Journal of Cleaner Production 429 (2023) 139682

Contents lists available at ScienceDirect

Journal of Cleaner Production

journal homepage: www.elsevier.com/locate/jclepro

Perception of the Sustainable Development Goals among university students: A multidisciplinary perspective

Cristina Cachero[1], Olga Grao-Gil[1,*], Raquel Pérez-delHoyo[1], María Covadonga Ordóñez-García[1], María Dolores Andújar-Montoya[1], María Ángeles Lillo-Ródenas[1], Rosa Torres[1]

University of Alicante, Ctra San Vicente Raspeig s.n., Alicante, 03690, Spain

ARTICLE INFO

Handling Editor: Giovanni Baiocchi

Keywords:
Sustainable development goals (SDGs)
Agenda 2030
Higher education
Trans-disciplinary empirical study
Subjective perception

ABSTRACT

This study explores the variations in perceptions and understanding of the Sustainable Development Goals (SDGs) among university students, influenced by their field of study and gender. To this end, we introduced the 17 SDGs across various academic disciplines. Students participated in a concise educational initiative, with data being gathered to evaluate their baseline awareness and comprehension (before the initiative) as well as their ensuing empowerment (after participating in the initiative, which equipped them with essential knowledge pertaining to the various SDGs). Additionally, the satisfaction levels associated with the initiative was assessed. The findings unveil that, generally, Spanish university students possess a restricted grasp of the SDGs. However, students immersed in Social-Legal (S-L) sciences exhibit a significantly heightened acquaintance with these objectives compared to their counterparts. Students perceive the impact of the SDGs on their lives as moderate to high and anticipate that their individual contributions can facilitate moderate progress towards the realization of these goals, with S-L science students manifesting a greater sense of empowerment. Moreover, the study underscores a pronounced interest among university students in engaging with the SDGs. Gender appeared to have a minimal effect on the evaluated variables, with the exception of satisfaction levels concerning the educational initiative.

1. Introduction

Since their adoption in 2015, the 2030 Agenda for Sustainable Development and its seventeen Sustainable Development Goals (SDGs) (UNESCO, 2015) have provided the foundation for policy development and the implementation of strategies to tackle global social, economic, and environmental challenges worldwide.

As catalysts for change, higher education institutions hold a pivotal role in preparing future leaders who will be instrumental in the successful realization of these goals (Žalėnienė and Pereira, 2021). This role demands a thoughtful integration of the various SDGs, both in their operational approach and academic curricula. Within the university community, it is imperative to recognize the importance of addressing critical issues such as ending inequalities, poverty, fostering respect for nature and resources, encouraging responsible consumption, and promoting education.

In this context, education extends beyond mere comprehension; it aligns with the broader aim of equipping future graduates with the tools to positively impact the communities they serve (Raimers, 2017; Fang and O'Toole, 2023; Seva-Larrosa et al., 2023). Aware of this fact, higher education institutions have embarked on promoting "Education for the Sustainable Development Goals" (ESDG). This involves providing clear guidance for university teaching and research to develop professionals dedicated to advancing the SDGs. The guidelines promoted by the Sustainable Development Solutions Network (SDSN) (SDSN Australia/Pacific, 2017; SDSN, 2020; UNESCO, 2017) are invaluable tools for achieving this goal and creating a better future for all.

The incorporation of these SDG concerns into university curricula around the world has sparked a wealth of narratives. These stories elucidate the challenges and rewards of integrating ESDG via a variety of actions and initiatives (SDSN, 2021; Greenland et al., 2023). In the case of Spain, most of the actions have focused on student training within the framework of official degrees (Miñano and García, 2020), using various teaching and learning methodologies (Climent et al., 2020; UPM, 2021; UPComillas, 2023). However, designing learning interventions to achieve this goal is not without challenges. One of the most significant issues is the already packed schedules and rapidly changing

* Corresponding author.
E-mail addresses: ccc@ua.es (C. Cachero), olga.grao@ua.es (O. Grao-Gil), perezdelhoyo@ua.es (R. Pérez-delHoyo), covadonga.og@ua.es (M.C. Ordóñez-García), lola.andujar@ua.es (M.D. Andújar-Montoya), mlillo@ua.es (M.Á. Lillo-Ródenas), rosa.torres@ua.es (R. Torres).
[1] All authors have contributed equally to this article.

https://doi.org/10.1016/j.jclepro.2023.139682
Received 21 June 2023; Received in revised form 2 November 2023; Accepted 6 November 2023
Available online 11 November 2023

curricula of official degree programs, coupled with the overwhelming amount of material that both students and teachers must handle on a daily basis (Wankat and Oreovicz, 2015; Lotz-Sisitka et al., 2015). One potential solution could be the implementation of transdisciplinary or interdisciplinary learning interventions (González et al., 2019), wherein courses are orchestrated around a unified goal, with each allocating a minor segment of its duration to this collective objective. Nonetheless, facilitating coordination amongst various courses can present certain challenges. An alternative solution, which is embraced in this study, employs a multidisciplinary approach. In this framework, each course maintains its autonomy, yet all participate in the meticulous crafting of concise interventions – spanning less than two hours – to address the Sustainable Development Goals (SDGs).

Regardless of the chosen strategy, assessing the impact and students' satisfaction of these initiatives is vital to guarantee the achievement of the objectives. Furthermore, acknowledging that today's students will evolve into the foremost influencers and decision-makers of the future underlines the necessity to delve deeper into their perspectives and attitudes towards sustainable development (Aleixo et al., 2021; Tang, 2018). Despite a growing interest in these facets within the scientific community in recent years, the ramifications of many actions documented in scholarly works remain ambiguous. Additionally, only a limited number of studies have explored variations in knowledge or perceptions of SDGs across different genders and fields of knowledge, both at the national and global levels (Aleixo et al., 2021; Zamora-Polo et al., 2019; Leiva-Brondo et al., 2022; Benavent et al., 2020; Alm et al., 2022). The necessity to augment this empirical repository, coupled with the authors' inherent responsibility as dedicated members of the university faculty involved with this matter, have motivated the undertaking of this study. In it, the aim is to gauge the prevailing levels of awareness, knowledge, and empowerment with SDGs across genders and knowledge fields, thereby paving the way for enlightened and apt future initiatives. Also, we aim to show the degree of acceptance among students of brief educational interventions.

For this purpose, our research adopts a multidisciplinary perspective, crucial from a pedagogical standpoint in fostering meta-cultural thought processes and thinking in a pluralistic manner (Bain, 2014). Additionally, although the focus of this study is not the evaluation of the impact of concrete educational actions, it measures the students' acceptance of a range of initiatives that can be used as examples of the types of activities that can be designed to encourage students to reflect on their understanding and perceptions towards SDGs and their future roles (Reimers, 2018).

This paper makes a twofold contribution. Firstly, it substantiates the viability and receptiveness of concise educational interventions among students, aiding individuals across diverse fields of study in cultivating the requisite knowledge and competencies to champion sustainable development. The succinct nature of these interventions, coupled with the elimination of the need for inter-course coordination, simplifies their incorporation into official degree curricula. This approach harmoniously aligns with the objectives of SDG target 4.7, which endeavors to "ensure that all learners are equipped with the knowledge and skills necessary to promote sustainable development (Edwards, Jr. et al., 2020). Secondly, it analyzes knowledge, awareness and empowerment across genders and knowledge fields in the Spanish context, thereby offering a significant contribution to the realm of educational innovation centered on the assimilation of the SDGs.

The findings of this study have the potential to enhance the understanding of ESDGs, raising awareness among educators about gender and knowledge field disparities regarding SDGs knowledge and perceptions. This awareness can facilitate the development of more effective and personalized strategies in higher education institutions to address these differences and promote sustainable development among students.

The remainder of this paper is organized as follows: Section 2 presents the current state of empirical studies on this topic. Section 3 outlines the study design, including research questions, variables, and hypotheses. The execution of the study and the analysis of the collected data is presented in Section 4. The key findings are discussed in Section 5. Section 6 discusses proposed countermeasures in light of the obtained results. Finally, Section 7 summarizes the main conclusions and suggests future research directions.

2. Related work

Given the power of education to transform society, universities are undoubtedly one of the key actors in advancing the achievement of the SDGs. The integration of the SDGs into higher education teaching activities has been carried out through the development of a plethora of experiences (SDSN, 2021).

In particular, a comprehensive compilation of the Spanish experience is available in Miñano and García (2020). Most of these initiatives have focused on training students in the context of official degrees following different methodologies such as Challenge-Based Learning (CBL) (ESADE, 2023), Service Learning (SL) (UVA, 2023; UPComillas, 2023), Cooperative Learning (EHU, 2023), Interdisciplinary Participatory Action Research (PAR) (Keahey, 2021), case studies (Miñano and García, 2020; Izquierdo et al., 2018), or simply introducing SDGs as part of the official curriculum (Climent et al., 2020; UPM, 2021; URJC, 2018; Pérez-Foguet and Lazzarini, 2019).

Additionally, the existing research highlights various aspects related to knowledge and gender differences in relation to SDGs.

Regarding knowledge, a survey reported in Zamora-Polo et al. (2019) among university students from different disciplines reveals a general lack of awareness and limited knowledge of the SDGs. Also, the study found significant differences in perception of the SDGs between education and health sciences students. The study emphasizes the need for the development of specific and cross-cutting competencies related to the SDGs and proposes their integration throughout university curricula. It suggests using a validated questionnaire developed for the study to assess and plan future teaching and learning processes, emphasizing the importance of coordinated efforts at the university level to promote and contribute to the achievement of SDGs.

Similarly, in Smaniotto et al. (2020) a survey among 1676 students was reported, which showed that most of them had low knowledge of the SDGs and the 2030 Agenda. However, those who had attended specific non-academic courses on SDGs displayed a greater knowledge. The study also found differences in interest across knowledge fields. The study emphasizes the role of academic initiatives in improving knowledge and interest in sustainable development and highlights students' high expectations for universities to provide education on SDGs.

Turning to the aspect of gender, in Arachchi and Managi (2021) the impact of gender differences on knowledge and attitudes towards energy sustainability was examined. Their analysis, based on self-reported data from 100,956 individuals across 37 countries, indicates that males tend to have greater knowledge of energy sustainability, while females place more importance on it. The study also highlights differences in cause–effect logic and holistic associations between genders when making energy-sustainable decisions.

Another study (Aleixo et al., 2021) reveals that most students express a keen interest in learning more about sustainable development, with a majority having been introduced to the topic during secondary education. It also found that women are more engaged in and sensitive to sustainability issues. Additionally, a small percentage of students (around 8%) express significant skepticism about climate change.

Furthermore, the empirical study reported in Murga-Menoyo (2009) examines gender differences among high-achieving students regarding their perceptions, attitudes, and values related to sustainable development. The findings reveal that gender differences are of limited significance. However, the study highlights the need to strengthen both

men's and women's education in relation to sustainability principles and values.

In a Taiwanese study that, closer to our approach, combined the analysis of importance, contribution, and gender (Ho et al., 2022), the authors explore students' perceptions of the importance of different SDGs and the gender differences therein. The findings suggest that female respondents exhibit a higher level of perceived importance compared to male respondents. However, they also demonstrate a relatively lower perception of their own participation in achieving the SDGs. Additionally, the study indicates that STEM fields believe they have a greater impact on SDGs compared to non-STEM fields, highlighting the need for efforts to empower non-STEM students in addressing the SDGs effectively.

In summary, the literature indicates that students generally have a limited knowledge of SDGs, but they demonstrate a keen interest in learning more about sustainable development. These findings underscore the significance of implementing initiatives like the one presented in this paper. Additionally, there is a consensus that the level of interest and engagement in sustainable development differs among knowledge fields and genders, with females exhibiting greater awareness to SDGs but lower empowerment. Our study seeks to test these hypotheses within the Spanish university system and across four knowledge fields.

3. Research method

To analyze the acceptance of the implemented learning actions and the differences in SDGs knowledge, awareness, and empowerment across genders and knowledge fields, we conducted a cross-sectional study within the observational category. Observational studies are a type of empirical study in which, unlike in experiments or quasi-experiments, the explanatory variables considered (in our case, gender and knowledge field) are not manipulated but are instead observed.[2] The researcher then uses these observations as the basis for attempting to draw conclusions (Bluman, 2012). The primary disadvantage of observational studies is that they do not allow for the establishment of cause–effect relationships due to a lack of control over confounding factors (i.e., alternative explanations for the study's results). However, despite this limitation, they remain valuable in education, as they can help confirm assumptions and inform educational actions (Carlson and Morrison, 2009).

3.1. Objective and context definition

The main goal of this study was to investigate potential differences in sustainability knowledge, awareness, and empowerment across genders and fields of study. Additionally, we aimed to design and assess the acceptance of concise learning interventions within the university context. This study focused on Spanish university students.

The Spanish university system organizes its educational offerings into five main 'knowledge branches' (KB): Arts and Humanities, Engineering and Architecture, Sciences, Social and Legal Sciences (S-L Sciences) and Health Sciences (BOE, 2007). These branches govern aspects such as students' rights to subject validation and opportunities for changing their course of study. Furthermore, recent regulations in the university system have introduced the concept of 'knowledge area' (KA), which essentially serves as a subdivision of these branches. The objective is to maintain the interdisciplinary nature of studies while achieving educational coherence (BOE, 2021). Specifically, within the Engineering and Architecture branch, these knowledge areas distinctly separate (a) Computer Engineering and Systems, and (b) Architecture, Construction, Building, Urbanism, and Civil Engineering.

Following this framework, in this study, we incorporated degrees from three distinct knowledge branches: Engineering and Architecture, Sciences, and S-L Sciences. Additionally, we subdivided the Engineering and Architecture branch into two sub-branches based on knowledge areas: Engineering and Architecture. The seven degrees and nine courses included in this study are presented in Table 1, classified by these knowledge fields. For each course, the semester in which it is taught and the number of students enrolled during the 2021/22 academic year are also displayed, with the number of females between parentheses.

3.2. Research questions

The research questions addressed in this study were designed to be answered using quantitative data. The questions are the following:

- RQ1: What is the level of students' subjective knowledge and awareness of the relevance of SDGs? Does it differ based on gender and/or knowledge field?
- RQ2: How do students perceive the potential contribution of their degree programs on achieving the SDGs? Does this perception vary by gender and/or knowledge field?
- RQ3: How satisfied are students with the incorporation of brief learning interventions, like those conducted in this study, into their courses? Does satisfaction differ by gender and knowledge field?

3.3. Variables and measurement instruments

The explanatory variables considered in this study include:

- Knowledge field (KF): nominal variable with four possible values: Architecture, Engineering, Social Sciences, and Chemistry.
- Gender: nominal variable with three possible values: Female, Male, Other.

On the other hand, the response variables of interest are:

- Subjective knowledge of the SDGs (SK-SDGs): a continuous variable with a range of values between 0 (no knowledge) and 10 (maximum knowledge).
- Awareness of the importance of the SDGs in daily life (AI-SDGs): an ordinal variable with three possible values: 0 (No), 1 (So-So), and 2 (Yes).
- Perceived potential contribution of the student's degree to the achievement of SDGs (PC-SDG): a continuous variable with a range of values between 17 and 85, corresponding to the sum of the values associated with the perceived potential contribution of their degree to each of the seventeen SDGs.
- Evaluation of the inclusion need of brief SDG-related learning activities within their degree programs (LA-Eval): an interval variable with five possible values, ranging from 0 (It was not necessary at all) to 4 (It was very necessary).

The questionnaires are presented in Appendix. Also, they are available online for consultation at https://bit.ly/sdg_questionnaires.

[2] Although the design incorporates an SDG training activity, this study does not analyze the effect of such training activities on the students' perceptions, but only the students' acceptance of such intervention. The reason is the differences among the training activities proposed by each domain expert (see Table 2). The purpose of incorporating this training activity was primarily to furnish students with the requisite knowledge, enabling them to articulate more enlightened viewpoints on the potential influence of their education in achieving the various SDGs (second questionnaire). That is why we classify the study as observational and not a quasi-experiment.

Table 1
Degrees and courses included in the study, classified by knowledge field. For each course, the table includes the semester in which it was taught (1-8) and the number of students enrolled -Total (Females)-.

Knowledge field	Degree	Course	Sem	#T(#F)
Architecture	Architecture fundamentals	Urbanism 2	5	76 (44)
		Urbanism 5	8	22 (11)
		Urbanism 6	9	61 (32)
	Technical architecture	Management of the construction process	7	18 (8)
Engineering	Computer engineering	Software quality management	8	44 (6)
	Biomedical engineering	Programming fundamentals	2	80 (41)
Sciences	Chemistry	Chemistry II	4	61 (31)
S-L sciences	International relations	Institutional relations and international protocol	8	31 (25)
	Gastronomy and culinary arts	Protocol and event management in gastronomy	6	47 (19)

Table 2
Specific SDGs addressed and educational actions carried out by degree and course.

Knowledge field	Course	SDGs	Activity
Architecture	Urbanism 2, Urbanism 5, Urbanism 6	11	Information on the goal, which aims for more inclusive, safe, resilient, and sustainable cities, was provided through links to videos and the UN website. After viewing and assimilating the content, a debate was opened in various formats.
	Management of the Construction Process	12	The activity focused on reflecting on and identifying risks in current management and execution models related to energy and responsible production. New practices were identified that allow for the introduction of realistic changes in construction sector companies to progressively align with the SDGs.
Engineering	Software Quality Management	3	Ideas for mobile applications with the potential to improve health in the elderly were proposed, and the Self-determination theory (SDT) model was introduced. Students participated in a forum where they defined how their application related to the goal and how it intended to incorporate SDT principles into the design.
	Programming Fundamentals	3	Students examined the content of the UN links related to Goal 3, Health and Well-being. Then, individually, they participated in a forum to discuss which goals they considered most relevant to their degree, and how they planned to integrate them into their university work.
Science	Chemistry II	2,3,6,7	Students carried out an activity based on watching a video that allowed them to understand how innovation and research in chemistry play a key role in all SDGs. This video paid special attention to SDG 2, Zero Hunger, highlighting how pest control, synthesis of veterinary products, polymers used in greenhouse covers, cold chains, packaging, and preservatives and additives, for example, are related to achieving this SDG. SDG 3 (health and well-being), SDG 6 (Water and Sanitation) and SDG 7 (sustainable and non-contaminant energy) were also tackled as part of the activity.
S-L Sciences	Institutional Relations and International Protocol	5,8,11,16,17	Students were initially introduced to the SDGs. Following that, they crafted a proposal for an Institutional Relations strategy to tackle some of the challenges highlighted by the SDGs. After the empirical study concluded, the students continued their work to finalize their proposals.
	Protocol and Event Management in Gastronomy	3,4,5,6,11,12,17	Students were initially introduced to the SDGs. Subsequently, they formed 15 teams and began outlining the design for a gastronomy-centered event, ensuring it aligned with specific SDGs. After concluding the empirical study, the students proceeded with the development of their proposals, which were tailored to cater to diverse contexts. These encompassed the GURMEET fair, local and rural development, sustainability, culinary arts and restoration via responsible entrepreneurship, and/or professional culinary workshops and conferences.

3.4. Quantitative hypotheses

Based on the previously listed research questions and variables, the research hypotheses that have been examined in this paper have been defined as follows:

- HKnowledge: the subjective knowledge of the students about the SDGs varies between genders and knowledge fields.
- HAwareness: the awareness of the importance of the SDGs in the daily life of the students varies according to gender and knowledge fields.

Table 3
Descriptive statistics: breakdown of participants in the pre-survey (1) and post-survey (2) by course and gender (F: Female, M: Male, O: Other).

KF	Course	F1	M1	O1	T1	F2	M2	O2	T2
Architecture	Management of the construction process	6	6	0	**12**	7	6	0	**13**
	Urbanism 2, Urbanism 5 and Urbanism 6	47	33	0	**82**	45	24	0	**69**
Engineering	Programming fundamentals	39	38	0	**79**	25	14	1	**40**
	Software quality management	7	37	0	**44**	5	20	0	**25**
Sciences	Chemistry II	15	15	1	**31**	15	15	1	**31**
Social Sciences and Law	Institutional relations and international protocol	17	3	0	**20**	10	2	0	**12**
	Protocol and event management in gastronomy	11	9	0	**20**	4	5	0	**9**

- HEmpowerment: the perceived potential student's empowerment, that is, the perceived potential contribution of the student's university degree to the achievement of the SDGs, varies based on the knowledge field and gender.
- HEvalLA: the evaluation of the brief SDGs learning activity conducted during the course varies based on the knowledge field and gender.

3.5. Empirical planning

As can be seen in Table 1, this study aimed to collect data from 441 students (217 females) enrolled in nine courses belonging to seven different degrees and four knowledge fields at the University of Alicante.

This selection of courses corresponds to a non-probabilistic, purposive sampling, with the target population consisting of the students enrolled in the courses taught by the authors of the research during the 2021/22 academic year. Despite the fact that this type of sampling limits the generalizability of the results, it is considered a valid non-probabilistic strategy in educational contexts (Alaminos and Castejón, 2006).

The study was planned to be carried out during the in-person class hours of each course, so that the teachers present in the classroom (all coauthors of this paper) could monitor its execution, and the answer rate could be maximized. Also, our previous experience has shown that activities that can be completed in no more than two hours are more manageable to schedule and benefit from a higher acceptance rate by students.

The execution was divided into three parts as follows:

- Block 1: Completion of the knowledge and awareness questionnaire (Questionnaire 1, 15 min). It included demographic data, perceived degree of knowledge of the SDGs and the 2030 Agenda, and student awareness of their importance in daily life.
- Block 2: Development of learning activity (90 min): Activity with two phases:
  - B2.1: activity common to all courses, aimed at familiarizing students with the SDGs and the 2030 Agenda (45 min). This activity consisted of a brief classroom explanation of the general terms of the SDGs, supported by the reading of an explanatory article and the viewing of a related video.
  - B2.2: Course-specific activity, in which students, depending on their particular degree and course, focused on a subset of goals more directly related to each discipline (45 min). A description of these activities, along with the specific SDGs targeted by each course, can be found in Table 2.
- Block 3: Completion of the empowerment and satisfaction questionnaire (Questionnaire 2, 15 min). It included a question that assessed their satisfaction with the learning activity, along with a series of questions related to their perceptions of their potential contributions to each SDG, both during their university education and in their future professional development.

This structure is consistent with a methodological strategy based on Participatory Action Research (PAR), which is considered very useful when developing a collective idea to implement improvements in teaching practices (Álvarez Balandra, 2014).

4. Study execution and data analysis

The activities were carried out as planned, and both questionnaires were completed accordingly. Table 3 shows the number of students who finally participated in the study, broken down by knowledge field, course, and gender. Students were not informed in advance when the questionnaires would be administered and the activity would take place, so we can confidently assume that the lack of participation was not related to the study itself, but rather to the typical student absence rates.

Based on the respondents' answers, the final set of values for gender in all subsequent analyses has been narrowed down to two categories: Female and Male.

In an attempt to disprove the hypotheses outlined in Section 3.4, a series of statistical tests were planned. For each analysis, the initial step involved determining whether it was feasible to employ a two-way ANOVA parametric test (which assumes two categorical explanatory variables, an interval or ratio response variable, no outliers, normal distribution for all cells in the study, and homogeneity of variances). When this was not the case, non-parametric tests (specifically, a Kruskal–Wallis H test for evaluating differences in the knowledge field, and a Mann–Whitney U test for examining differences between genders) were applied instead.

4.1. Data analysis: HKnowledge

Concerning the SK-SDGs variable, a Shapiro–Wilk test refuted the hypothesis of normal distribution for the study cells. Moreover, as skewness varied across different cells, transforming the variable was considered ineffective. Lastly, the Levene test for homogeneity of variances indicated a violation of this assumption. Due to these reasons, the application of a two-way ANOVA was abandoned in favor of employing two non-parametric tests: the Kruskal–Wallis H test to assess SK-SDGs differences by knowledge field (four possible values: Engineering, Architecture, Sciences, S-L sciences) and the Mann–Whitney U test to evaluate SK-SDGs differences by gender (two groups: Female and Male).

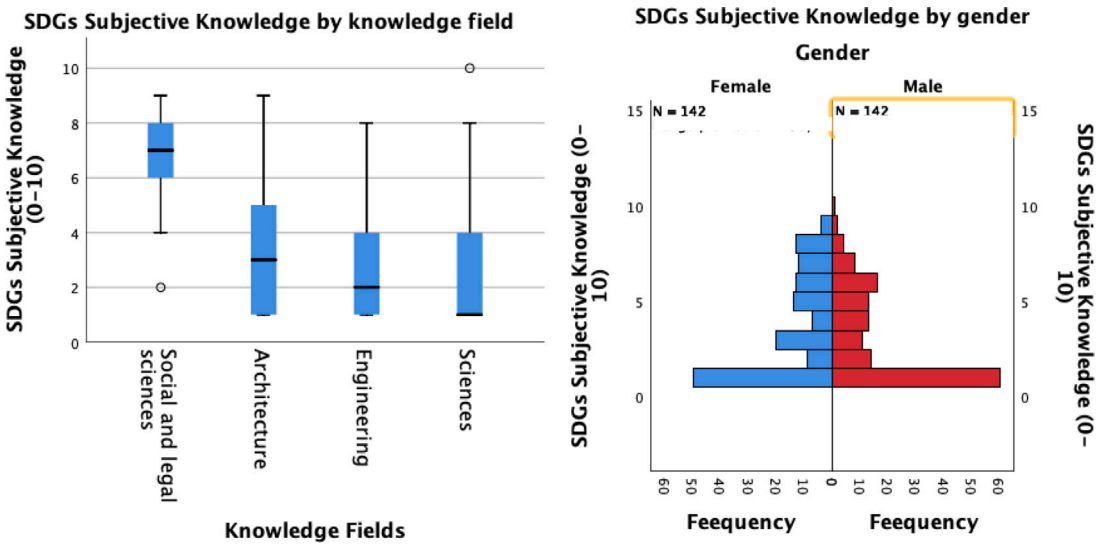

Fig. 1. SK-SDGs distribution comparison.

4.1.1. SK-SDGs differences by knowledge field

A Kruskal–Wallis H test was conducted to determine if there were significant differences in SK-SDGs scores among the four knowledge fields analyzed: Engineering ($n = 123, median = 2, mean\_rank = 117.89$), Architecture ($n = 94, median = 3, mean\_rank = 149.44$), Sciences ($n = 31, median = 1, mean\_rank = 110.71$), and S-L Sciences ($n = 40, median = 7, mean\_rank = 240.90$). The distributions of SK-SDGs scores were not similar across all groups, as assessed by a visual inspection of the corresponding boxplot (see Fig. 1). Consequently, the results of this test should be interpreted as pertaining to differences in distribution. The distributions of the knowledge scores were statistically significantly different among knowledge fields, $\chi^2(3) = 76.55, p < 0.001$.

Pairwise comparisons were carried out using Dunn's procedure, along with a Bonferroni correction for multiple comparisons (Dunn, 1964). Adjusted p-values are provided. This post hoc analysis revealed statistically significant differences in SK-SDGs mean ranks between S-L Sciences and Sciences ($p < 0.001$), S-L Sciences and Architecture ($p < 0.001$), S-L and Engineering ($p < 0.001$), and Engineering and Architecture ($p = 0.02$). However, no significant differences were found between Sciences and Engineering or Sciences and Architecture.

4.1.2. SK-SDGs differences by gender

A Mann–Whitney U test was conducted to ascertain if there were significant differences in SK-SDGs scores between males and females. The distributions of knowledge scores for both genders appeared fairly similar, as assessed through visual inspection (see Fig. 1). The median SK-SDGs score did not exhibit a statistically significant difference between males (Median=2) and females (Median=3), with $U = 8907, z = -1.753, p = .08$, using an exact sampling distribution for U (Dinneen and Blakesley, 1973).

4.2. Data analysis: HAwareness

Since the AI-SDGs is defined as an ordinal variable, two non-parametric tests were employed to analyze this hypothesis.

4.2.1. AI-SDGs differences by knowledge field

A Kruskal–Wallis H test was conducted to determine if there were significant differences in AI-SDGs scores among the four knowledge fields analyzed: Engineering ($n = 123, median = 2, mean\_rank = 133.63$), Architecture ($n = 94, median = 2, mean\_rank = 155.14$), Sciences ($n = 31, median = 2, mean\_rank = 140.81$), and S-L Sciences ($n = 40, median = 2, mean\_rank = 155.76$). The distributions of AI-SDGs scores were similar across all groups, as assessed through visual inspection of the corresponding boxplot (see Fig. 2). As a result, the test outcomes should be interpreted in terms of differences in medians. The AI-SDGs medians were not statistically significantly different among knowledge fields, $\chi^2(3) = 5.91, p = 0.116$, with all fields demonstrating similar medium to high awareness of the importance of the SDGs in their daily lives. Nonetheless, S-L Science students were the most conscious of this fact.

4.2.2. AI-SDGs differences by gender

A Mann–Whitney U test was conducted to ascertain if there were differences in AI-SDGs scores between males and females. The distributions of AI-SDGs scores for both genders appeared fairly similar, as assessed through visual inspection (see Fig. 2). Median AI-SDGs scores did not exhibit a statistically significant difference between males ($Median = 2$) and females ($Median = 3$), with $U = 9143, z = -1.57, p = .116$, using an exact sampling distribution for U (Dinneen and Blakesley, 1973).

4.3. Data analysis: HEmpowerment

Concerning the perceived potential contribution of the knowledge gained through enrollment in a university degree to the achievement of the SDGs, data was collected via a series of questions in the post-questionnaire. Each question evaluated the perceived impact of the studies in which the student was enrolled on each of the seventeen SDGs. The PC-SDGs was then calculated as the sum of all perceived impacts, as follows:

$$PC - SDGs = \sum_{SDG_1}^{SDG_{17}} PC_{SDG_i} \quad (1)$$

Upon examining the assumptions required to perform a two-way ANOVA parametric test, three extremely unusual values were identified. Additionally, data was not normally distributed for some study cells, as assessed by the Shapiro–Wilk test ($p < .05$), although homogeneity of variances was present, as evaluated by Levene's test for equality of variances, $p = .062$. Due to these reasons, we chose to apply non-parametric tests, which do not necessitate these assumptions to be upheld.

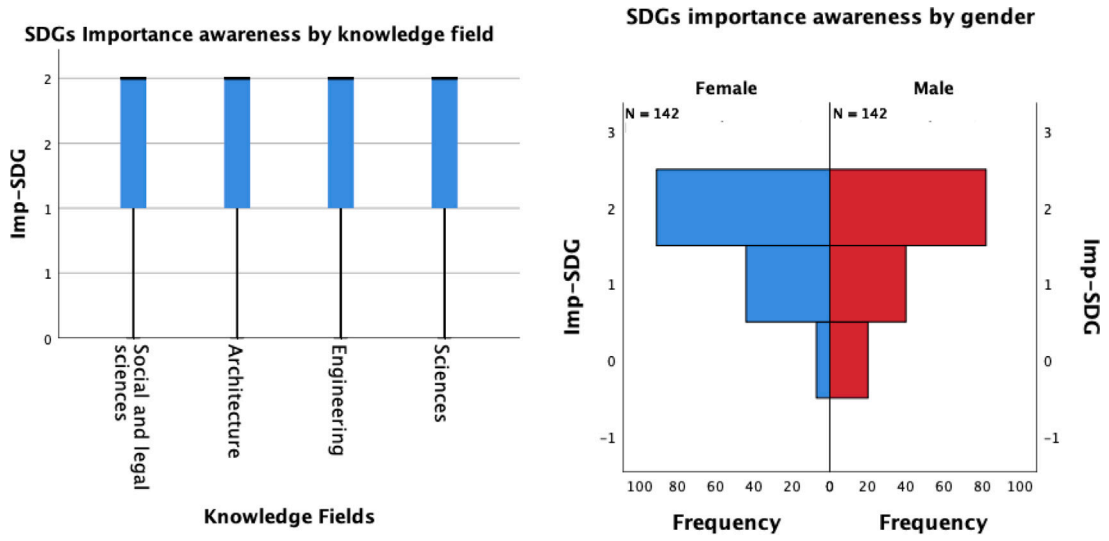

Fig. 2. Imp-SDGs distribution comparison.

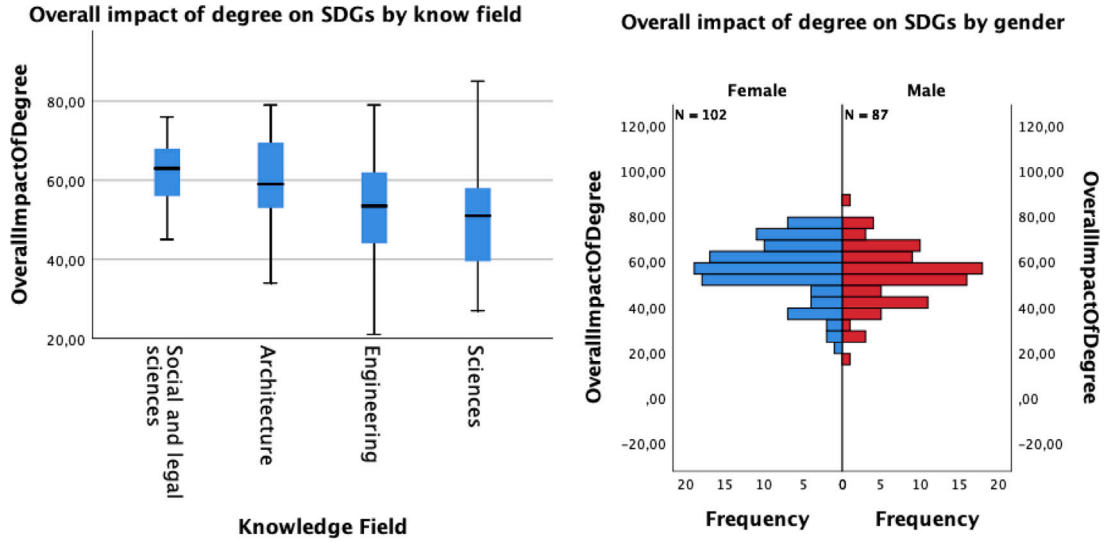

Fig. 3. Overall impact of studies on SDGs: distribution comparison.

4.3.1. PC-SDGs differences by knowledge field

A Kruskal–Wallis H test was conducted to determine if there were significant differences in PC-SDGs scores among the four knowledge fields analyzed: Engineering ($n = 66, median = 53, mean\_rank = 81.51$), Architecture ($n = 72, median = 59, mean\_rank = 110.65$), Sciences ($n = 31, median = 51, mean\_rank = 68.65$), and S-L Sciences ($n = 20, median = 63, mean\_rank = 124.03$).

Distributions of PC-SDGs scores were not similar across all groups, as assessed by visual inspection of the corresponding boxplot (see Fig. 3). Consequently, the results of this test should be interpreted as pertaining to differences in distribution. The distributions of PC-SDGs scores were statistically significantly different among knowledge fields, $\chi^2(3) = 22.76, p < 0.001$.

Pairwise comparisons were carried out using Dunn's procedure with a Bonferroni correction for multiple comparisons (Dunn, 1964). Adjusted p-values are provided. This post hoc analysis revealed statistically significant differences in PC-SDGs mean ranks between Sciences and Architecture ($p = 0.002$), S-L Sciences and Sciences ($p = 0.002$), Architecture and Engineering ($p = 0.011$), and Engineering and S-L Sciences ($p = 0.014$). However, no significant differences were found between Sciences and Engineering or S-L Sciences and Architecture.

In Fig. 4, we delve further into this topic by illustrating the perceived contribution of each student's degree to the achievement of each of the seventeen SDGs, organized by Knowledge Field. In the realm of Engineering, SDG 3 is perceived as the most relevant, followed by SDGs 9, 8, and 4. In Architecture, SDG 11 is distinctly prominent, succeeded by SDGs 6 and 7. These findings are partially attributable to the fact that the learning interventions were centered on these particular SDGs. Within the S-L Sciences, nearly half of the SDGs are deemed significant in their field, whereas in the Sciences, SDG 13 is notably prominent, followed closely by SDG 3.

4.3.2. PC-SDGs differences by gender

Additionally, a Mann–Whitney U test was conducted to determine if there were significant differences in PC-SDGs scores between males and females. The distributions of scores for both genders appeared fairly similar, as assessed through visual inspection (see Fig. 3). The median PC-SDGs score did not exhibit a statistically significant difference between males ($Median = 55$) and females ($Median = 58$), with $U = 3816.5, z = -1.65, p = .098$, using an exact sampling distribution for U (Dinneen and Blakesley, 1973). Despite this, females displayed a slightly higher PC-SDGs median score than males.

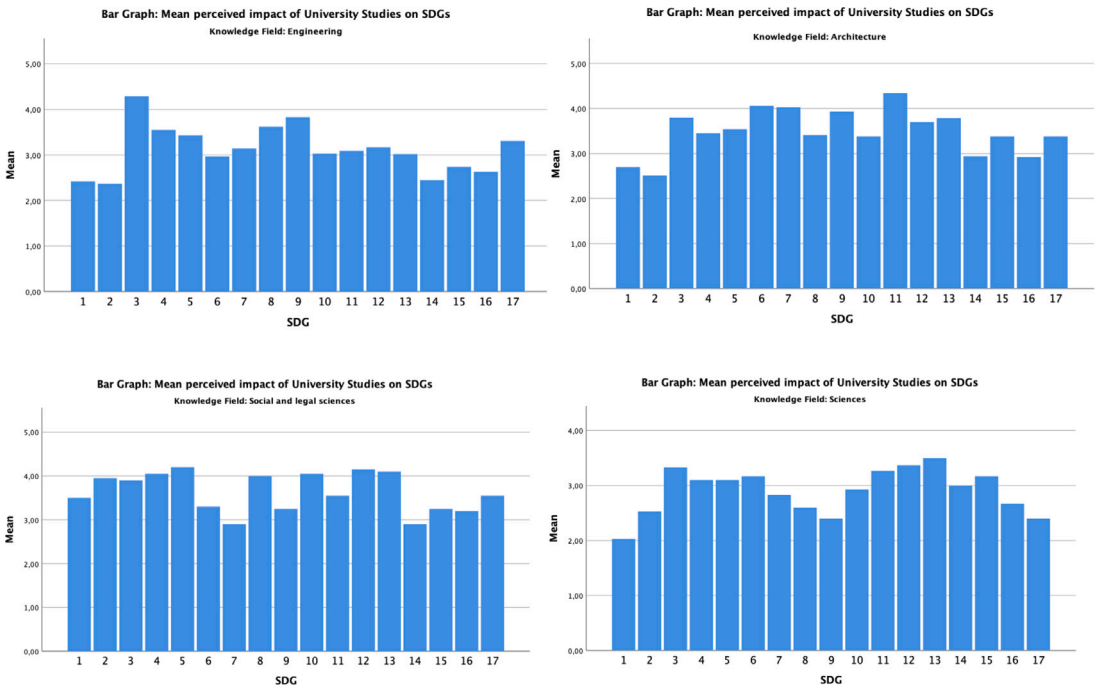

Fig. 4. Perceived potential contribution of degree to the achievement of each individual SDG.

4.4. Data analysis: HEvalLA

Last but not least, to evaluate the satisfaction of the students with the inclusion of short educational interventions, such as the one presented in this paper, in different degrees, the LA-Eval variable was examined.

Once again, a check of the assumptions required to perform a parametric test (two-way ANOVA) identified three extremely unusual values. Furthermore, data were not normally distributed for the majority of the study cells, as indicated by Shapiro–Wilk's test ($p < .05$), though there was homogeneity of variances, as demonstrated by Levene's test for equality of variances, $p = 0.83$. As a result, we chose to employ non-parametric tests, which do not necessitate these assumptions to be fulfilled.

4.4.1. LA-Eval by knowledge field

A Kruskal–Wallis H test was performed to investigate if there were significant differences in LA-Eval scores among the four knowledge fields analyzed: Engineering ($n = 66, median = 3, mean\_rank = 83.78$), Architecture ($n = 72, median = 3, mean\_rank = 99.30$), Sciences ($n = 31, median = 3, mean\_rank = 98.92$), and S-L Sciences ($n = 20, median = 4, mean\_rank = 110.48$).

The distribution of LA-Eval scores varied among groups, as determined through visual inspection of the corresponding boxplot (see Fig. 5). Thus, the results of this test should be interpreted in terms of differences in distribution. The distributions of LA-Eval scores were not statistically significantly different among knowledge fields, $\chi^2(3) = 6.171, p = 0.104$. All students highly valued the learning intervention, with no significant variations across knowledge fields.

4.4.2. LA-Eval by gender

We also conducted a Mann–Whitney U test to determine if there were significant differences in LA-Eval scores between males and females. The distributions of the scores were quite dissimilar between males ($n = 87, median = 3, mean\_rank = 79.45$) and females ($n = 102, median = 4, mean\_rank = 108.26$), as evaluated through visual inspection (see Fig. 5). Therefore, the results of this test should be interpreted as reflecting differences in distribution. The distributions of LA-Eval scores were statistically significantly different between males and females, $U = 3084.5, z = -4.018, p < 0.0005$, using an exact sampling distribution for U (Dinneen and Blakesley, 1973). Although both males and females reported positive attitudes towards the inclusion of SDGs learning interventions, females rated these interventions significantly more positively.

5. Discussion

Table 4 summarizes the main results derived from this study.

These results demonstrate that, in general, students from Spanish universities declare having a limited understanding of the SDGs. They believe the SDGs' impact on their lives is quite high and they perceive their work can have a relatively high impact towards achieving these goals. They also value educational actions revolving around the SDGs. The differences in all these variables are generally not significant among knowledge fields, except for subjective knowledge. These findings partially align with those described in the related work in Section 2, where several authors pointed out a general lack of awareness and limited knowledge of the SDGs among students (Zamora-Polo et al., 2019; Murga-Menoyo, 2009; Coronado-Marín et al., 2020), but also significant differences among knowledge fields (which, in our case, are only verified between the field of S-L Sciences and the rest) (Smaniotto et al., 2020). It is also surprising to note that contrary to the conclusion in Ho et al. (2022), it is the non-STEM students (specifically, those of S-L Sciences) who exhibit greater knowledge and empowerment.

The case of S-L Sciences is intriguing: within the context under study, students from this field evidently feel better prepared, assign more importance to, feel more capable of influencing, and highly value SDG-oriented training compared to students from Engineering, Architecture, or Sciences. What could be the underlying cause? Could it be that these latter disciplines, with their specialized and technical curricula in Spanish universities, engender a sense of disconnect in students regarding the potential application of their studies to sustainable development? We propose this as a hypothesis worthy of investigation because, if validated, it would present compelling evidence of the necessity to adapt curriculum plans to the new realities defined by the SDGs. The multidisciplinary approach is specifically designed to rectify

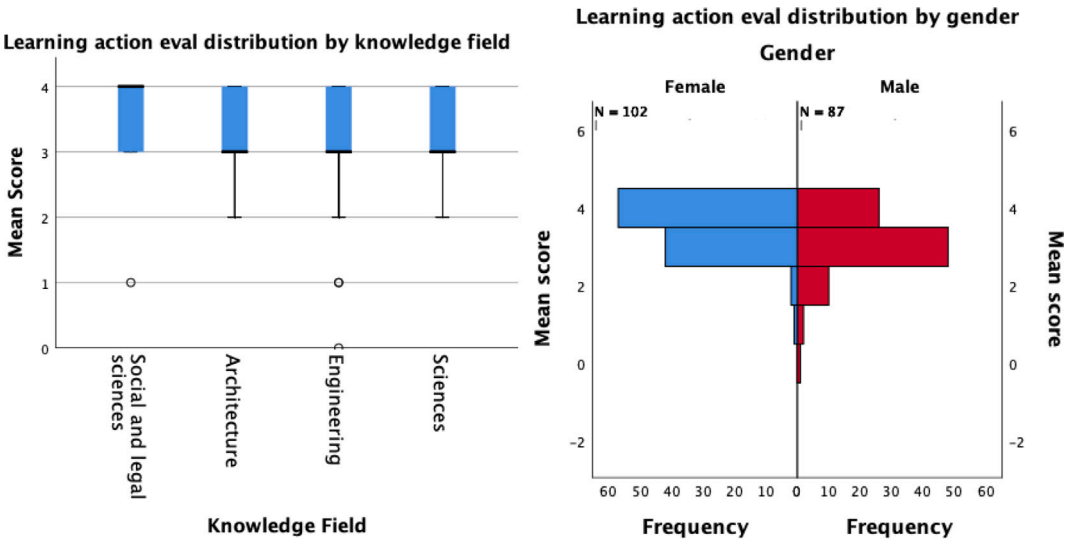

Fig. 5. Overall impact of studies on SDGs: distribution comparison.

Table 4
Results summary.

Hypothesis	Quest	DV [range]	IV	Test	Conclusion
HKnowledge	1	SK-SDG [0-10]	Field	Kruskal-Wallis H	Significant differences between 'S-L Sciences' and the other KF (distribution)
			Gender	Mann–Whitney U	No significant differences (median)
HAwareness	1	AI-SDG [0-2]	Field	Kruskal-Wallis H	No significant differences, although S-L Sciences show greater awareness (median)
			Gender	Mann–Whitney U	No significant differences (median)
HEmpow	2	PC-SDG [17-85]	Field	Kruskal-Wallis H	Non significant differences between Sciences-Engineering and S-L Sciences -Architecture. Significant differences between the remaining pairs (distribution).
			Gender	Mann–Whitney U	No significant differences (median)
HEvalLA	2	LA-Eval [0-4]	Field	test	No significant differences (distribution)
			Gender	test	Significant differences (distribution): women give higher scores.

this situation, as the SDGs, their study, and implementation should permeate all aspects of university education.

Our results also reveal how, in the context of the knowledge fields and subjects studied, gender does not significantly impact subjective knowledge and awareness of SDG issues, and the perception of empowerment associated with the impact of the chosen degree on achieving the SDGs is higher in females. These results contrast with some of the conclusions of the studies presented in Section 2, where men were identified as expressing greater knowledge and empowerment, and women as having greater awareness (Arachchi and Managi, 2021; Aleixo et al., 2021; Ho et al., 2022). The results do align better, however, with the work of Murga-Menoyo (2009), Quiroz-Niño and Murga-Menoyo (2017), Coronado-Marín et al. (2020), where no significant gender differences were found. Additionally, these results somewhat contradict the presence of marked stereotypes about women in the studied context, such as being more cooperative, supportive, and empathetic, roles that are constantly communicated and seem to be assumed in other contexts (Gómez-Tabares and Marin, 2020; Auné and Attorresi, 2017). A possible explanation for this is that as students progress through higher levels of education, these stereotypes are mitigated. Moreover, the highly technical profile of five of the seven degrees included in the study may have also introduced a bias in the knowledge profile, awareness, and empowerment of women, which might have been more stereotypical if those women had been selected at random in a purely experimental setting. Nevertheless, the results are useful in dismissing, at least in the studied context, the need to design specific awareness and empowerment activities for the female population, thereby simplifying the sustainability and viability of our proposal.

Finally, the high level of satisfaction expressed by the students with receiving SDG training confirms the assertion made by Smaniotto et al. (2020) regarding the students' high expectations for universities to provide education on SDGs. Examining each of the 17 SDGs, it can be concluded that the level of knowledge of the SDGs varies significantly, depending on the field and the specific SDG. For instance, in the field of architecture, SDG 11, which focuses on cities, stands out, while in the social sciences, SDG 5, which focuses on equality, is prominent.

5.1. Limitations of the study

Based on Cook and Campbell's framework (Cook et al., 1979), the main threats to the validity of this study can be categorized into four groups: internal, external, construct, and conclusion. By definition, observational studies have lower internal validity than experiments or quasi-experiments. Also, the external validity of the study is diminished by the fact that the study has been carried out in a single institution, the University of Alicante in Spain. Perhaps the conclusions cannot

be applied to other realities. The main construct threat is the use of questionnaires that have not been validated. Although the questions were straightforward, we cannot dismiss the possibility that more sophisticated research instruments could have been more sensible to variations in awareness, knowledge or empowerment among genders or knowledge fields. Finally, conclusion validity was preserved by using non-parametric tests for all the analyses.

6. Proposed countermeasures in light of the obtained results

In view of these findings, where it is clearly observed that (a) the students possess a limited understanding of the SDGs, and (b) there is a relatively diminished sense of empowerment, particularly among students in the fields of Engineering and Sciences, regarding their role in the realization of these goals, it is suggested that measures to counteract this effect should include the co-creation or co-design of activities involving students, universities, professors, and policymakers. This would be facilitated through a collaborative methodology, functioning as a kind of open social innovation operation. This article illustrates how even short and customized activities within each degree are perceived as useful and necessary by the students. Other types of actions that could be implemented to co-create are:

- Webinars on the 2030 agenda, as a means to reach a broader audience, complemented by in-person seminars that would reinforce online activities.
- The co-design of projects related to the SDGs between students and professors from different fields of knowledge, encouraging the formation of multidisciplinary teams and fostering greater involvement. It would be advisable for these projects to involve staff who design the university policy on the matter, from both the university itself and public administration.

7. Conclusions and further lines of research

In this article, we have presented the design and evaluation of a learning intervention that aligns with SDG target 4.7, which seeks to ensure all learners acquire the knowledge and skills needed to advocate for sustainable development.

For this purpose, students from four knowledge fields and seven degrees were recruited. They participated in a short-duration educational action (2 h) designed to encourage their reflection on their knowledge, the impact on their lives, and their sense of empowerment with respect to these goals. Data were collected through two forms: one administered before the educational action, focused on their knowledge and awareness, and another after the action, where they were asked about how they believed their studies could contribute to achieving the SDGs and how they valued the educational action itself.

For data analysis, non-parametric tests were applied due to the characteristics of the distributions. The existence of significant differences among both knowledge fields and genders was evaluated. The results of these analyses were summarized in Table 4.

These results indicate that Spanish university students generally possess a limited understanding of the SDGs, with a moderate belief in their personal impact. S-L Sciences students, however, show higher SDG knowledge and empowerment. This discrepancy might be due to specialized curricula in other fields, suggesting a need for curricular adaptation and a more multidisciplinary or even transdisciplinary approach to SDGs in university education. Gender does not significantly affect the SDGs understanding, awareness, or perceived empowerment, contrasting with some earlier works. Lastly, high student satisfaction with SDG training, even when it involves a brief learning intervention, implies a strong desire for university students to be introduced to SDGs.

This experience has reinforced our conviction that learning activities that propose the challenge of integrating SDGs from a multidisciplinary perspective are highly appreciated and provide motivation for research, creativity, and responsible intra-entrepreneurship. The SDGs serve as an educational tool not only due to their content founded on theoretical and research references, but also because of the operational guidelines for their achievement. These guidelines provide both teachers and students with a reference framework for designing real-world projects, thereby facilitating access to the job market or at least offering various professional opportunities related to their fields of study.

This work should be seen as a foundational step that can guide future research avenues such as:

- Improvement of the measurement instruments to augment the internal validity of the studies.
- Study of SDGs perception differences between STEM and no-STEM degrees
- Longitudinal tracking of knowledge transfer stemming from the projects designed in classrooms as an exercise in applying the SDGs.
- Exploration of social entrepreneurship in connection with the SDGs.
- Adoption of a critical perspective on SDGs for the reframing of public policies and active measures related to them, a task that can be undertaken by the new generations of well-prepared graduates.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Olga Grao-Gil reports financial support was provided by University of Alicante Institute of Education Sciences.

Data availability

Data will be made available on request.

Acknowledgments

We would like to thank the students who kindly agreed to participate in our study. This work has been partially funded by the Instituto de Ciencias de la Educación (ICE) of the University of Alicante, Spain through their 'Programa de redes de investigación en docencia universitaria' in the 2021/2022 and 2022/2023 editions. This article reflects the views only of the authors, and the funding bodies cannot be held responsible for any use which may be made of the information contained therein.

Appendix. Questionnaires

A.1. Questionnaire 1

Estimado alumnado: Por favor, responde las siguientes preguntas sobre tus conocimientos *y* percepción sobre los objetivos de desarrollo sostenible (ODS). Es fundamental que no consultes internet ni ninguna otra fuente para realizar la encuesta *y* que contestes de manera personal, sin preguntar a los compañeros. No importa si no sabes las respuestas. Se trata de medir el nivel general de conocimiento/percepción sobre el tema en la actualidad. Este formulario tiene únicamente fines académicos *y* se enmarca dentro de una investigación educativa dentro del Programa REDES del Instituto de Ciencias de la Educación (ICE) de la Universidad de Alicante. Toda la información que proporciones permanecerá completamente anónima *y* confidencial. ¡Muchas gracias por tu colaboración!

Dear student: Please answer the following questions about your knowledge and perception of the Sustainable Development Goals (SDGs). It is essential that you do not use the internet or any other source

for filling the survey and that you respond according to your own answers, without asking your classmates. It does not matter if you do not know the answer. The aim is to measure the general level of knowledge/perception of the issue as it stands today. The information in this form is for academic purposes only and is part of an educational research within the REDES Programme of the Institute of Education Sciences (ICE) of the University of Alicante. All the information you provide will remain completely anonymous and confidential. Thank you very much for your collaboration!

1. ¿Qué grado/estudios de la UA estás cursando? / What is your degree at the UA?:
    - Grado en Fundamentos de la Arquitectura
    - Grado en Arquitectura Técnica
    - Grado en Ingeniería Biomédica
    - Grado en Ingeniería Informática
    - Experto en competencias personales *y* laborales en entornos de empleo con apoyo
    - Grado en Turismo
    - Grado en Química
    - Grado en Relaciones Internacionales
    - Grado en Gastronomía *y* Artes Culinarias
    - Alumno de intercambio/exchange student (ERASMUS, for example)
2. ¿A qué asignatura/materia perteneces? / Which subject are you studying?
    - Urbanismo 2
    - Urbanismo 3
    - Urbanismo 5
    - Urbanismo 6
    - Gestión del proceso constructivo
    - Fundamentos de programación
    - Gestión de calidad software
    - Estructura de mercados
    - Química II
    - Relaciones institucionales *y* protocolo internacional
    - Protocolo *y* gestión de eventos en gastronomía
3. ¿En qué curso estás? /In which course are you?
    - 1°
    - 2°
    - 3°
    - 4°
    - 5°
    - Máster
    - Otros/Others
4. Tu edad es/Your age is:
    - 18 años/18 years old
    - 19 años/19 years old
    - 20 años/20 years old
    - 21 años/21 years old
    - 22 años/22 years old
    - 23 años/23 years old
    - 24 años/24 years ol
    - Entre 25–30 años/ between 25–30 years old
    - Entre 30–40 años/between 30–40 years old
    - Entre 40–50 años/between 40–50 years old
    - Más de 50 años/more than 50 years old
5. Sexo/Gender:
    - Mujer/Female
    - Hombre/Male
    - Otro/Other
    - Prefiero no decirlo/I prefer not to specify
6. ¿Has oído hablar sobre la Agenda 2030? / Have you heard about the Sustainable Development Goals?
    - Sí/Yes
    - No
    - Tal vez/Maybe
7. ¿Has oído hablar de los ODS? / Have you heard about the Sustainable Development Goals?
    - Sí/Yes
    - No
    - Tal vez/Maybe
8. ¿Qué significado tienen para ti los ODS? ¿Cómo los interpretarías? / What do the SDG mean to you? What do you think they mean?
9. ¿Cómo valorarías tu nivel actual de conocimiento de los ODS?/ How would you rate your knowledge on the SDG (0-min and 10-max)
10. ¿Cuántos ODS crees que existen? How many SDG are there according to your previous knowledge?
    - Menos de 5/less than 5
    - Entre 5 *y* 10/ between 5–10
    - Entre 10 *y* 15/between 10–15
    - Entre 15 *y* 20/between 15–20
11. ¿Qué entiendes por sostenibilidad?/ What do you understand by the term sustainability?
12. Valora la importancia que debe tener la prosperidad, la protección del medio ambiente *y* la lucha por la erradicación de la pobreza en nuestras vidas/In your opinion, how important do you think the environmental protection and the fight to eradicate poverty should be in our lives (0-not important and 10 - very important)
13. ¿Consideras que la sostenibilidad *y* la conciencia sobre la protección del planeta forman parte de tu día a día? / Do you consider sustainability and awareness of protecting the planet to be part of your daily life?
    - Sí/Yes
    - No
    - Tal vez/Maybe
14. ¿Consideras suficiente la información que se le da al alumnado de la UA acerca de la sostenibilidad *y* las medidas contenidas en la Agenda 2030? / Do you consider the information given to UA students about sustainability and the measures included in the 2030 Agenda to be sufficient?
    - Sí/Yes
    - No
    - Tal vez/Maybe
15. ¿Qué propuestas harías para la implementación de la conciencia sobre el desarrollo sostenible *y* la protección del medio ambiente en tu Universidad? / What suggestions would you offer to promote awareness of sustainable development and environmental protection at your university?

A.2. Questionnaire 2

Estimado alumnado: Ahora que ya conoces más sobre los ODS *y* la Agenda 2030, por favor, responde las siguientes preguntas sobre tus conocimientos *y* percepción sobre los OBJETIVOS DE DESARROLLO SOSTENIBLE (ODS). Este formulario tiene únicamente fines académicos *y* se enmarca dentro de una investigación educativa dentro del Programa REDES del Instituto de Ciencias de la Educación (ICE) de la Universidad de Alicante. Toda la información que proporciones permanecerá completamente anónima *y* confidencial. ¡Muchas gracias por tu colaboración!

Dear student: Now that you know more about the SDGs and the 2030 Agenda, please answer the following questions about your knowledge and perception of the SUSTAINABLE DEVELOPMENT GOALS (SDGs). The information in this form is for academic purposes only and is part of an educational research within the REDES Programme of the Institute of Education Sciences (ICE) of the University of Alicante. All the information you provide will remain completely anonymous and confidential. Thank you very much for your collaboration!

1. ¿Qué grado/estudios de la UA estás cursando? / What is your degree at the UA?
   - Grado en Fundamentos de la Arquitectura
   - Grado en Arquitectura Técnica
   - Grado en Ingeniería Biomédica
   - Grado en Ingeniería Informática
   - Experto en competencias personales *y* laborales en entornos de empleo con apoyo
   - Grado en Turismo
   - Grado en Química
   - Grado en Relaciones Internacionales
   - Grado en Gastronomía *y* Artes Culinarias
   - Alumno de intercambio
2. ¿A qué asignatura/materia perteneces? / Which subject are you studying?
   - Urbanismo 2
   - Urbanismo 3
   - Urbanismo 5
   - Urbanismo 6
   - Gestión del proceso constructivo
   - Fundamentos de programación
   - Gestión de calidad software
   - Estructura de mercados
   - Química II
   - Relaciones institucionales *y* protocolo internacional
   - Protocolo *y* gestión de eventos en gastronomía
3. ¿En qué curso estás? / In which course are you?
   - 1°
   - 2°
   - 3°
   - 4°
   - 5°
   - Máster
   - Otros/Other
4. Tu edad es/Your age is:
   - 18 años /18 years old
   - 19 años/19 years old
   - 20 años/20 years old
   - 21 años/21 years old
   - 22 años/22 years old
   - 23 años/23 years old
   - 24 años/24 years old
   - Entre 25–30 años/Between 25 and 30 years of age
   - Entre 30–40 años/Between 30 and 40 years of age
   - Entre 40–50 años/Between 40 and 50 years of age
   - Más de 50 años/More than 50 years old
5. Sexo/Gender:
   - Mujer/Female
   - Hombre/ Male
   - Otro/Other
   - Prefiero no decirlo/I prefer not to say
6. Ahora que ya conoces los ODS, ¿qué te ha parecido invertir tiempo en este tema? / Now that you know the SDGs, how did you find spending time on this topic?
   - Muy necesario/ Very necessary
   - Necesario/Necessary
   - Más o menos necesario/More or less necessary
   - Poco necesario/Little necessary
   - Nada necesario/No necessary
7. ¿Cuánto piensas que, desde tu disciplina, puedes aportar a cada uno de los ODS? / How much do you think that, from your discipline, you can contribute to each of the SDGs?
8. ¿De qué forma piensas que pueden incorporarse los ODS en tu formación universitaria? Indica tres formas/In which ways do you think the SDGs can be incorporated into your university studies? Please indicate three ways
9. ¿Con qué otras carreras o disciplinas piensas que podría complementarse tu trabajo para lograr los ODS en tu ámbito profesional? / What degree or disciplines do you think could complement your work to achieve the SDGs in your professional field?
10. ¿Crees que existe suficiente información en los medios de comunicación sobre los ODS? / Do you think there is enough information in the media about the SDGs?
    - Sí, mucha/Yes, very much
    - Bastante/Quite a lot
    - Más o menos/More or less
    - Bastante poca/Very few
    - No, muy poca/No, very little information is available

References

Alaminos, A., Castejón, J.L., 2006. Elaboración, análisis e interpretación de encuestas, cuestionarios y escalas de opinión. Universidad de Alicante.

Aleixo, A.M., Leal, S., Azeiteiro, U.M., 2021. Higher education students' perceptions of sustainable development in Portugal. J. Clean. Prod. 327, 129429.

Alm, K., Beery, T.H., Eiblmeier, D., Fahmy, T., 2022. Students' learning sustainability–implicit, explicit or non-existent: a case study approach on students' key competencies addressing the SDGs in HEI program. Int. J. Sustain. Higher Educ. 23 (8), 60–84.

Álvarez Balandra, A.C., 2014. Métodos En la Investigación Educativa. Universidad Pedagógica Nacional.

Arachchi, J.I., Managi, S., 2021. Preferences for energy sustainability: Different effects of gender on knowledge and importance. Renew. Sustain. Energy Rev. 141, 110767.

Auné, S.E., Attorresi, H.F., 2017. Dimensionalidad de un test de conducta prosocial. Evaluar.

Bain, K., 2014. Lo que hacen los mejores estudiantes de universidad. Universitat de València.

Benavent, X., de Ves, E., Forte, A., Botella-Mascarell, C., López-Iñesta, E., Rueda, S., Roger, S., Perez, J., Portalés, C., Dura, E., et al., 2020. Girls4STEM: Gender diversity in STEM for a sustainable future. Sustainability 12 (15), 6051.

Bluman, A.G., 2012. Elementary Statistics: A Step by Step Approach. McGraw-Hill.

BOE, 2007. Real decreto 1393/2007, de 29 de octubre, por el que se establece la ordenación de las enseñanzas universitarias oficiales. URL https://www.boe.es/eli/es/rd/2007/10/29/1393/con, Last accessed: 2023-04-03.

BOE, 2021. Real decreto 822/2021, de 28 de septiembre, por el que se establece la organización de las enseñanzas universitarias y del procedimiento de aseguramiento de su calidad. URL https://www.boe.es/eli/es/rd/2021/09/28/822/con, Last accessed: 2023-04-03.

Carlson, M.D., Morrison, R.S., 2009. Study design, precision, and validity in observational studies. J. Palliat. Med. 12 (1), 77–82.
Climent, J., Cabré, J.M., Sánchez, F., López, D., Martín, C., Vidal, E.M., Bragós, R., 2020. De la teoría a la práctica: 1011 años después de la integración de la sostenibilidad en el grado en ingeniería informática de la FIB. In: Actas de las XXVI Jornadas sobre Enseñanza Universitaria de la Informática, Vol. 5. Asociación de Enseñantes Universitarios de la Informática (AENUI), pp. 133–140.
Cook, T.D., Campbell, D.T., Day, A., 1979. Quasi-Experimentation: Design & Analysis Issues for Field Settings, Vol. 351. Houghton Mifflin Boston.
Coronado-Marín, A., Bautista-Cerro, M., Murga-Menoyo, M., 2020. Students and university teachers facing the curricular change for sustainability. Reporting in sustainability literacy and teaching methodologies at UNED. Int. Bus., Trade Ins. Sustain. 1021–1041.
Dinneen, L., Blakesley, B., 1973. Algorithm AS 62: A generator for the sampling distribution of the mann-whitney u statistic. J. R. Stat. Soc. Ser. C (Appl. Stat.) 22 (2), 269–273.
Dunn, O.J., 1964. Multiple comparisons using rank sums. Technometrics 6 (3), 241–252.
Edwards, Jr., D.B., Sustarsic, M., Chiba, M., McCormick, M., Goo, M., Perriton, S., 2020. Achieving and monitoring education for sustainable development and global citizenship: A systematic review of the literature. Sustainability 12 (4), 1383.
EHU, 2023. Campus bizia lab. https://www.ehu.eus/es/web/iraunkortasuna/campus-bizia-lab, Last accessed: 2023-04-03.
ESADE, 2023. Fusion point. https://fusionpoint.eu, Last accessed 2023-04-03.
Fang, J., O'Toole, J., 2023. Embedding sustainable development goals in an undergraduate business capstone subject using an experiential learning approach: A qualitative analysis. Int. J. Manag. Educ. 21 (1).
Gómez-Tabares, A.S., Marin, M.N., 2020. Tendencias prosociales y su relación con la empatía y la autoeficacia emocional en adolescentes en vulnerabilidad psicosocial. Rev. Colombiana Psicología 29 (2), 125–147.
González, S.S., Lucas, J.M., Franco, D.C., Rodríguez, J.M.M., 2019. Responsabilidad universitaria en la implementación de los objetivos de desarrollo sostenible. Eur. J. Child Dev., Educ. Psychopathol. 7 (2), 183–196.
Greenland, S.J., Saleem, M., Misra, R., Nguyen, N., Mason, J., 2023. Reducing SDG complexity and informing environmental management education via an empirical six-dimensional model of sustainable development. J. Environ. Manag. 344, 118328.
Ho, S.S.H., Lin, H.C., Hsieh, C.C., Chen, R.J.C., 2022. Importance and performance of SDGs perception among college students in Taiwan. Asia Pac. Educ. Rev. 1–11.
Izquierdo, M.A.F., Torres, M.J.M., Lirio, J.R., Ferrero, I.F., Olmedo, E.E., Marullo, M.C., 2018. The "case study" as a teaching tool for the integration of sustainable development goals. In: Edulearn 18. 10th international conference on education and new learning technology. IATED Academy, pp. 4036–4041.
Keahey, J., 2021. Sustainable development and participatory action research: A systematic review. Syst. Pract. Action Res. 34 (3), 291–306.
Leiva-Brondo, M., Lajara-Camilleri, N., Vidal-Meló, A., Atarés, A., Lull, C., 2022. Spanish university students' awareness and perception of sustainable development goals and sustainability literacy. Sustainability 14 (8), 4552.
Lotz-Sisitka, H., Wals, A.E., Kronlid, D., McGarry, D., 2015. Transformative, transgressive social learning: Rethinking higher education pedagogy in times of systemic global dysfunction. Curr. Opin. Environ. Sustain. 16, 73–80.
Miñano, R., García, M., 2020. Implementando la agenda 2030 en la universidad: casos inspiradores. https://www.uv.es/uvsostenible/REDSCasosEODS.pdf, Last accessed: 2023-04-03.
Murga-Menoyo, M., 2009. Sobre las diferencias de género en la percepción social del desarrollo sostenible. Estudio empírico en estudiantes universitarios de alto rendimiento. Universidad de Murcia. Servicio de Publicaciones.
Pérez-Foguet, A., Lazzarini, B., 2019. Continuing professional education in engineering faculties: Transversal integration of sustainable human development in basic engineering sciences courses. J. Clean. Prod. 218, 772–781. http://dx.doi.org/10.1016/j.jclepro.2019.01.199.
Quiroz-Niño, C., Murga-Menoyo, M.Á., 2017. Social and solidarity economy, sustainable development goals, and community development: The mission of adult education & training. Sustainability 9 (12), 2164.
Raimers, F., 2017. Empoderar alumnos para la mejora del mundo, en 60 lecciones. https://cutt.ly/BvMuOr6, Last access: 2023-04-03.
Reimers, F.M., 2018. Hoja de Ruta para Cambiar el Mundo. UNESCO, https://es.unesco.org/courier/2018-1/hoja-ruta-cambiar-mundo, Last accessed: 2023-04-03.
SDSN, 2020. Accelerating education for the SDGs in universities: A guide for universities, colleges, and tertiary and higher education institutions. https://irp-cdn.multiscreensite.com/be6d1d56/files/uploaded/accelerating-education-for-the-sdgs-in-unis-ES-web.pdf, Last accessed: 2023-04-03.
SDSN, 2021. Accelerating education for the SDGs in universities: Case studies 2021. https://blogs.upm.es/education4sdg/tag/case-studies-2021/, Last accessed: 2023-04-03.
SDSN Australia/Pacific, 2017. Getting started with the SDGs in universities: A guide for universities, higher education institutions, and the academic sector. Australia, New Zealand, and Pacific edition. https://unesdoc.unesco.org/ark:/48223/pf0000252423/PDF/252423spa.pdf.multi, Last accessed: 2023-04-03.
Seva-Larrosa, P., Marco-Lajara, B., Úbeda-García, M., Zaragoza-Sáez, P., Rienda-García, L., García-Lillo, F., Andreu-Guerrero, R., Manresa-Marhuenda, E., Ruiz-Fernández, L., Sánchez-García, E., 2023. Students´ perception of sustainable development goals (SDGs) and the benefits for companies derived from their implementation. Econ. Res. 36 (1).
Smaniotto, C., Battistella, C., Brunelli, L., Ruscio, E., Agodi, A., Auxilia, F., Baccolini, V., Gelatti, U., Odone, A., Prato, R., et al., 2020. Sustainable development goals and 2030 agenda: awareness, knowledge and attitudes in nine Italian universities, 2019. Int. J. Environ. Res. Public Health 17 (23), 8968.
Tang, K.H.D., 2018. Correlation between sustainability education and engineering students' attitudes towards sustainability. Int. J. Sustain. Higher Educ. 19 (3), 459–472.
UNESCO, 2015. Transformar nuestro mundo: la agenda 2030 para el desarrollo sostenible. https://unctad.org/system/files/official-document/ares70d1_es.pdf, Accessed: 2023-04-03.
UNESCO, 2017. Educación para los objetivos de desarrollo sostenible. Objetivos de aprendizaje. https://unesdoc.unesco.org/ark:/48223/pf0000252423/PDF/252423spa.pdf.multi, Last accessed: 2023-04-03.
UPComillas, 2023. Voluntariado universitario. https://www.comillas.edu/comillas-solidaria/, Last accessed: 2023-04-03.
UPM, 2021. Sostenibilidad en los estudios oficiales de la UPM 2020. https://sostenibilidad.upm.es/wp-content/uploads/sites/759/2021/03/Sostenibilidad-estudios-oficiales-UPM-2020.pdf, Last accessed: 2023-04-03.
URJC, 2018. Docencia URJC 2030. https://oficinaverdeurjc.wordpress.com/2018/06/19/docencia-urjc-2030/, Last accessed: 2023-04-03.
UVA, 2023. ETHIC-AD-LAB. http://sjc.uva.es/ethic-ad-lab/, Last accessed: 2023-04-03.
Wankat, P.C., Oreovicz, F.S., 2015. Teaching Engineering. Purdue University Press.
Žalėnienė, I., Pereira, P., 2021. Higher education for sustainability: A global perspective. Geogr. Sustain. 2 (2), 99–106.
Zamora-Polo, F., Sánchez-Martín, J., Corrales-Serrano, M., Espejo-Antúnez, L., 2019. What do university students know about sustainable development goals? A realistic approach to the reception of this UN program amongst the youth population. Sustainability 11 (13), 3533.