Rosak-Szyrocka and Knop (2023) also noted that public universities show higher levels of commitment than private universities in this respect.

The limited scope of studies in this field is accompanied by an absence of comprehensive management-oriented models that explain how various institutional factors interact to shape awareness of and behaviours related to sustainability (Alves-Pinto & Giannetti, 2019; Salsabila et al., 2019; Eugenio et al., 2021; Hastuti et al.,

2022; Ostrow, 2022; Chu May et al., 2023; Bolstad et al., 2023; Suminar et al., 2024; Dela Cruz et al., 2024). Finally, many researchers highlight the need for longitudinal studies to better understand how management of sustainability initiatives influences the evolutions of students' attitudes and engagement with sustainability over time (Eugenio et al., 2021; Khoiri et al., 2023; Zulkarnaen et al., 2023; Chu May et al., 2023; Alves-Pinto & Giannetti, 2019; Dela Cruz et al., 2024; Hastuti et al., 2022; Salsabila et al., 2019; Faizah et al., 2024; Ostrow, 2022).

Taking into account each of the above-mentioned research areas, it is extensive and requires separate in-depth investigation, this article focuses specifically on the management dimension of HEIs commitment to shaping students' attitudes and engagement in sustainability (Perrault & Clark, 2018).

An analysis of the existing research indicates a consistent pattern: the relationship between students' sustainability-related attitudes and behaviours is shaped by the internal and external factors, is highly context-dependent, and is influenced by how sustainability is managed within HEIs. Factors such as: the institutional/organizational culture, stakeholder involvement (university authorities, university employees and students), as well as effective and diverse communication and activities seem to play a central role.

Our literature review confirms the social and scientific relevance of conducting in-depth research on the effectiveness of various pro-ecological management initiatives and their impact on shaping positive attitudes and behaviours related to sustainability. While this type of research can be time-consuming and resource-intensive, its results can provide valuable input for HEI leadership, supporting the management and design of more effective educational and organisational strategies for sustainability. To summarise, the analyses conducted show that a wide range of studies worldwide address HEIs' engagement in sustainability issues. There is a growing scholarly interest in investigating HEIs' sustainability-related activities, with fewer single case studies and an increasing emphasis on systemic, comparative, and critical analyses. Many authors demonstrate how restrictive legal regulations influence HEIs' actions and how this translates into inequalities, for example between countries in the Global South and the Global North (Ankareddy et al., 2025). Another global research trend concerning HEIs' sustainability activity relates to rising expectations that HEIs should implement sustainability agendas in a measurable way (Buckner & Zhang, 2024). An equally strong trend involves organising and synthesising practices and identifying barriers that hinder HEIs' implementation of sustainability in the context of global guidelines such as the SDGs and the 2030 Agenda (Serafini et al., 2022). In addition, comparative studies are frequently conducted, placing emphasis on culture and on forms of education and communication in order to assess whether these factors affect HEIs' activity (Grossmann et al., 2025). Research is also being carried out on segmenting and personalising HEIs' sustainability-related actions towards students (Grunwald et al., 2025). Finally, many

studies provide critical analyses of legal regulations and prevailing standards in the area of sustainability, highlighting real constraints and barriers to HEIs' implementation of sustainability principles (Young, 2024).

3. Research methods

The empirical research of this paper reflects the application of methodological triangulation, integrating both quantitative and qualitative research methods. The data collection and statistical analysis was preceded by a literature review in scientific databases, i.e. Science Direct and Scopus with open access, as well as various types of existing material from HEIs websites and press releases. The aim was to assess how the management of various sustainability initiatives and actions influences students' attitudes and engagement. In addition, two research questions were formulated:

Q1. How do higher education institutions (HEIs)' initiatives and curricular' activities affect students' level of awareness of sustainability?
Q2. How do higher education institutions (HEIs)' initiatives and curricular' activities affect the level of student sustainability-related engagement (behaviour)?

The research was carried out using the CAWI survey method (Computer Assisted Web Interview) and PAPI (Paper-and-Pencil Interviewing) techniques. The corresponding questionnaire was prepared, consisting of 23 closed questions with pre-set answers complemented by a free-text field for additional answer options. The questionnaires used a 7-point Likert scale to allow respondents to express their attitudes and opinions on the topics studied more precisely. This range of the scale increases the sensitivity of the measurement, allowing one to capture subtle differences in students' levels of engagement and attitudes towards sustainability. The questionnaire was tested and subsequently translated into: Polish, German and English in paper and electronic versions using the MS forms application to enable all respondents to participate in the survey. Data collection took place between November 12, 2024 and February 12, 2025 at two universities (in Poland and Germany). The respondents' data were anonymized, as the study did not constitute a report or expert opinion, but rather focused on assessing students' attitudes and engagement in sustainability in the context of how sustainability is managed within HEIs.

The questionnaires were validated by performing Cronbach alpha tests. The value of Cronbach's alpha coefficient = 0.92, which suggests a very high internal consistency of the scales used. Such an exceptionally high consistency of scale implies a high degree of similarity between the survey items, which is why the questionnaire was reviewed to eliminate potentially unnecessary items. Nevertheless, an in-depth substantive analysis did not reveal unnecessary similarities.

The sampling was non-random and purposive, targeting students potentially involved in sustainability-related activities and university initiatives, given their close exposure to the management of sustainability efforts within HEIs. Two types of non-random selection were used: accidental/convenience sampling (i.e. students participating in university classes and events were invited to the study), and quota sampling (i.e. at least 90 students from each university would be invited to the study, but no sampling was carried out within these groups).

Derived from the literature review, a total of five independent variables were identified, which were included in one package called "University Initiatives Activating Involvement in Sustainability (UIASS)" and 23 dependent variables (DV), which were divided into two groups (Fig. 1).

The 10 variables relating to Students' Attitudes and Awareness on Sustainability (SAAS): from DV1a to DV1j (Fig. 1) and the 13 variables relating to Student Engagement in Sustainability (SES): DV2a to DV2m were tested against the five UIASS (IV1a-e) and 10 SAAS variables (DV1 a–j), resulting to a total of 50 $\chi 2$ tests were performed (5 IV1 ×10 DV1). For the five UIASS initiatives (IV1a–e) and 13 SES variables (DV2a–m), 65 U-Mann-Whitney tests were performed (5 IV1×13 DV2). The separate independent variables (IV1a-e) and dependent variables (DV1a-j and DV2a-m) formed the basis for the construction of the research model and enabled operation in accordance with the theory of cause-and-effect management (Williamson & Johanson, 2018). The identification of the variables enabled the creation of a research model outlining the research hypotheses testing the relationships between the studied dependent and independent variables (Czakon, 2021). Based on the above-mentioned research gaps, a decision was made to propose two research hypotheses, namely:

H1. *University Initiatives Activating Involvement in Sustainability (Independent Variable - IV1) have a significant impact on the Students' Attitudes and Awareness on Sustainability (Dependent Variable - DV1) [UIASIS: SAAS].*
H2. *University Initiatives Activating Involvement in Sustainability (Independent Variable - IV1) have a significant impact on the Student Engagement in Sustainability (Dependent Variable - DV2) [UIASIS: SES].*

The remaining identified research gaps are to be addressed in future studies. To provide a comprehensive understanding of the quantitative variables, descriptive statistics were calculated to summarise their key characteristics and distribution. To analyse the nominal data, percentages were calculated for the examined subgroups, providing an overview of their distribution and proportions. Relationships between variables were assessed based on the Spearman rank correlation coefficient. Furthermore, the conformity of the variables to a normal distribution was assessed using the Shapiro-Wilk test with a correction for sample size.

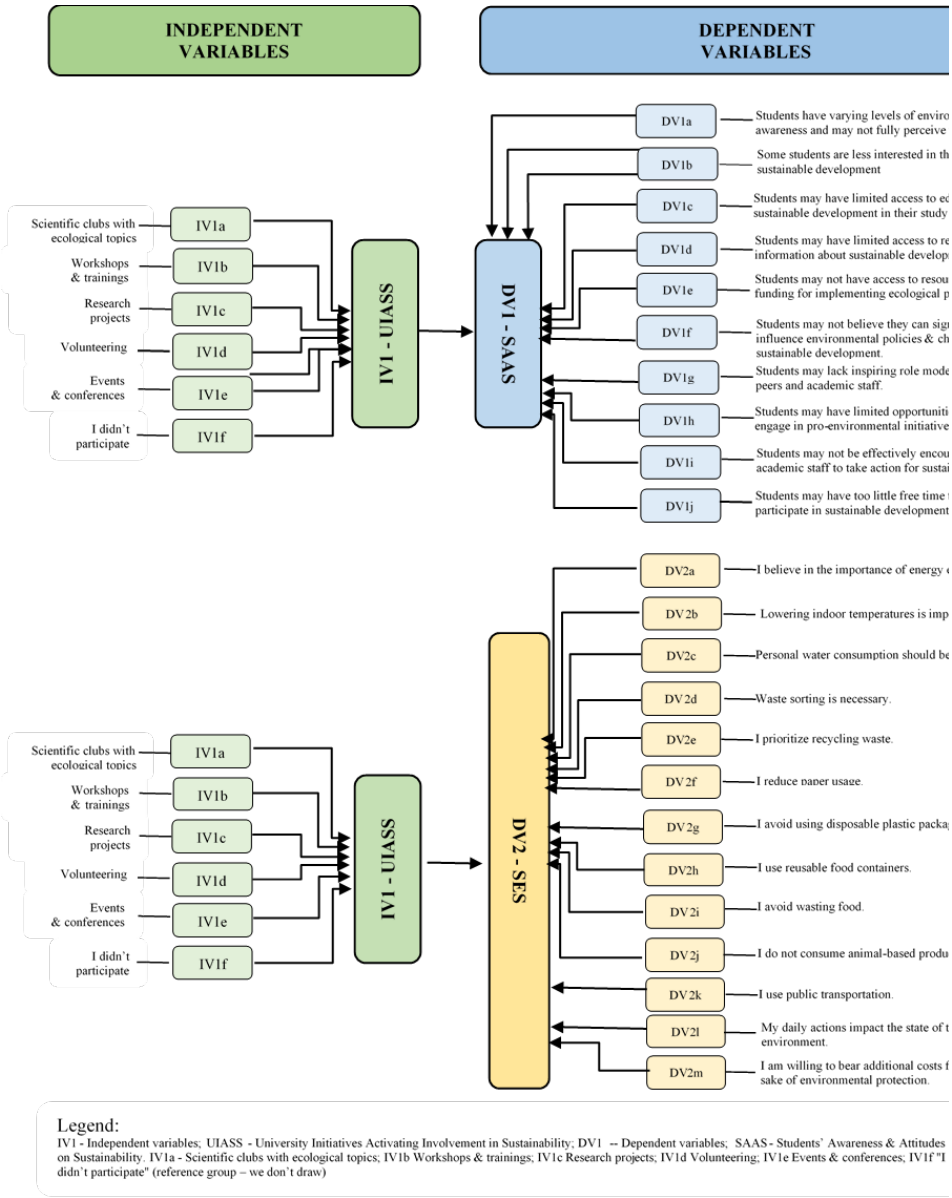

Figure 1. **The research model: dependent and independent variables**

Source: own study

Due to the asymmetry of the distributions, significance was tested using non-parametric tests, e.g. comparisons of two groups in an independent setup were performed with the Mann-Whitney U test (Z statistic with a correction for tied ranks). When analysing the UIASS (IV1a-f) and SES (DV2a-m) variables, the η^2 (eta-squared) statistic was used as a measure of effect for the U-Mann-Whitney tests. Relationships between characteristics were also analysed using the χ^2 (chi-squared) test. With the variables UIASS (DV1 a-f) and SAAS (DV1a-j), the effect size was evaluated using φ (phi) for χ^2 tests. The effect size for the above tests should be interpreted as φ / $\eta^2 \approx 0.01$ – small effect, ≈ 0.06 – medium effect, ≥ 0.14 – large effect, and an empty field (-) means that the effect size was not reported or that the result was not significant, so it was not calculated. A significance level of $\alpha = 0.05$ was adopted for the study. Statistical analyses were conducted using the Statistica 13.0 package (TIBCO Software Inc.; 2017). In addition, Cramér's φ was also used to measure the effect. Differences between percentages were tested using the test for two structural indicators.

4. Results of research study and discussion

4.1. Description of the sample of respondents

The activity of students at two universities in Poland and Germany was evaluated. These are public academic universities with just over 3,000 students each. A total of 187 students of all years studying at two public universities (95 respondents from Poland and 92 respondents from Germany) were surveyed, yielding a total of 185 valid questionnaires (Table 1).

Table 1. **Demographic characteristics of the surveyed respondents**

Arialem	*N*	% share	Calculation chip	*n*	% share
Gender					
Female	122	65,95	Female	122	68,16
Male	57	30,81	Male	57	31,84
Non-binary/Other	5	2,70	-	-	-
Prefer not to say	1	0,54	-	-	-
Age					
Under 20 years	40	21,62	<20 years	40	21,62
20–24 years	128	69,19	20-24	128	69,19

25–29 years	16	8,65	>24 years	17	9,19
30 years and above	1	0,54			
Country					
Poland	97	52,43	Poland	97	52,43
German	76	41,08	Germany	76	41,08
Thai	4	2,16	Others	12	6,49
Ukraine	1	0,54			
Portugal	1	0,54			
Japan	1	0,54			
Viert Nam	1	0,54			
Russia	1	0,54			
Iran	1	0,54			
Kazakhstan	1	0,54			
Portugal	1	0,54			

Source: own study

In the end, 52.43% were students from a university in Poland (92/95 respondents) and 47.57% students from a university in Germany (76/92 respondents), with 41.08% being citizens of Germany and 6.48% citizens of other countries (i.e. Thailand, Ukraine, Portugal, Japan, Viet Nam, Russia, Iran, Kazakhstan, and Portugal). The respondents also represented all years of study, with the largest group being first-year students (over 50%), and the remaining groups were distributed quite evenly. The vast majority of respondents came from cities with 50,000 to 200,000 inhabitants, and a total of almost 38% from smaller towns, and just over 16% from larger ones.

4.2. The impact of HESs' initiatives on students' attitudes and awareness of sustainability

Analysing the activity of students in HEI sustainability initiatives, our research showed that they were most often involved in volunteer work – a total of 10.27% of respondents, with the percentages in Poland and Germany being similar (5.41% and 4.86%, respectively). Moreover, 5.95% of the respondents participated in various types of events and conferences, with higher involvement of Polish students (4.86%) than German

students (2.15%). Students also took part in workshops, training sessions, research projects, and also in scientific circles addressing environmental issues. Unfortunately, as many as 77.84% of all respondents did not participate in any sustainability-related activities, despite the availability of a relatively wide offer in their institutions. Low student involvement in the initiatives could be attributed to a lack of time, or inadequate scheduling of such events, overlapping with regular classes.

Large-scale campaigns promoting sustainability, regular "Eco-weeks" blocked in advance in the academic year calendar and study program, or, for example, the organisation of competitions combined with attractive prizes, all could serve as counter-measures here. HEIs could consider the possibility of organizing courses, workshops, seminars, mini-symposia, or co-financing microgrants related to ecology. A complementary measure could also involve effective incentives for the establishment of ecology-themed scientific student clubs (Table 2).

Table 2. **Students participation in University pro-environmental initiatives (IV1 – UPI) in Poland and Germany**

Variables	No.	%	Students - Poland	% Share	Students - Germany	%
IV_{1a}	6	3,24%	4	2,16%	4	2,16%
IV_{1b}	8	4,32%	3	1,62%	5	2,70%
IV_{1c}	8	4,32%	8	4,32%	0	0,00%
IV_{1d}	19	10,27%	10	5,41%	9	4,86%
IV_{1e}	11	5,95%	9	4,86%	4	2,16%
IV_{1f}	144	77,84%	86	46,49%	72	38,92%

Source: own study

60.5% of the respondents reported that environmental protection and sustainable development are important or very important to them, indicating a solid value base for engaging with sustainability management initiatives at HEIs. In addition, the situation is similar when it comes to the respondents' perceptions of their impact concerning environmental protection and sustainability. More than half of the respondents (58.9%) rated their activity impact as significant or very significant. Having said that, as many as 21% of the surveyed students appear to believe that their actions are unimportant and irrelevant when it comes to the state of the natural environment. The situation gets slightly better when it comes to their attitude concerning the importance of environmental protection, with as many as 76.2% rating it as an important or extremely important; while only 10.8% expressed a negative opinion on this matter (Table 3).

Table 3. **Students' attitudes and awareness on sustainability**

Arialem	1	2	3	4	5	6	7*
Environmental-Sustainability Importance ESI	3,2%	2,7%	10,8%	22,7%	28,6%	17,8%	14,1%
Environmental-Impact Self-Efficacy EISI	4,3%	7,0%	9,7%	20,0%	28,1%	13,0%	17,8%
Environmental-Protection Priority EPP	1,6%	3,8%	5,4%	13,0%	25,4%	23,8%	27,0%

*scale from 1 to 7, where 1 – strongly disagree, 7 – completely agree

Source: own study

There is also a group of students who are sceptical about the activities offered. Approximately 6-11% deny the importance and impact of such initiatives. Therefore, HEIs could consider segmenting the information provided to this group of recipients, emphasising on concrete personal benefits (Table 4).

Table 4. **Students' attitudes and awareness on sustainability**

Variables	Mean	Median	% Agreement (5-7)*	% Strong agreement (6-7)	% Disagreement (1-2)
ESI	4.80	5	60.5 %	31.9 %	5.9 %
EISI	4.71	5	58.9 %	30.8 %	11.3 %
EPP	5.36	6	76.2 %	50.8 %	5.4 %

*scale from 1 to 7, where 1 – strongly disagree, 7 – strongly agree

Source: own study

Overall, the results reveal a positive students' attitude towards complying with sustainability principles, which is encouraging, as it confirms that the younger generations are more sensitive to environmental issues and receptive to sustainability-oriented management practices implemented by HEIs. It is also worth noting that more than half of the respondents (51.9%) believe that students should get involved in supporting their institution's sustainability actions. Increasing student participation in initiatives organised on campus and forming eco-friendly attitudes and behaviours remains a key challenge for HEIs.

The average DV1 (Students' Attitudes & Awareness on Sustainability) level was lower among students who had never participated in any sustainability-related education and activities than among those who had, indicating that well-managed sustainability education and initiatives contribute to higher levels of

pro-sustainability attitudes and awareness (5.0 vs 6.0). There were no statistically significant differences in the average sustainability-related knowledge between students declaring participation in education (compulsory or non-compulsory and non-university). Only 2% of the DV1 variability can be attributed to participation in various forms of education, which may mean that these forms do not fulfil their purpose and bring low results (Table 5).

Table 5. **DV1 - comparison of students' attitudes and awareness on sustainability by their participation in initiatives offered by Universities (N=185)**

Student engagement	M	n	SD	Min.	,aks.	Q_{25}	Me	Q_{25}	Z_{pop}	*p*	η2
Yes	5,04	110	1,33	1,00	7,00	4,00	5,00	6,00	**1,78%**	0,0756	0,02
No	5,35	75	1,26	1,00	7,00	5,00	6,00	6,00			

Source: own study

In relation to those who participated in various forms of activity (6.0; IQR=1) or declared their willingness to participate in them, if available (0.6; IQR=1), the average level of Students' Attitudes & Awareness on Sustainability (DV1) was significantly lower in the group of students who had never participated in any form of institutional activities and declared unwillingness to participate in them in the future (Me=5.0; IQR=2.0). Based on this, it can be concluded that stimulating students' interest in sustainability issues can lead to pro-ecological behaviours and attitudes (Table 6).

Table 6. **Interest in participating in university-organised sustainability initiatives**

Intensity of desire for education	M	n	SD	Min.	Maks.	Q_{25}	Me	Q_{75}	H	*p*	η2
Inactivity in university initiatives	4,68	71	1,42	1,00	7,00	4,00	**5,00**	6,00	18,92	**0,0001**	10%
Willingness to take part in university initiatives	5,69	39	0,83	4,00	7,00	5,00	**6,00**	6,00			
Participation in university initiatives	5,35	75	1,26	1,00	7,00	5,00	**6,00**	6,00			

Source: own study

Amongst students, an increase in their own perceived impact on the state of the natural environment was accompanied by an increase in the perceived impact of their institution's commitment to sustainable practices (rS = 0.30; p<0.05) (Fig. 2).

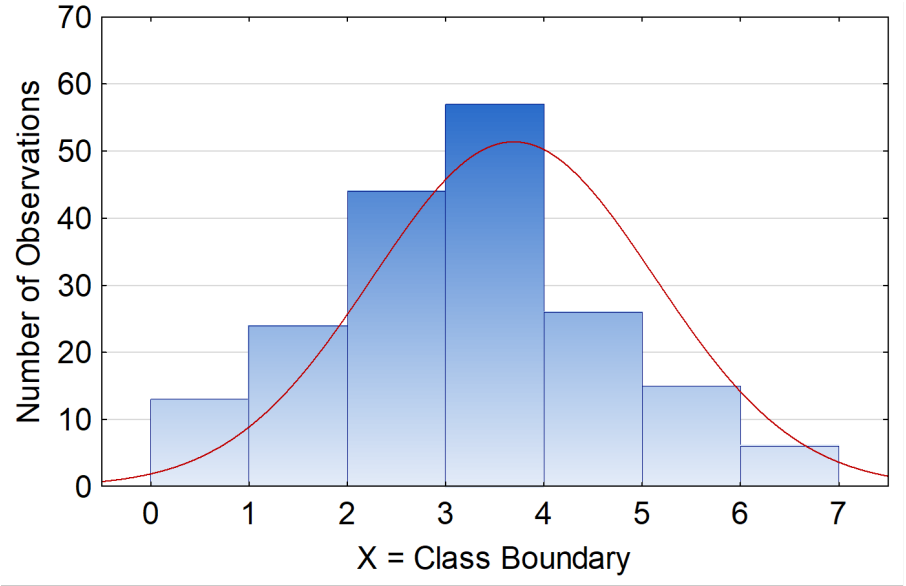

Figure 2. **The impact of universities initiatives on students' attitudes and awareness on sustainability**

Note: K–S d=0,16100 d=0,16100, p<0,01 p<0,01; Lilliefors p < 0,01 p<0,01; Shapiro–Wilk W = 0,94741 W=0,94741, p = 0,00000 p=0,00000.

Source: own study

Our results confirm the a considerable lack of environmental self-awareness amongst students (over 74% of respondents) and a persisting significant lack of interest in sustainability issues (almost 63% of respondents). This is primarily due to a lack of emotional involvement and sense of meaning attributed to such activities. Another problem is a lack of perceived agency related to the impact of their involvement in pro-ecological activities (41% of respondents – Table 7).

Table 7. **Students' perceived barriers to students' attitudes & awareness on sustainability (N=185)**

Dependent variables	n	% answers	% cases
DV_{1a}	137	19,77	74,05
DV_{1b}	116	16,74	62,70
DV_{1c}	42	6,06	22,70
DV_{1d}	56	8,08	30,27
DV_{1e}	65	9,38	35,14
DV_{1f}	75	10,82	40,54
DV_{1g}	61	8,80	32,97
DV_{1h}	39	5,63	21,08
DV_{1i}	37	5,34	20,00
DV_{1j}	65	9,38	35,14
Total	693	100,00	-

Source: own study

A third of students also reported a lack of adequate financial- and time-resources, which hinder their engagement in eco-friendly activities, in spite of their willingness to engage in pro-ecological activities. They also pointed to difficulties in accessing sources of knowledge (30% of respondents) and a lack of inspiring role models for environmentally-friendly behaviour (33% of respondents). Finally, one in five respondents indicated that they see limited opportunities to engage in pro-ecological activities and believe that the institutional incentives are too weak to mobilise them. Hence, HEIs are also confronted with task of ensuring that students' conviction is sufficiently incentivised and that individual actions have a visible impact on the state of the environment and are considered be important for systemic change. In this regard, it is also necessary to conduct extensive information and dissemination activities through education and various other initiatives, as well as to develop a motivational system that will encourage students to act (Fig. 3).

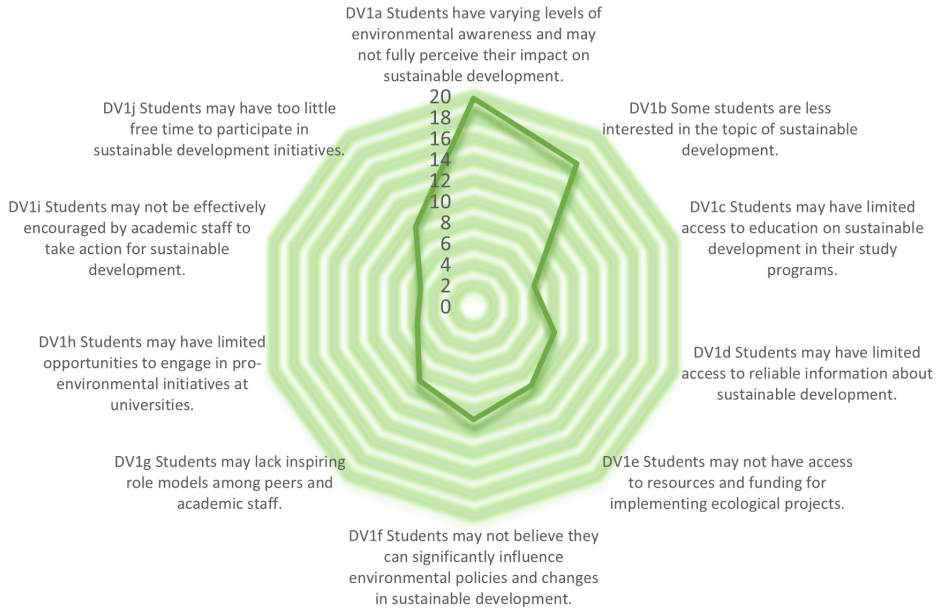

Figure 3. **Structure of responses regarding perceived barriers to students' attitudes & awareness on sustainability (%)**

Source: own study

A statistical analysis using χ^2 tests for the Independent Variable (IV1 - UIASS) University Initiatives Activating Involvement in Sustainability and the Dependent Variable (DV1a-j - SAAS) Students' Attitudes and Awareness on Sustainability, showed that students declaring participation in workshops/trainings (IV1b), as a result of managed sustainability initiatives, were less likely to report that they were not interested in sustainable development (DV1b), which in turn may indicate greater awareness in this respect (IV1b → DV1b: $p = 0.0086$, $\varphi = 0.22$; $\varphi \approx 0.22$ → medium effect). The lower the p-value, which measures statistical significance (< 0.05), the lower the probability that the observed effect reflects a coincidence. The values in bold in Table 8 are cases where $p < 0.05$ (statistically significant). In addition, the designations in Table 9 φ (phi) indicate measures of effect size. This should be interpreted as (Cohen, 1994), $\varphi \approx 0.01$ – small effect, ≈ 0.06 – medium effect, ≥ 0.14 – large effect, and an empty field (-) means that the size of the effect was not reported or that the result was not significant, and thus not calculated.

On this basis, it can be concluded that the organization of workshops for students by universities effectively increases their interest in sustainability. A study conducted by Grossmann (2025), which compared students' perceptions of sustainability in the USA and Germany, showed that education has a similar impact on behaviour in both countries, but awareness campaigns are more effective in the USA. In turn, research by Puertas (2023) confirmed that an assessment of universities' ability to strengthen environmental perceptions and engagement in Spain versus Italy, based on the GreenMetric ranking (2018–2022), indicated better performance by Spanish universities than Italian ones.

The situation is similar the issue of people reporting that they had taken part in voluntary work related to sustainability (IV1d → DV1b: $p = 0.0013$, $\varphi = 0.25$; $\varphi \approx 0.25$ → medium effect). It is also worth noting that this group of students also tends to complain less about lack of time (DV1j) as the main reason for their low interest in sustainability issues. (IV1d → DV1j: $p = 0.0341$, $\varphi = 0.17$; $\varphi \approx 0.17$ → small effect). This means that HEIs would be well-advised to place more emphasis on this type of activity. On the other hand, the remaining 47 relationships between variables did not show statistical significance ($p > 0.05$), hence φ were not reported for them (Table 8).

Table 8. **χ^2 test results for IV1 – UIASS and DV1a-j - SAAS**

Variables (IV → DV1a-e)	p-value	Φ*	Variables (IV → DV1f-j)	p-value	Φ*
IV1a → DV1a	0.9571	—	IV1a → DV1f	0.1024	—
IV1b → DV1a	0.7264	—	IV1b → DV1f	0.1994	—
IV1c → DV1a	0.7264	—	IV1c → DV1f	0.8501	—
IV1d → DV1a	0.7527	—	IV1d → DV1f	0.2772	—
IV1e → DV1a	0.3369	—	IV1e → DV1f	0.5435	—
IV1a → DV1b	0.2787	—	IV1a → DV1g	0.1918	—
IV1b → DV1b	**0.0086**	**0.22**	IV1b → DV1g	0.3817	—
IV1c → DV1b	0.7177	—	IV1c → DV1g	0.9156	—
IV1d → DV1b	**0.0013**	**0.25**	IV1d → DV1g	0.5246	—
IV1e → DV1b	0.6984	—	IV1e → DV1g	0.9331	—
IV1a → DV1c	0.8914	—	IV1a → DV1h	0.4364	—
IV1b → DV1c	0.2561	—	IV1b → DV1h	0.8687	—
IV1c → DV1c	0.5552	—	IV1c → DV1h	0.8687	—

IV1d → DV1c	0.9141	—	IV1d → DV1h	0.7641	—
IV1e → DV1c	0.9984	—	IV1e → DV1h	0.5325	—
IV1a → DV1d	0.2344	—	IV1a → DV1i	0.7556	—
IV1b → DV1d	0.3962	—	IV1b → DV1i	0.9280	—
IV1c → DV1d	0.4684	—	IV1c → DV1i	0.4161	—
IV1d → DV1d	0.6931	—	IV1d → DV1i	0.8559	—
IV1e → DV1d	0.9083	—	IV1e → DV1i	0.8156	—
IV1a → DV1e	0.7333	—	IV1a → DV1j	0.1621	—
IV1b → DV1e	0.8140	—	IV1b → DV1j	0.8140	—
IV1c → DV1e	0.3210	—	IV1c → DV1j	0.8140	—
IV1d → DV1e	0.9290	—	**IV1d → DV1j**	**0.0341**	**0.17**
IV1e → DV1e	0.8122	—	IV1e → DV1j	0.6792	—

* ≈ 0,10 small effect (difficult to see in practice; ≈ 0.30 medium effect; ≥ 0.50 large effect

Source: own study

Statistical analysis showed that the hypothesis, stating that H1: University Initiatives Activating Involvement in Sustainability (Independent Variable - IV1) have a significant impact on the Students' Attitudes and Awareness on Sustainability (Dependent Variable - DV1) [UIASIS: SAAS], receives partial support, because only the organization workshops & training sessions (IV1b) and volunteer work (IV1d) turned out as statistically significant; yet the effects were moderate, as they $\varphi \approx 0.22–0.25$, which should be interpreted as participation in the initiative explains 5–6% of the variance in attitudes (φ^2). Research by Leal Filho (2023) also showed that students are aware of climate change and its risks, and that climate education is perceived as a way to shape attitudes and develop their competencies. While the difference is noticeable, most factors shaping students' attitudes and awareness of sustainable development seem to lie outside the managed UIASS themselves. For example, Serafini (2022) highlighted the need for coherence in strategic planning across all levels of the organization and for better decision-making support for university leadership. No significant differences were found when testing for other variables related, amongst others, to students' awareness of their potential impact and agency on sustainable development, access to education and information, as well as patterns of behaviour and so on (Fig. 4).

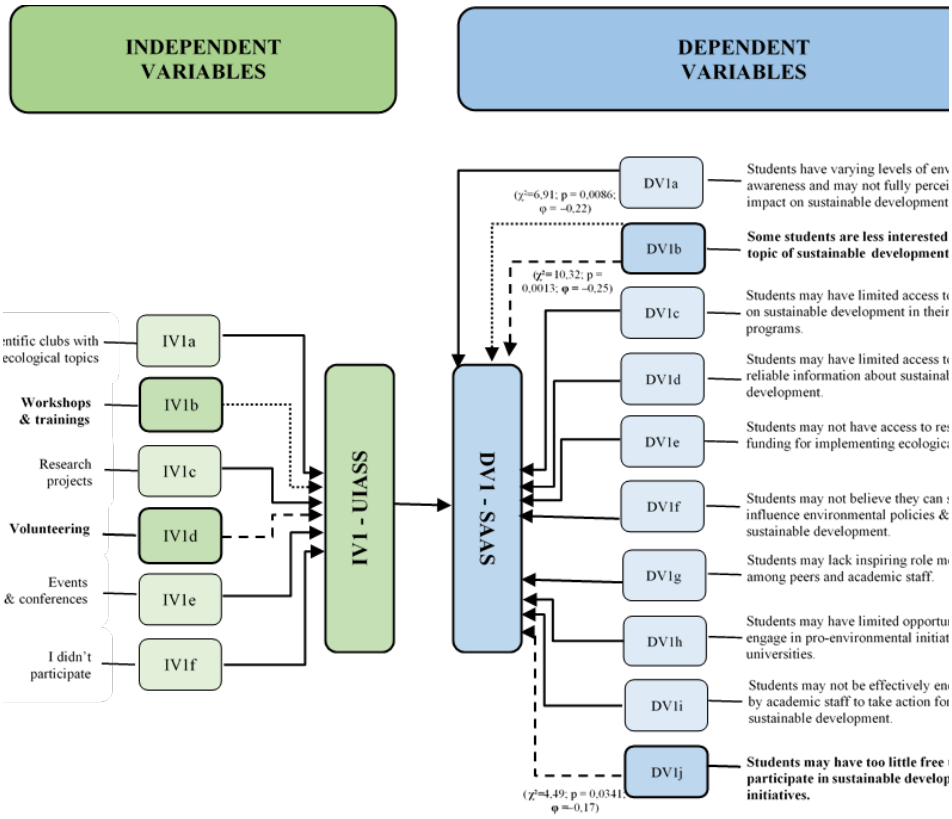

Figure 4. **Verification of the research model – results of statistical tests for IV1-UIASS i DV1-SAAS**

Source: own study

At this point, one may also be tempted to conclude that the HEI initiatives proposed by our research, such as: scientific clubs with ecological themes, events & conferences, research projects, may not be as effective as hoped for. Urbano (2025) conducted a study assessing the level of higher education institutions' (HEIs) engagement in sustainability, pointing to the need for further research on differences in participation and the determinants of reporting, including analyses of strategic behaviour.

Perhaps here, it is worth thinking more deeply about their conceptualization, scope, and form, while better communicating to students the benefits of activity and its added value for the environment and their future. A variety of activities seem to be

necessary, including integrating sustainable management into regular classes within study programs, as well as mentoring and, most importantly, intensifying outreach activities.

4.3. The Impact of HEI initiatives on student engagement in sustainability

The analysis of the study's results showed that the general level of pro-environmental behaviour of students can be considered high (average = 5.13 / 7. As many as 81.6% (151/185 cases) of respondents stated that they sort waste (DV2d), and 77.8% (144/185 cases) declare that they use public transport (DV2m). The results were also positive regarding the use of reusable containers (DV2h). More than half of the surveyed students, indicated that they regularly sort waste. They also claimed that they regularly use public transport and take care to save electricity (turning off the lights). On the other hand, they are less willing to buy certified eco-products and reduce the use of plastic due to by financial constraints. They are least inclined to sacrifice in terms of their diet and abstain from eating meat dishes (positive skewness and high variation of SD > 2.0). The activity of students in pro-environmental organisations also appears low. Here, it should be noted that meat production is responsible for almost 14% of global greenhouse gas emissions, primarily methane from ruminant digestion and nitrous oxide from fertilizers (Gerber et al., 2013; IPCC, 2019). As much as 15,000 litres of water are needed to produce just 1 kg of beef. In addition, grazing animals are the primary cause of biodiversity losses (Poore & Nemecek, 2018) (Table 9).

Table 9. **Declared students' engagement in sustainability – descriptive statistics (N = 185)**

Dependent variables	Mean Likert score (1-7)	M	SD	Me	Mo	n_{Mo}	Min	Maks	Sk.
DV_{2a}	5,52	5,52	6,00	6,0	73	1,00	7,00	1,45	-1,5
DV_{2b}	5,29	5,29	6,00	6,0	60	1,00	7,00	1,60	-1,1
DV_{2c}	5,1	5,10	6,00	7,0	50	1,00	7,00	1,88	-0,9
DV_{2d}	6,1	6,10	7,00	7,0	110	1,00	7,00	1,51	-1,9
DV_{2e}	5,34	5,34	6,00	6,0	61	1,00	7,00	1,72	-1,2
DV_{2f}	5,05	5,05	5,00	6,0	46	1,00	7,00	1,76	-0,9
DV_{2g}	4,96	4,96	5,00	7,0	42	1,00	7,00	1,77	-0,7
DV_{2h}	5,71	5,71	6,00	7,0	85	1,00	7,00	1,70	-1,4

DV_{2i}	5,57	5,57	6,00	7,0	73	1,00	7,00	1,67	-1,3
DV_{2j}	4,96	4,96	5,00	5,0	47	1,00	7,00	1,60	-0,7
DV_{2k}	4,08	4,08	4,00	6,0	39	1,00	7,00	1,96	-0,2
DV_{2l}	3,04	3,04	2,00	1,0	71	1,00	7,00	2,13	0,6
DV_{2m}	6,01	6,01	7,00	7,0	110	1,00	7,00	1,66	-1,9

Source: own study

For a deeper understanding of the impact of university initiatives on student engagement in sustainability activities, two clusters were created: students actively involved in UIASS and students not involved in UIASS at all, reflecting different levels of exposure to managed sustainability initiatives. Grunwald (2025) conducted an interesting study that identified student segments in the USA and Germany based on their intentions to engage in sustainability and mapped their expectations to help design engagement strategies. The study distinguished four segments: "Convinced Doers," "Latent Doers," "Unintentionally Passives," and "Sceptical Passives."

A statistical analysis using the U-Mann-Whitney tests for the Independent Variable (IV1 – UIASS: University Initiatives Activating Involvement in Sustainability) and the Dependent Variable (DV2a-m – SES: Students' in Engagement Sustainability), revealed differences between the two groups: students who reported their institution manages programs and/or initiatives for sustainable development (n = 41), and those who did not indicate such activities (n = 144)). Students from the first group reported that their own commitment to sustainable development and also agreed that their institution's activities had an impact on their commitment. The average rating of their involvement was 4.17 ± 1.16 in the "Yes" group and 3.66 ± 1.34 in the "None" group. On the other hand, the average assessment of the HEI's impact is 4.15 ± 1.33 (Yes) compared to 3.56 ± 1.44 (None). The results of the Mann-Whitney test: $Z = -2.59$; $p = 0.0095$ for the first question and $Z = -2.50$; $p = 0.0123$ for the second, mean that the probability of their accidental occurrence is below 1.5% (Fig. 5).

By contrast, the effect indicators are small ($\eta^2 \approx 0.04$ and 0.03), which should be explained by the mere fact HEI initiatives account for only 3-4% of the variability in outcomes. Common medians (4) and overlapping quartiles (Q1-Q3 = 4-5 vs. 3-4) indicate that there is some overlap in the distributions of responses; this means that a significant group of students also report a high commitment to sustainability issues even without institutional support. This explains the 2-4% of the variance in behaviour. Most of the differences depend on several other factors, beyond the scope of this study such as: accepted social norms, personal motives, or the influence of economic and other factors (Table 10).

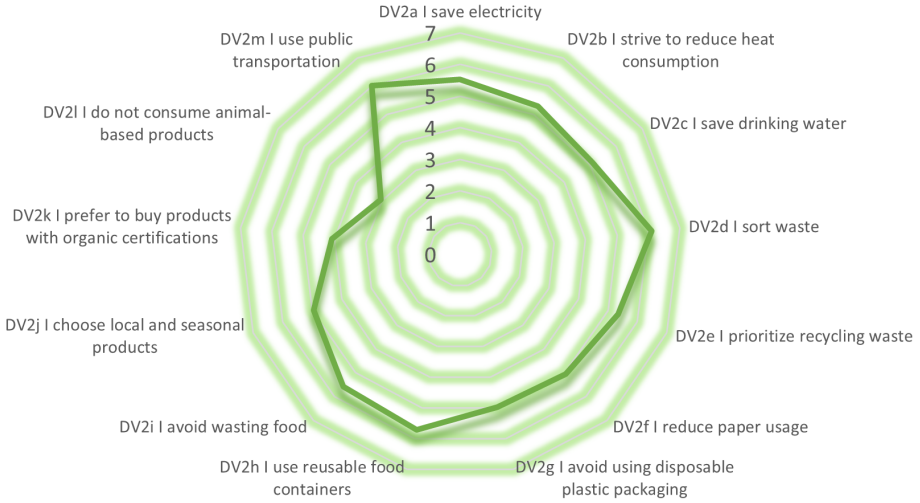

Figure 5. **Declared students' engagement in sustainability**

Source: own study

Table 10. **Impact of University Sustainability Initiatives on student engagement – descriptive statistics and Mann-Whitney U test results**

Variables	Answer	M	N	SD	Min	Max.	Q25	Me	Q75	Z_{pop}	*p*	η2
Does your university offer programs or initiatives promoting sustainable development?	Yes	4,17	41	1,16	2,00	7,00	4,00	4,00	5,00	-2,59	**0,0095**	0,04
	None	3,66	144	1,34	1,00	7,00	3,00	4,00	4,00			
How do you rate the impact of your university's actions on your engagement in sustainable development?	Yes	4,15	41	1,33	1,00	7,00	3,00	4,00	5,00	-2,5	**0,0123**	0,03
	None	3,56	144	1,44	1,00	7,00	3,00	4,00	4,00			

Source: own study

A total of 65 tests were performed for IV1 variables: DV2 (5 initiatives × 13 behaviours = 65), with only 7 (≈ 11 %) tests showing statistical significance ($p < 0.05$), with the effect size being small ($\eta^2 = 0.02 – 0.04$). Analysing the results, several phenomena can be observed. Students who declared participation in conferences indicated a slightly higher percentage of people buying certified food (DV2j) (Table 11).

Table 11. **Test results U-Manna-Whitney for IV1 - UIASS and DV2a-m - SES**

Variables (IV → DV2a-g)	p-value	η^{2*}	Variables (IV → DV2g-m)	p-value	η^{2*}
IV1a → DV2a	0.1654	—	IV1d → DV2g	0.4497	—
IV1b → DV2a	0.9577	—	IV1e → DV2g	0.8359	—
IV1c → DV2a	0.5341	—	IV1a → DV2h	0.2806	—
IV1d → DV2a	0.7137	—	IV1b → DV2h	**0.0196**	**0.03**
IV1e → DV2a	0.5214	—	IV1c → DV2h	0.6372	—
IV1a → DV2b	0.3052	—	IV1d → DV2h	0.4705	—
IV1b → DV2b	**0.0434**	**0.02**	IV1e → DV2h	0.3654	—
IV1c → DV2b	0.9288	—	IV1a → DV2i	0.1413	—
IV1d → DV2b	0.2961	—	IV1b → DV2i	0.4120	—
IV1e → DV2b	0.4459	—	IV1c → DV2i	**0.0106**	**0.04**
IV1a → DV2c	**0.0113**	**0.03**	IV1d → DV2i	0.2998	—
IV1b → DV2c	0.3733	—	IV1e → DV2i	0.9926	—
IV1c → DV2c	0.3157	—	IV1a → DV2j	0.9490	—
IV1d → DV2c	0.2748	—	IV1b → DV2j	0.1458	—
IV1e → DV2c	0.8092	—	IV1c → DV2j	0.7200	—
IV1a → DV2d	0.4975	—	IV1d → DV2j	0.1285	—
IV1b → DV2d	**0.0070**	**0.04**	IV1e → DV2j	**0.0472**	**0.02**
IV1c → DV2d	**0.0322**	**0.02**	IV1a → DV2k	0.0701	—

IV1d → DV2d	0.9303	—	IV1b → DV2k	0.1034	—
IV1e → DV2d	0.7153	—	IV1c → DV2k	0.2015	—
IV1a → DV2e	0.3680	—	IV1d → DV2k	0.3476	—
IV1b → DV2e	0.1121	—	IV1e → DV2k	0.6549	—
IV1c → DV2e	0.1121	—	IV1a → DV2l	0.0658	—
IV1d → DV2e	0.5961	—	IV1b → DV2l	0.3509	—
IV1e → DV2e	0.5850	—	IV1c → DV2l	0.4292	—
IV1a → DV2f	0.1962	—	IV1d → DV2l	0.7893	—
IV1b → DV2f	0.8874	—	IV1e → DV2l	0.5528	—
IV1c → DV2f	0.2177	—	IV1a → DV2m	0.2843	—
IV1d → DV2f	0.5491	—	IV1b → DV2m	0.7525	—
IV1e → DV2f	0.1814	—	IV1c → DV2m	0.4244	—
IV1a → DV2g	0.1354	—	IV1d → DV2m	0.2981	—
IV1b → DV2g	0.0699	—	IV1e → DV2m	0.8549	—
IV1c → DV2g	0.5680	—			

*$\eta^2 \approx 0{,}01$ → low; $\eta^2 \approx 0{,}06$ → average; $\eta^2 \geq 0{,}14$ → high.

Source: own study

Respondents who declared activity in HEI initiatives and who were more familiar with environmental standards, assessed their own habits more strictly, which may suggest higher levels of pro-ecological awareness. Secondly, the results also show that institutional initiatives increase knowledge, but do not necessarily facilitate changes on everyday habits, which may be due to their incidental nature, the lack of systemic sustainability management, infrastructural deficiencies, but also the organizational, technical and financial limitation, currently faced by university authorities. The chart below highlights the variables exhibiting statistical significance as a result of descriptive statistics and Mann-Whitney U Test Results (Fig. 6).

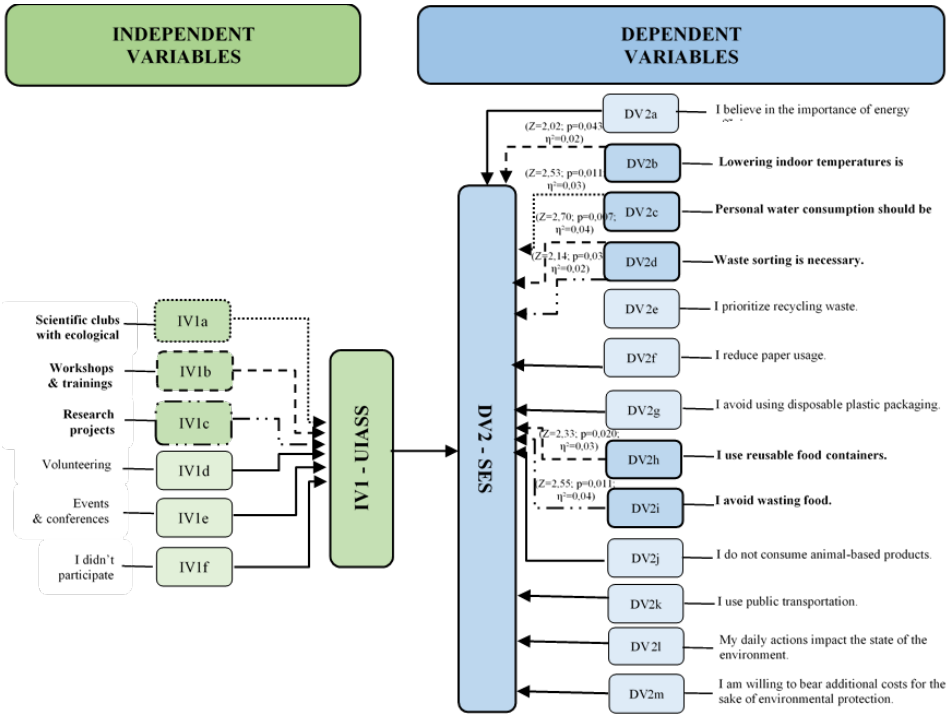

Figure 6. **Verification of the test model – results of statistical tests for IV1-UIASS and DVE-SES**

Source: own study

In the light of the analysis above, the second hypothesis, postulating that H2: University Initiatives Activating Involvement in Sustainability (Independent Variable - IV1) have a significant impact on the Student Engagement in Sustainability (Dependent Variable - DV2) [UIASIS: SES], suggests that university initiatives aimed at facilitating commitment to sustainability (IV1a-f) have an impact on student engagement in sustainability (DV2a-m) and is statistically supported; although the effect is moderate (Fig. 6). Buckner (2024) also emphasized the importance of this area in his research, describing the growing commitments of higher education institutions (HEIs) worldwide to sustainability, as well as the increase in universities' declarations and pledges related to sustainability and sustainable development. Our results support the notion that students' knowledge of HEI pro-ecological initiatives is conducive to their own participation in sustainability-related activities (Fig. 7), but also to a higher assessment of HEIs' role

in this context (Fig. 8). Unfortunately, this effect, although statistically significant, is actually rather moderate.

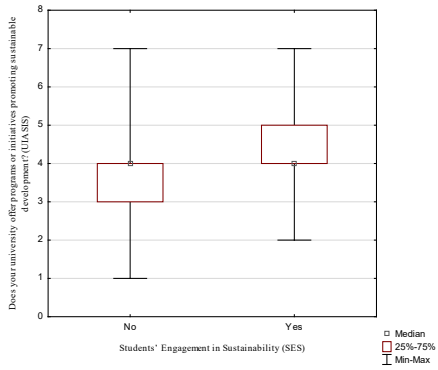

Figure 7. **Perception of the university's initiatives in education for sustainable development vs. student engagement**

Source: own study

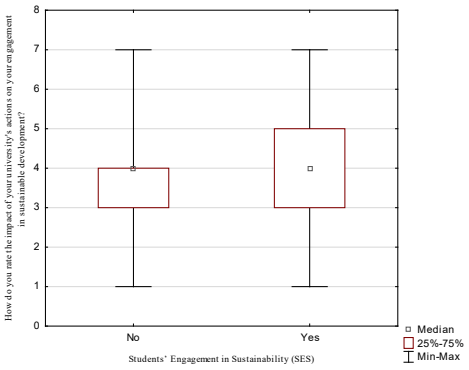

Figure 8. **Perception of the university's initiatives in education for sustainable development vs. student engagement**

Source: own study

Unfortunately, most of the initiatives proposed by HEIs do not fulfil their role sufficiently and, as our analysis shows, sometimes even inhibit activity, rather than notably increasing students' involvement. Therefore, there is a pressing need for programs that combine education with practical support for students, such as workshops combined with motivational systems, both intangible and material. At the same time, it should be emphasized that culture plays a major role in students' pro-environmental attitudes and behaviours, as it influences behaviour through values and by moderating the relationship between psychological determinants and behaviour (Tam, 2025).

5. Conclusions

It should be noted that there is a growing awareness among HEIs regarding the necessity of sustainable action, beyond the scope of so-called 'soft' activities manifesting themselves in the form of meetings, seminars, pro-ecological events, and as described above, include 'hard' investments. Increasingly, more HEIs around the world are introducing regulations to segregate waste and equip campuses accordingly. They also introduce solutions for energy efficiency such as installing motion sensors in public areas and the use of energy-saving bulbs, photovoltaic panels, or restrictions on

the heating of office spaces. In addition, they are investing on the promotion of micro mobility, by offering facilities for cyclists, as well as creating apiaries for bees and green gardens on campus.

The results of the study showed that our sampled students are not strongly involved in the activities initiated by their corresponding institutions. Low student involvement in sustainability-related HEI-led initiatives may well be the result non-controllable organisational, social-, but also psychological factors. Students usually suffer from a chronic lack of time availability, due to the overscheduling and sheer number of compulsory classes, apprenticeships and professional internships, but also the need for a side-job to subsidise their living costs. All this causes fatigue and lack of willingness to engage in extracurricular initiatives. The second pertinent reason may be financial limitations, as some of the activities require paying fees, which students simply cannot afford, and cannot always count on their HEIs support with this.

Students clearly *declare that* environmental protection is important to them, but unfortunately have low faith in the relevance and effectiveness of their own actions. Their enthusiasm does not readily translate into a sense of agency. Perhaps, students need more impactful and visible effects of their actions to build on their initial enthusiasm and maintain interest over time. Quick-win projects where results are readily visible ought to be prioritised from this perspective.

The research has shown that sustainability initiatives involving students are effective in increasing their awareness and expressed support, but unfortunately this does not fully spill-over to the pro-ecological behaviours outlined in this study. The conclusion is that in order to move from students' beliefs to action, HEIs are called to act systemically, introducing incentives and programs to build students' competences.

Hopefully, the research presented here provides useful information on how HEI initiatives affect young people's sustainability awareness and engagement. This issue is currently more relevant than ever, considering the global ecological challenges and the associated social and economic challenges several governments have long been struggling with. The study's results can amplify the voices calling for effective educational strategies and HEI policies, which ultimately facilitate responsible attitudes and sustainable action at a wider societal level. An educated and environmentally-aware graduate will also likely be a responsible consumer, and perhaps even a sustainability transformation agent or leader in the future.

6. Practical implications for HEIs

Given the challenging nature of shaping pro-ecological attitudes and behaviours among students, the corresponding measures and activities have a systemic character. The overall HEI development strategy of an HEI provides the framework within which operational activities are managed, with some institutions developing dedicated

sub-strategies for sustainability. Where sustainability management is not explicitly and visibly embedded in institutional strategy or related policies, the necessary that resources and structures are unlikely to be prioritised. In such cases, pro-ecological activities targeted students and the wider academic community are likely to be perceived as incidental and unattractive.

HEI staff support and involvement in the promotion and organisation of sustainability-related events has an important role to play when it comes to activities involving students in this context. Students who are actively encouraged to act, are more willing to get involved and even initiate various activities in this area themselves. Such support is particularly pertinent for first-year students, who have not yet participated in initiatives and may be reluctant to take initiative.

The conducted analysis showed that hypothesis H(1) is partially confirmed, i.e., University Initiatives Activating Involvement in Sustainability (Independent Variable – IV1) have a significant impact on Students' Attitudes and Awareness of Sustainability (Dependent Variable – DV1) [UIASIS: SAAS], because only workshops/training sessions (IV1b) and volunteer work (IV1d) demonstrated a statistically significant effect on students' attitudes and awareness of sustainability, and the strength of these relationships was moderate ($\varphi \approx 0.22–0.25$; about 5–6% of explained variance). In turn, the analysis supports hypothesis H(2): University Initiatives Activating Involvement in Sustainability (Independent Variable – IV1) have a significant impact on Student Engagement in Sustainability (Dependent Variable – DV2) [UIASIS: SES], suggesting that university initiatives aimed at strengthening commitment to sustainability (IV1a–f) are significantly associated with student engagement in sustainability (DV2a–m), with a moderate effect size.

As a result of the research presented here, the following recommendations can be formulated:

- a serious problem is insufficient information regarding the potential benefits of student participation in the various pro-ecological activities offered by HEIs, which may be the outcome of inadequate event communication and internal promotion,
- in order to really increase the involvement of students in sustainability activities, HEIs should merely launch programs, but also effectively manage their promotion and consider their frequency, reach, recognition, and most importantly, their adaptation to the specific conditions and needs of various student population groups,
- HEIs are called to ensure that the various events are accessible to students by taking into account academic calendars and secure availability blocks to avoid schedule conflicts prior to semester start,
- it is necessary to combine sustainability education with practical/experiential opportunities for students, while offering support and monitoring of changes in attitudes and behaviours over time,

- it is worth considering the introduction of various participatory and engaging forms of pro-environmental education, such as decision-making games, case studies, contact with practitioners-activists, promoting success stories of graduates, as well as introducing micro-grant options for university eco-initiatives, etc.,
- it is also advisable to carry out activities aimed at engaging academic staff so that they actively participate in pro-ecological initiatives through a system of training or a system of rewards for mentoring sustainability-related projects,
- during their education, students appreciate the tangible results and rewards of their involvement. This means that, in addition to acquiring knowledge, they attach great importance to the formal confirmation of the competences obtained, for example by obtaining references and certificates or, for example, ECTS points,
- HEIs need to be aware that students pay more attention to the competences which they consider highly relevant for their future careers. Thus, including practical aspects in various events and initiatives can be a significant incentive for student attention,
- of course, there is always a group of students who actively participate in various activities for higher purposes as part of volunteering, but unfortunately this only reflects a small percentage of the student population, which has also been confirmed by our research here,
- it is worth conducting regular monitoring and evaluation of the activities undertaken in order to keep track of the evolution of pro-ecological attitudes and behaviours of students, but also for assessing the actual consumption of resources over time. Regular ESG reports, which are already being implemented by some universities around the world, can serve as an effective mechanism for this purpose,
- HEIs should engage in an active dialogue with students about the possibilities of pro-ecological activities in order to develop their perceived agency and increase their readiness for participation in the institutional governance bodies (behavioural motivation),
- a practical management solution for students activation is the implementation of programs and incentive systems for those demonstrating commitment to sustainability, using gamification and rewards for real activities (e.g. ECTS points, certificates, rankings of academic groups),
- measures are also needed to install easily accessible infrastructure and facilities, such as drinking water stations, a deposit system for cups, cheaper public transport tickets for students, energy and water saving programs on campuses, etc.

Overall, the research showed that awareness and motivation issues outweigh logistical constraints. This is an important indication for HEI management: student-focused education and engagement strategies that build confidence on their efficacy should form the basis for the management of organizational and technical measures, including time

planning, financial support, and incentive systems, so that these measures can be truly effective in promoting sustainability.

7. Limitations and recommendations

The presented research is cross-sectional, and does not track the long-term effects of HEI sustainability management activities on students' attitudes and engagement. There is no data on the sustainability impacts and on the long-term outcomes of such efforts. Future research should consider conducting systematic, comparative and/or longitudinal studies of this type, to improve processes and policies implemented in higher education institutions. Each of these findings should also be enriched and interpreted by employing qualitative research approaches (e.g. interviews, focus groups) in order to adjust the institutional offers and effectively increase sustainability-related activity.

Our results cannot be classified as representative, as the sampling selection method does not satisfy the randomness requirement. Although this places a limitation for the generalisation of results and statistical inference, the results of our research reveal clear tendencies and permit conclusions regarding the sustainability-related attitudes and behaviours of the younger generation; for those studying and perhaps also for those who do not.

In future research, it is worth undertaking to increase the size and diversity of groups of participants and measure real attitudes and behaviours, not declarative ones, and consider moderators such as duration of participation, quality of the program, etc.

The research of this paper is subject to limitations due to the sampling method and size of the sample. Despite not being able to generalise its findings and conclusions, the analysis carried out revealed certain regularities meriting further in-depth research and analysis. For example, it would be useful to carry out complementary qualitative research to extract and interpret additional variables, including, but not limited to, variables such as course of study, year of study and previous experiences of students, which could have an impact on their attitudes and commitment to sustainability. In addition, to what extent do demographic variables account for differing students' sustainability-related attitudes and behaviours? It could be also worthwhile to investigate which type of sustainability initiatives have the most lasting impact on the students' desired attitudes and behaviours and which are main drivers of sustainable action; specifically concerning participation in pro-ecological projects, undertaking education in this area, or activities in the form of volunteering.

Authors' contribution

J.K.: article conception, theoretical content of the article, research methods applied, conducting the research, data collection, analysis and interpretation of results, draft manuscript preparation. **A.P.:** theoretical content of the article, analysis and interpretation of results, draft manuscript preparation

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Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this work the authors did not use Generative AI and AI-assisted technologies in the writing process.

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