

Sustainability knowledge, attitudes and behaviors: Psychometric properties and perceptions among sport science students in higher education

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ABSTRACT

Sustainable development is a widely used concept today, making education for sustainable development one of the pillars of the 2030 Agenda. Recent research highlights persistent disparities between students' cognitive understanding of sustainability and their actual sustainable actions. In this context, this research aims to analyse the psychometric properties of the Sustainability Consciousness Questionnaire in a sample of 201 undergraduate students enrolled in the Bachelor's Degree in Physical Activity and Sport Sciences program. Secondly, it assesses perceptions of sustainability awareness segmented by gender and academic year. The results reveal adequate psychometric properties in a factor structure that differs slightly from the original. Student assessments show higher scores among women, with significant differences compared to men in 17 of the 27 items. Regarding academic year, first-year students (1st and 2nd year) showed higher scores overall, although the differences were significant in only 2 items. These findings confirm the existence of a cognitive-behavioural gap that limits the effective integration of sustainability in higher education. The study underscores the need to strengthen experiential and transformative learning approaches that promote not only awareness but also real behavioural change in university settings.

Keywords: Sustainability consciousness, Sustainability knowingness, Sustainability attitudes, Sustainable development goals, Higher education, University students.

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INTRODUCTION

Sustainable development (SD) currently represents a dynamic concept with multiple interpretations, with the most widely accepted definition established by the World Commission on Environment and Development (1987, p. 41), which describes it as development that “*meets the needs of the present generation without compromising the ability of future generations to meet their own needs*”. In this sense, the current societal challenges regarding sustainability issues generated by human–environment interaction (Voulvoulis et al., 2019) require addressing behaviour, lifestyle, and undertaking a collaborative effort to meet this challenge where education plays a fundamental role as an agent of change.

Within this framework, Education for Sustainable Development (ESD) constitutes one of the fundamental pillars of the 2030 Agenda, which is structured around the 17 Sustainable Development Goals (SDGs). Specifically, SDG 4 includes Target 4.7, which calls for ensuring that all learners acquire the knowledge and skills necessary to promote sustainable development (UNESCO, 2015, 2017). According to Berglund et al. (2014), ESD represents a teaching and learning approach aimed at developing skills through active and participatory citizenship. In this context, universities play a crucial role in training future professionals capable of integrating sustainability both into their professional fields and daily lives. Nevertheless, several studies have shown that the presence of sustainability in higher education remains uneven, often limited to declarative approaches with little translation into real behaviour (Gericke et al., 2019; Marcos-Merino et al., 2020; Mohamed et al., 2024).

To assess the effectiveness of ESD strategies, the concept of sustainability consciousness (SC) has been consolidated. It is understood as the combination of knowledge, attitudes, and sustainable behaviours (KAB) across three dimensions: environmental, social, and economic (Gericke et al., 2019). This is a concept developed to measure the effect of the implementation of EDS on students in Swedish schools (Nousheen & Kalsoom, 2022) and is defined as the experience or understanding of sustainability phenomena (Gericke et al., 2019). It therefore integrates the environmental, social, and economic dimensions of SD, emphasizing the importance of knowledge, attitudes, and behaviours across these dimensions (Olsson, 2014). This perspective connects knowing, feeling, and acting in relation to sustainability, enabling a holistic assessment of the educational impact on the formation of committed citizens and a genuine disposition toward transformation.

To understand why knowledge and attitudes do not always translate into behaviour, it is useful to situate SC within theoretical models of behavioural change. In the literature on pro-environmental behaviour and education, the Theory of Planned Behaviour (Ajzen, 1991) remains widely used and validated in recent contexts, including meta-analyses highlighting its predictors and mechanisms of action (Hagger & Hamilton, 2025). Likewise, transformative learning theory (Mezirow, 1991) has been applied to explain the mediation of attitudes, social norms, and perceived behavioural control in the transition from knowing to doing. Applied to the university context, these approaches suggest that educational interventions should go beyond information transmission and address motivational, contextual, and self-efficacy factors that facilitate the adoption of sustainable practices.

Research on SC in the educational field has grown significantly in recent years, with studies analysing SC across different educational levels and contexts—for example, in secondary education in Canada (Michalos et al., 2011; Michalos et al., 2015) and in higher education in countries such as Sweden, Spain, Egypt, and Indonesia (Berglund et al., 2014; Gericke et al., 2019; Marcos-Merino et al., 2020; Mohamed et al., 2024; Suwanto et al., 2021). Despite heterogeneity in samples (ranging from 27 to over 1,500 students) and

disciplines (sciences, social sciences, teacher education, or nursing), findings show consistent patterns: in general, students present relatively high levels of knowledge and positive attitudes toward sustainability but lower engagement in sustainable behaviours, particularly in the environmental dimension (Berglund et al., 2014; Gericke et al., 2019; Michalos et al., 2011; Marcos-Merino et al., 2020). This pattern highlights a discrepancy between knowledge, attitudes, and behaviours, evidencing that formal education contributes to awareness-raising but does not always lead to concrete actions (Olsson et al., 2016). Moreover, several studies point out that specific training in sustainability and active or contextualized learning experiences (such as service-learning or interdisciplinary projects) are associated with a more integrated and coherent awareness across the three dimensions of SC (Evans, 2019; Lozano et al., 2017).

Methodologically, several studies have employed the Sustainability Consciousness Questionnaire (SCQ), in either its long (SCQ-L) or short (SCQ-S) versions, as a validated instrument with adaptations to different educational contexts. This instrument assesses the three dimensions of SD through the three components of SC: knowledge, attitudes, and behaviours (KAB). In this sense, as Gericke et al. (2019) indicates, including the three psychological constructs of knowledge, attitudes and behaviour implies adopting a holistic approach to researching people's cognitive and affective perspectives on sustainable development, where section K covers what people recognize as necessary characteristics of SD, section A reflects attitudes towards SD problems, and section B indicates what people do in relation to SD problems (Figure 1). Validation results have demonstrated adequate psychometric properties, confirming internal consistency and cross-cultural applicability (Berglund et al., 2014; Gericke et al., 2019; Michalos et al., 2015; Marcos-Merino et al., 2020).

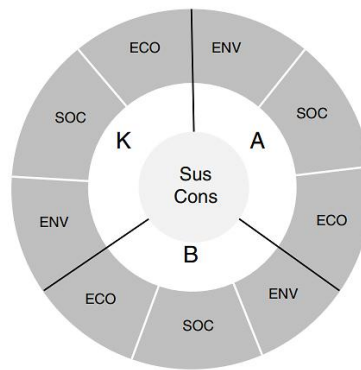


Figure 1. Conceptual representation of sustainability consciousness (Gericke et al., 2019).

The Bachelor's Degree in Physical Activity and Sport Sciences (GCCAFD) presents specific educational and professional characteristics that may influence sustainability consciousness: a high practical orientation, an emphasis on the management of sports facilities and events, and a direct connection with the areas of health, leisure, and consumption (Baena-Morales et al., 2023). These authors also point out that Physical Education possesses unique features that can mobilize competencies essential to enhancing sustainability consciousness, reinforcing the relevance of addressing these specificities in university education. In fact, these characteristics may influence how students perceive and prioritize the environmental, social, and economic dimensions of sustainability; therefore, it is particularly relevant to assess SC in this population to design educational strategies adapted to their professional profile and to promote training aligned with the 2030 Agenda.

Despite the growing number of studies, the literature on sustainability consciousness among Spanish university students remains limited and fragmented, particularly in degrees related to GCCAFD, leaving a

gap in the literature. Therefore, it would be appropriate to analyse the levels of sustainable knowledge, attitudes, and behaviours among these students, contributing to a better understanding of the effectiveness of ESD in specific educational contexts and its potential to promote sustainability through professional practice (Fuentes-Camacho et al., 2019), who point out that integrating sustainability into university curricula is essential for future professionals to understand how their activity relates to society and the environment and to develop competencies that foster real change toward a sustainable culture in higher education.

This research has a dual objective. The first is to validate the Sustainability Consciousness Questionnaire (SCQ) in the context of university students in Spain, verifying the psychometric properties of the tool in a sample of GCCAFD students. The second objective is to evaluate and analyse students' perceptions of sustainability awareness (knowledge, attitudes, and behaviours) (KAB), segmenting the results according to gender and academic year.

MATERIAL AND METHODS

Participants

A non-probabilistic convenience sampling method was used, resulting in the participation of 201 students after cleaning the database and excluding 12 cases due to incomplete questionnaire responses (missing data detection). Participation was entirely voluntary and anonymous, and students provided informed consent before beginning, being reminded that they could withdraw at any time without the need for justification. All participants are studying for the GCCAFD degree at different universities (both public and private) in the city of Seville (Spain), having in common that they were taking sports management courses. The gender distribution revealed a predominantly male sample (N = 160; 79.6%), mainly aged between 18 and 21 years, distributed fairly evenly across the first three years of study, with a slightly higher representation of fourth-year students. Table 1 displays the complete sociodemographic information.

Table 1. Sociodemographic characteristics.

Variable / Category	N	%
Gender		
Female	40	19.9
Male	160	79.6
Lost	1	0.5
Age		
18	41	20.4
19	30	14.9
20	43	21.4
21	45	22.4
22	21	10.4
23	11	5.5
24 or more	10	5.0
Academic year		
1º	49	24.4
2º	43	21.4
3º	44	21.9
4º	65	32.3

Instruments

Data collection was carried out using the Sustainability Consciousness Questionnaire (SCQ; Gericke et al., 2019), an instrument that encompasses the three dimensions of sustainable development (SD)—namely, sustainability knowledge, sustainability attitudes, and sustainable behaviour—as established within the

UNESCO framework (2006; 2009; 2014). This allows the measurement of the integrated and holistic concept of sustainability (Gericke et al., 2019). The questionnaire consists of 27 items, organized into three blocks of nine items corresponding to each dimension. Within each dimension, there are three factors (environment, society, and economy) with three items each. Responses are recorded on a five-point Likert scale, ranging from “strongly disagree” (1) to “strongly agree” (5).

This instrument was originally applied in a sample of Swedish students aged 18–19 years (Gericke et al., 2019) and has since been used with pre-service primary teachers sample in Spain (Marcos-Merino et al., 2020), as well as with the long version (SCQ-L, 49 items) among nursing students from three Egyptian public universities, all demonstrating adequate psychometric properties.

Data analysis

Data were analysed using SPSS and AMOS (v.21.0). SPSS was used for the descriptive analysis of sociodemographic variables, exploratory factor analysis (EFA), reliability testing, item analysis, and group comparisons (U Mann–Whitney test for gender differences and Kruskal–Wallis H test for academic year differences). AMOS was used for the confirmatory factor analysis (CFA).

The EFA was conducted using maximum likelihood estimation and oblique Oblimin rotation, with factor loadings used to assess item adequacy, alongside the Kaiser–Meyer–Olkin (KMO) index and explained variance. Reliability was assessed using Cronbach’s alpha coefficient. The CFA used on a combination of fit indices, including the χ^2/df ratio, Comparative Fit Index (CFI), Incremental Fit Index (IFI), Tucker–Lewis Index (TLI), Parsimony Comparative Fit Index (PCFI), and Root Mean Square Error of Approximation (RMSEA). Additionally, Composite Reliability (CR), Average Variance Extracted (AVE) for convergent validity, and discriminant validity were examined.

Procedure

Data were collected through an online questionnaire distributed via the Microsoft 365 Forms platform. The data collection took place during the first semester of the 2025–2026 academic year, between September 8 and 23. Prior to participation, students were informed about the study objectives, the voluntary nature of participation, and guarantees of anonymity and confidentiality. Participants were also reminded that they could withdraw at any time and that no incentives or compensation were provided. This study received ethical approval from the Ethics Committee of the local University (ID: 2024/130). Additionally, informed consent was obtained from all participants. The inclusion criteria were: (i) being enrolled in the GCCAFD program, and (ii) studying sports management courses at the time of participation. The exclusion criteria were: (i) not having completed 100% of the questionnaire, or (ii) providing inconsistent responses. The questionnaire was self-administered and took approximately 10–15 minutes to complete. It was available both during class time (with teachers’ consent and supervision) and remotely through an online link.

Regarding the instrument used, content validity was determined despite its previous application in a Spanish university context. For this purpose, an expert panel of seven university lecturers specializing in sport management (each with over five years of experience) was convened. Experts remained anonymous to avoid mutual influence. They were contacted individually via email and provided with an evaluation template containing four criteria: adequacy, clarity, coherence, and relevance. Each item was rated on a four-point scale: (1) does not meet the criterion, (2) low level, (3) moderate level, and (4) high level. Only minor recommendations for slight modifications were received for a few items, and no changes were implemented as fewer than three experts suggested them.

RESULTS

Descriptive analysis of the items

The descriptive analysis of the items showed skewness and kurtosis values within the acceptable normality criteria (-3 to 3 for skewness and -7 to 7 for kurtosis) (Finney & DiStefano, 2006). Overall, participants' evaluations of the items exceeded the value of 4 in the sustainability knowingness and sustainability attitudes dimensions (except for item A5). However, the sustainability behaviours dimension obtained the lowest mean scores, although all of them were above the midpoint of the scale.

Exploratory factor analysis

The results confirmed the suitability of conducting a factor analysis. Both the KMO measure and Bartlett's test of sphericity revealed that the items presented adequate common variance for the factor analysis (KMO = 0.87; $\chi^2 = 2311.59$, $df = 351$, $p < .001$), resulting in a factorial solution explaining 57.34% of the variance. Factor loadings exceeded the 0.60 cutoff point (Hair et al., 2009), except for item A5 ($\lambda = 0.37$). The reliability of the dimensions, assessed using Cronbach's alpha coefficient, was above 0.70 (Table 2).

Table 2. Descriptive items related to mean (M) and standard deviation (SD), internal consistency (α), factor loadings (λ) in exploratory and confirmatory factor analyses, composite reliability (CR), and average variance extracted (AVE).

Dimension / Factor / Item		M (SD)	λ EFA	λ CFA	CR	AVE
Sustainability knowingness ($\alpha = 0.83$)						
Env	K3	4.28 (0.84)	0.62	0.73	0.78	0.54
	K14	4.59 (0.60)	0.66	0.72		
	K21	4.36 (0.76)	0.61	0.74		
Soc	K5	4.45 (0.67)	0.67	0.73	0.76	0.52
	K10	4.56 (0.62)	0.71	0.77		
	K11	4.45 (0.70)	0.69	0.64		
Eco	K12	4.44 (0.63)	0.64	0.76	0.74	0.49
	K16	4.21 (0.78)	0.67	0.69		
	K17	4.10 (0.85)	0.62	0.64		
Sustainability attitudes ($\alpha = 0.77$)						
Env	A5	2.42 (1.34)	0.66	0.39*	0.76	0.61
	A6	4.15 (0.84)	0.76	0.73		
	A10	4.32 (0.77)	0.76	0.83		
Soc	A1	4.47 (0.64)	0.76	0.80	0.79	0.55
	A2	4.52 (0.63)	0.65	0.68		
	A18	4.56 (0.62)	0.63	0.73		
Eco	A3	4.30 (0.75)	0.74	0.73	0.75	0.50
	A7	4.39 (0.72)	0.69	0.69		
	A8	4.00 (0.92)	0.68	0.68		
Sustainability behaviours ($\alpha = 0.80$)						
Env	B3	3.94 (0.91)	0.68	0.78	0.81	0.59
	B10	3.73 (1.06)	0.73	0.80		
	B12	3.76 (1.02)	0.69	0.73		
Soc	B4	4.45 (0.67)	0.62	0.67	0.65	0.49
	B15	3.13 (1.27)	0.75	0.41*		
	B17	4.74 (0.51)	0.60	0.71		
Eco	B6	3.69 (0.92)	0.65	0.70	0.76	.051
	B9	3.47 (1.13)	0.65	0.69		
	B11	3.40 (1.07)	0.69	0.73		

Note. * = Items removed during the refinement of the confirmatory factor analysis.

Confirmatory factor analysis

The second phase of the psychometric evaluation included a confirmatory factor analysis (CFA) based on the original structure. However, the initial results did not show satisfactory goodness-of-fit indices, as they were below the minimum recommended thresholds [χ^2 (288) = 580.25; χ^2/df = 2.01; CFI = 0.86; TLI = 0.83; IFI = 0.86; PCFI = 0.75; RMSEA = 0.07]. Although the χ^2/df (≤ 3.0 ; Kline, 2005) and RMSEA (≤ 0.08 ; Hu & Bentler, 1999) indices were adequate, the others did not meet the minimum acceptable values.

Modification indices were examined, but no substantial values were found that would suggest incorporating covariances between pairs of errors. However, when reviewing the factor loadings, items A5 (sustainability attitudes dimension) and B15 (sustainability behaviours dimension) showed values below 0.5 ($\lambda = 0.39$ and $\lambda = 0.41$, respectively) (Table 2). These items were therefore removed from the model, resulting in a satisfactory model fit in the confirmatory factor analysis [χ^2 (239) = 381.38; χ^2/df = 1.59; CFI = 0.92; TLI = 0.91; IFI = 0.93; PCFI = 0.81; RMSEA = 0.05]. The complementary measures of composite reliability (CR) and average variance extracted (AVE) were also satisfactory, although the economic factor of the sustainability knowingness dimension and the social factor of the sustainability behaviours dimension were slightly below the recommended cutoff point of 0.50 (Bagozzi & Yi, 1988) (Table 2).

Table 3. Perception of sustainability knowingness, sustainability attitudes, and sustainability behaviours according to gender.

Dimension / Factor / Item		M (SD)		U-Mann Whitney (sig.)
		Women	Men	
Sustainability knowingness				
Env	K3	4.53 (0.71)	4.21 (0.86)	0.030*
	K14	4.68 (0.57)	4.56 (0.61)	0.240
	K21	4.52 (0.64)	4.31 (0.78)	0.144
Soc	K5	4.60 (0.70)	4.41 (0.65)	0.038*
	K10	4.68 (0.52)	4.52 (0.64)	0.205
	K11	4.65 (0.53)	4.40 (0.73)	0.058
Eco	K12	4.68 (0.52)	4.38 (0.64)	0.005**
	K16	4.43 (0.71)	4.16 (0.79)	0.047*
	K17	4.38 (0.74)	4.03 (0.87)	0.022*
Sustainability attitudes				
Env	A5	2.03 (1.27)	2.50 (1.33)	0.025*
	A6	4.50 (0.71)	4.06 (0.85)	0.001***
	A10	4.63 (0.66)	4.24 (0.78)	0.002**
Soc	A1	4.83 (0.38)	4.37 (0.66)	0.000***
	A2	4.80 (0.46)	4.45 (0.65)	0.001***
	A18	4.88 (0.33)	4.48 (0.65)	0.000***
Eco	A3	4.48 (0.81)	4.26 (0.72)	0.024*
	A7	4.62 (0.62)	4.32 (0.74)	0.012*
	A8	4.15 (0.92)	3.94 (0.92)	0.183
Sustainability behaviours				
Env	B3	4.20 (0.88)	3.87 (0.90)	0.019*
	B10	4.00 (1.06)	3.65 (1.05)	0.038*
	B12	3.95 (1.01)	3.71 (1.02)	0.158
Soc	B4	4.62 (0.58)	4.41 (0.68)	0.053*
	B15	3.23 (1.31)	3.10 (1.26)	0.632
	B17	4.90 (0.30)	4.69 (0.54)	0.026*
Eco	B6	3.90 (1.05)	3.63 (0.88)	0.104
	B9	3.40 (1.21)	3.48 (1.11)	0.730
	B11	3.33 (1.20)	3.41 (1.04)	0.735

Note: * = $p < .05$; ** $p < .01$; *** $p < .001$.

Subsequently, students' perceptions were analysed considering segmentation by gender and academic year. In the first case, the results are presented in Table 3, showing that mean scores were generally higher among female students, with the exception of three items (A5, B9, and B11). Significant differences were found using the Mann-Whitney U test in 17 of the 27 items, with highly significant differences observed in the three items corresponding to the society factor within the sustainability attitudes dimension.

Regarding students' perceptions according to academic year, those enrolled in the 1st and 2nd years generally obtained higher mean scores, with only five items showing higher scores among students in the 4th or 5th years. In this case, only two items displayed significant differences, both within the sustainability attitudes dimension (A6 from the environment factor and A1 from the society factor) (Table 4).

Table 4. Perception of sustainability knowingness, sustainability attitudes, and sustainability behaviours according to academic year.

Dimension / Factor / Item		M (SD)				H Krustal-Wallis (sig.)
		1 ^o	2 ^o	3 ^o	4 ^o	
Sustainability knowingness						
Env	K3	4.18 (0.80)	4.21 (0.91)	4.45 (0.76)	4.28 (0.87)	0.342
	K14	4.59 (0.61)	4.49 (0.63)	4.59 (0.54)	4.65 (0.62)	0.472
	K21	4.43 (0.57)	4.53 (0.70)	4.16 (0.86)	4.32 (0.83)	0.152
Soc	K5	4.43 (0.81)	4.49 (0.63)	4.45 (0.50)	4.45 (0.68)	0.914
	K10	4.59 (0.61)	4.58 (0.54)	4.48 (0.62)	4.57 (0.68)	0.700
	K11	4.55 (0.64)	4.49 (0.70)	4.41 (0.75)	4.38 (0.72)	0.580
Eco	K12	4.59 (0.61)	4.40 (0.62)	4.50 (0.55)	4.31 (0.68)	0.090
	K16	4.35 (0.72)	4.14 (0.74)	4.20 (0.82)	4.17 (0.84)	0.553
	K17	4.02 (0.92)	4.19 (0.79)	4.09 (0.83)	4.12 (0.87)	0.876
Sustainability attitudes						
Env	A5	2.43 (1.51)	2.53 (1.29)	2.27 (1.33)	2.43 (1.26)	0.657
	A6	4.45 (0.61)	4.09 (0.84)	4.16 (0.86)	3.95 (0.94)	0.033*
	A10	4.43 (0.67)	4.37 (0.87)	4.36 (0.68)	4.18 (0.82)	0.364
Soc	A1	4.69 (0.46)	4.49 (0.59)	4.43 (0.66)	4.31 (0.72)	0.030*
	A2	4.69 (0.50)	4.60 (0.54)	4.48 (0.62)	4.37 (0.74)	0.074
	A18	4.71 (0.45)	4.47 (0.70)	4.55 (0.58)	4.52 (0.68)	0.369
Eco	A3	4.43 (0.67)	4.33 (0.83)	4.30 (0.66)	4.20 (0.79)	0.426
	A7	4.41 (0.73)	4.33 (0.77)	4.27 (0.75)	4.49 (0.66)	0.434
	A8	4.10 (0.84)	4.05 (0.92)	3.89 (0.89)	3.94 (1.01)	0.674
Sustainability behaviours						
Env	B3	3.98 (0.98)	3.95 (0.92)	3.95 (0.83)	3.89 (0.90)	0.902
	B10	3.86 (1.22)	3.84 (1.02)	3.57 (0.97)	3.66 (1.03)	0.301
	B12	3.65 (1.14)	3.79 (1.03)	3.86 (0.90)	3.75 (1.01)	0.888
Soc	B4	4.59 (0.53)	4.42 (0.69)	4.27 (0.75)	4.49 (0.66)	0.181
	B15	3.33 (1.36)	3.26 (1.27)	3.11 (1.29)	2.92 (1.17)	0.217
	B17	4.86 (0.35)	4.60 (0.62)	4.70 (0.50)	4.75 (0.53)	0.148
Eco	B6	3.82 (0.92)	3.70 (0.98)	3.70 (0.90)	3.57 (0.90)	0.414
	B9	3.43 (1.25)	3.60 (1.21)	3.64 (0.99)	3.29 (1.07)	0.264
	B11	3.41 (1.15)	3.51 (1.07)	3.45 (1.02)	3.29 (1.07)	0.550

Note: * = $p < .05$; ** $p < .01$; *** $p < .001$.

DISCUSSION

The present study was designed with the objective of examining the psychometric properties of the Sustainability Consciousness Questionnaire (SCQ; Gericke et al., 2019) in a sample of university students from different academic years within the GCCAFD, as well as a secondary objective of evaluating and

analysing participants' perceptions of sustainability consciousness, segmenting the analysis by gender and academic year.

The results of the factor analyses indicate that the scale is valid and reliable, displaying adequate psychometric properties. The exploratory factor analysis revealed a slight weakness in the evaluation of factor loadings (item A5 with $\lambda < 0.6$), although overall suitability tests were adequate. However, in the confirmatory factor analysis, the scale required adjustment due to poor initial fit resulting from low factor loadings in two items (A5 and B15), whose removal produced satisfactory model fit. This outcome, however, provides a structure that differs from the study conducted by Gericke et al. (2019) on a sample of upper secondary students in Sweden (equivalent to Spanish *bachillerato*), as well as from the study by Marcos-Merino et al. (2020) with university students in the Primary Education degree, both of which maintained the original 27-item structure without reporting any factorial modification.

These findings are particularly relevant considering the recent decline in job satisfaction and employment conditions among graduates in Sport Sciences in Spain, reflecting challenges to the social sustainability of the sector (Grimaldi-Puyana et al., 2025). Hence, the results of the present study confirm trends observed in the international literature: university students generally present high levels of knowledge and attitudes toward sustainability, but significantly lower sustainable behaviours (Berglund et al., 2014; Marcos-Merino et al., 2020; Michalos et al., 2011; Michalos et al., 2015; Mohamed et al., 2024). This cognitive-behavioural gap indicates that awareness generated through formal education does not always translate into sustainable practices, particularly in the environmental domain. Consistent with previous studies, the social dimension was rated highest, while the economic dimension showed weaker scores, which may be linked to a more limited understanding of this aspect within the GCCAFD educational context.

Previous research, such as studies conducted in Canada, has shown that knowledge and attitudes explain approximately 25% of the variance in sustainable behaviour, with knowledge exerting a slightly stronger influence (Michalos et al., 2011; Michalos et al., 2015). This pattern appears partially reproduced in the present sample, where high scores in knowledge are not accompanied by equivalent behaviours, suggesting that increasing sustainability information does not necessarily guarantee real behavioural change. This finding aligns with the notion that knowledge acquisition represents only a first step toward the internalization of sustainable values and practices, requiring transformative learning experiences to consolidate into everyday action.

Moreover, the results highlight the importance of the educational context in developing sustainability consciousness. In Indonesia, the implementation of structured EDS programs, such as the *Adiwiyata* model, significantly enhances the environmental dimension, while in Egypt, universities that are institutionally more committed to sustainability obtain higher overall SC scores (Mohamed et al., 2024; Suwanto et al., 2021). Similarly, in Canada, the explicit inclusion of sustainability content in university courses has been shown to improve all three dimensions of the construct (Michalos et al., 2015). In this regard, the results obtained from GCCAFD students confirm the need to integrate sustainability in a transversal and practical manner within sport-related degrees, fostering learning experiences that connect knowledge with transformative action and the social responsibility of future professionals.

Overall, the findings indicate that university education in the field of sport and physical activity contributes partially to the development of balanced sustainability consciousness. Although high levels of knowledge and attitudes are achieved, the persistence of moderate sustainable behaviours underscores the need to rethink current pedagogical strategies. These results highlight the importance of promoting more experiential,

reflective, and contextualized learning experiences that facilitate the transfer of learning to students' every day and professional actions. Furthermore, the validation of the SCQ in this specific population provides a robust tool for diagnosing and monitoring sustainability consciousness in sport-related degrees, opening new avenues of research aimed at evaluating the impact of active methodologies and institutional programs on the transformation of sustainable behaviours.

Limitations

This study presents several limitations that should be considered when interpreting the results, providing a deeper understanding of their scope. The use of a non-probabilistic convenience sample, composed of university students from the Autonomous Community of Andalusia, restricts the generalizability of the findings to other geographical, cultural, or academic contexts. Therefore, it would be advisable to expand the study to other degree programs and universities in different geographical areas to obtain a more representative view of Spanish university students. On the other hand, the sample size limits the results obtained from segmentation by gender and academic year. In addition, the uneven gender distribution (predominantly male) could introduce bias into the results, although it should be noted that this situation is quite common in studies involving sport sciences students in the Spanish context (Escamilla-Fajardo et al., 2021). Therefore, future studies across other degree programs and geographical contexts would enable more in-depth comparative analyses, allowing better identification of the profile of university students.

Practical implications

The findings of this study have important implications for the design and implementation of educational strategies aimed at strengthening sustainability consciousness in the university context. First, the observed gap between knowledge and sustainable behaviours suggests that universities should reconsider their pedagogical approaches, shifting from information-transmission models toward active, participatory, and transformative methodologies. Strategies such as service-learning, project-based learning, or community immersion experiences enable students to apply the principles of sustainable development in real contexts, thereby facilitating the internalization of sustainable values and behaviours.

Second, the results highlight the need to integrate sustainability transversally across curricula, particularly within the GCCAFD. Beyond including specific courses, it is recommended that all subjects, from biomechanics to sport management, incorporate content, activities, and assessments that promote ethical reflection, social responsibility, and understanding of the three dimensions of sustainable development: environmental, social, and economic. Such integration would support education that is more coherent with the Agenda 2030 goals and with the demands of employers who value sustainability competencies.

Third, the data encourage institutions to reinforce their institutional commitment to sustainability, generating university environments aligned with the values being taught. This involves promoting sustainable practices in resource management, mobility, food, and energy, as well as fostering student participation in sustainability projects and initiatives both on and off campus.

Finally, the results support the use of the SCQ as a valuable tool for diagnosing and monitoring sustainability consciousness in higher education. Its periodic application could facilitate the evaluation of the impact of educational programs and institutional policies, providing valuable information for decision-making and the continuous improvement of sustainability training strategies.

CONCLUSIONS

The present study analysed the sustainability consciousness of GCCAFD university students, examining the relationship between sustainability knowingness, sustainability attitudes, and sustainability behaviours. The results confirmed the reliability and validity of the Spanish version of the SCQ in the university student context, showing adequate psychometric properties with a factor structure that differs slightly from that obtained in other studies. Regarding the participants' perceptions, students demonstrated high levels of knowledge and positive attitudes toward sustainability, but lower levels of sustainable behaviours, highlighting the existence of a cognitive–behavioural gap. This pattern aligns with previous international studies and underscores the difficulty of translating consciousness and attitudes into concrete and lasting actions in the university context.

These results suggest that current ESD strategies in higher education are effective in generating awareness and favourable attitudes but insufficient to promote real behavioural changes, suggesting the need for active methodologies such as project-based learning or service-learning (Marcos-Merino et al., 2020; Suwanto et al., 2021). Therefore, universities should move beyond declarative approaches and implement active, participatory, and transformative methodologies, such as project-based learning or service-learning (Marcos-Merino et al., 2020; Suwanto et al., 2021), which strengthen the connection between knowing and doing. In conclusion, consolidating sustainability in the university context requires the balanced integration of the three dimensions of sustainable development (environmental, social, and economic) through learning experiences that enable students not only to understand sustainability but also to live it and apply it in their everyday lives and future professional practice.

AUTHOR CONTRIBUTIONS

All authors meet the criteria for authorship in accordance with established ethical guidelines. PCLD – conceptualization of the study, data collection, writing - original draft, review and editing; PGR – study design, data curation, analysis and interpretation of the data, writing of the article; JMLG – conceptualization of the study, writing of the article; MGP – study design, development of the theoretical bases, data collection, review and editing. All authors have critically reviewed and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

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CONFLICT OF INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this manuscript.

AI USE DISCLOSURE

In accordance with current publishing ethics and transparency recommendations, artificial intelligence (AI) tools were used solely to assist with translation and language editing, with the aim of improving clarity and readability. No AI tools were used in the generation of scientific content, including the study design, data

collection, analysis, interpretation of results, or the formulation of conclusions. The authors retain full responsibility for the content of the manuscript and confirm its originality, integrity, and accuracy.

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REFERENCES

- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179-211. [https://doi.org/10.1016/0749-5978\(91\)90020-T](https://doi.org/10.1016/0749-5978(91)90020-T)
- Baena-Morales, S., Barrachina-Peris, J., García-Martínez, S., González-Villora, S., & Ferriz-Valero, A. (2023). La Educación Física para el Desarrollo Sostenible: un enfoque práctico para integrar la sostenibilidad desde la Educación Física. *Revista Española de Educación Física y Deportes*, 437(1), 1-15. [https://doi.org/10.55166/reefd.vi437\(1\).1087](https://doi.org/10.55166/reefd.vi437(1).1087)
- Bagozzi, R. P., & Yi, T. (1988). On the evaluation of structural equation models. *J. Acad. Mark. Sci.* 16, 74-94. <https://doi.org/10.1007/BF02723327>
- Berglund, T., Gericke, N., & Chang Rundgren, S. N. (2014). The implementation of education for sustainable development in Sweden: Investigating the sustainability consciousness among upper secondary students. *Research in Science & Technological Education*, 32(3), 318-339. <https://doi.org/10.1080/02635143.2014.944493>
- Escamilla-Fajardo, P., Alguacil, M., & López-Carril, S. (2021). Incorporating TikTok in higher education: Pedagogical perspectives from a corporal expression sport sciences course. *Journal of Hospitality, Leisure, Sports and Tourism Education*, 28, Article 100302. <https://doi.org/10.1016/j.jhlste.2021.100302>
- Evans, T. L. (2019). Competencies and pedagogies for sustainability education: A roadmap for sustainability studies program development in colleges and universities. *Sustainability*, 11(19), 5526. <https://doi.org/10.3390/su11195526>
- Finney, S. J., & DiStefano, C. (2006). Nonnormal and categorical data in structural equation modeling. In G. R. Hancock and R. O. Mueller (Eds.), *Structural Equation Modeling: A second course* (pp. 269-314). Charlotte: Information Age Publishing.
- Fuertes-Camacho, M. T., Graell-Martín, M., Fuentes-Loss, M., & Balaguer-Fàbregas, M. C. (2019). Integrating sustainability into higher education curricula through the project method: A global learning strategy. *Sustainability*, 11(3), 767. <https://doi.org/10.3390/su11030767>
- Gericke, N., Boeve-de Pauw, J., Berglund, T., & Olsson, D. (2019). The sustainability consciousness questionnaire: the theoretical development and empirical validation of an evaluation instrument for stakeholders working with sustainable development. *Sustainable Development*, 27(1), 35-49. <https://doi.org/10.1002/sd.1859>
- Grimaldi-Puyana, M., López Domínguez, P. C., Angosto, S., Bernal-García, A., Muñoz-Llerena, A., & Gálvez-Ruiz, P. (2025). Trends in job satisfaction and employment conditions among sport sciences graduates in Spain (2019-2024): A social sustainability perspective. *Physical Culture and Sport. Studies and Research*, 110(1), 62-70. <https://doi.org/10.2478/pcssr-2025-0024>
- Hagger, M. S., & Hamilton, K. (2025). Progress on theory of planned behavior research: advances in research synthesis and agenda for future research. *Journal of Behavioral Medicine*, 48(1), 43-56. <https://doi.org/10.1007/s10865-024-00545-8>
- Hair, J., Black, W. C., Babin, B., & Anderson, R. E. (2009). *Multivariate data analyses* (7th ed.). New York: Prentice-Hall.

- Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, 6(1), 1-55. <https://doi.org/10.1080/10705519909540118>
- Kline, R. B. (2005). *Principles and practice of structural equation modeling* (2nd ed.). New York: The Guilford Press.
- Lozano, R., Merrill, M. Y., Sammalisto, K., Ceulemans, K., & Lozano, F. J. (2017). Connecting competences and pedagogical approaches for sustainable development in higher education: A literature review and framework proposal. *Sustainability*, 9(10), 1889. <https://doi.org/10.3390/su9101889>
- Marcos-Merino, J. M., Corbacho-Cuello, I., & Hernández-Barco, M. (2020). Analysis of sustainability knowingness, attitudes and behavior of a Spanish pre-service primary teachers sample. *Sustainability*, 12(18), 7445. <https://doi.org/10.3390/su12187445>
- Mezirow, J. (1991). *Transformative dimensions of adult learning*. San Francisco: Jossey-Bass.
- Michalos, A. C., Creech, H., Swayze, N., Maurine Kahlke, P., Buckler, C., & Rempel, K. (2011). Measuring knowledge, attitudes and behaviours concerning sustainable development among tenth grade students in Manitoba. *Social Indicators Research*, 106(2), 213-238. <https://doi.org/10.1007/s11205-011-9809-6>
- Michalos, A. C., Kahlke, P. M., Rempel, K., Lounatvuori, A., MacDiarmid, A., Creech, H., & Buckler, C. (2015). Progress in measuring knowledge, attitudes and behaviours concerning sustainable development among tenth grade students in Manitoba. *Social Indicators Research*, 123(2), 303-336. <https://doi.org/10.1007/s11205-014-0752-1>
- Mohamed, M. A. E. S., Ghallab, E., Hassan, R. A. A., & Amin, S. M. (2024). Sustainability consciousness among nursing students in Egypt: a cross-sectional study. *BMC Nursing*, 23(1), 343. <https://doi.org/10.1186/s12912-024-01990-1>
- Noulheen, A., & Kalsoom, Q. (2022). Education for sustainable development amidst COVID-19 pandemic: Role of sustainability pedagogies in developing students' sustainability consciousness. *International Journal of Sustainability in Higher Education*, 23(6), 1386-1403. <https://doi.org/10.1108/IJSHE-04-2021-0154>
- Olsson, D. (2014). *Young people's sustainability consciousness: Effects of ESD implementation in Swedish School* (Licentiate Thesis). Karlstad University Studies.
- Olsson, D., Gericke, N., & Chang Rundgren, S. N. (2016). The effect of implementation of education for sustainable development in Swedish compulsory schools—assessing pupils' sustainability consciousness. *Environmental Education Research*, 22(2), 176-202. <https://doi.org/10.1080/13504622.2015.1005057>
- Suwarto, R. S., Sanjaya, Y., & Solihat, R. (2021, March). Implementation of education for sustainable development and pupils' sustainability consciousness in Adiwiyata School and ESD-based school. *Journal of Physics: Conference Series*, 1806(1), 012153. <https://doi.org/10.1088/1742-6596/1806/1/012153>
- UNESCO (2006). *United Nations decade of Education for Sustainable Development (2005-2014): International Implementation Scheme*. Paris: UNESCO.
- UNESCO (2009). *United Nations Decade of Education for Sustainable Development (DESD, 2005-2014): Review of Contexts and Structures for Education for Sustainable Development Learning for a Sustainable World*. Paris: UNESCO.
- UNESCO (2014). *UNESCO Roadmap for Implementation of the Global Action Programme on Education for Sustainable Development*. Paris: UNESCO.
- UNESCO (2015). *Shaping the future we want. UN Decade of Education for Sustainable Development (2005-2014)*. Paris: UNESCO.

- UNESCO (2017). Educación para los objetivos de desarrollo sostenible: Objetivos de aprendizaje. Retrieved from (Accessed 2026, 05 February): <https://unesdoc.unesco.org/ark:/48223/pf0000247444>
- Volvoulis, N., & Burgman, M. A. (2019). The contrasting roles of science and technology in environmental challenges. *Critical Reviews Environmental Science and Technology*, 49(12), 1079-1106. <https://doi.org/10.1080/10643389.2019.1565519>
- World Commission on Environment and Development (1987). Our common future: Report of the World Commission on Environment and Development. United Nations. Retrieved from (Accessed 2026, 05 February): <https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf>
- Worthington, R. L., & Whittaker, T. A. (2006). Scale development Research: A content analysis and recommendations for best practices. *The Counseling Psychologist*, 34(6), 806-838. <https://doi.org/10.1177/0011000006288127>

