

RESEARCH ARTICLE OPEN ACCESS

A Leap Toward Sustainable Consciousness: SCQ-S Validation for Spanish Adolescents

Salvador Boned-Gómez¹ | José María Giménez-Egido²  | Alberto Ferriz-Valero² | Salvador Baena-Morales² 

¹Faculty of Education, Comillas Pontifical University-CESAG, Palma, Spain | ²Department of General Didactics and Specific Didactics, University of Alicante, Alicante, Spain

Correspondence: Salvador Baena-Morales (salvador.baena@ua.es)

Received: 2 October 2024 | **Revised:** 13 March 2025 | **Accepted:** 15 March 2025

Keywords: cultural adaptation | education for sustainable development | psychometric network analysis | Spanish adolescents | sustainability awareness | sustainable consciousness | sustainable development

ABSTRACT

This study explores sustainability awareness using an advanced psychometric approach to validate the Sustainability Consciousness Questionnaire (SCQ) for Spanish adolescents. The focus is on examining item-item interactions and the influence of contextual and cultural factors. A cross-sectional study was conducted to translate and culturally adapt the SCQ, originally developed by Gericke et al., following established guidelines. The forward-backward translation method was employed, involving bilingual experts and cognitive interviews with students to refine the Spanish version. Data collection included 29 sustainability-related items and seven sports-related items, administered via paper and Google Forms. Psychometric network analysis was then used to reveal item-item interactions and contextual influences. The study identifies a complex network of factors affecting sustainability awareness, with particular emphasis on unusual correlations, especially with item 10, highlighting the need to review and adapt SCQ items to improve their applicability across different cultural and demographic contexts. On the other hand, items I2, I12, and I24, which received the highest intermediate centrality coefficients, indicate that they are central points that are on the shortest connecting paths to other nodes. The findings emphasize the importance of a holistic and adaptive approach in measuring sustainability. The validation and cultural adaptation of the SCQ are crucial for enhancing the effectiveness of education for sustainable development and fostering a deep commitment to sustainability across diverse populations.

1 | Introduction

The term Sustainable Development (SD) has gained considerable prominence in today's society, particularly due to its crucial role in times of crisis (Global Sustainable Development Report 2023). However, it is imperative to understand that SD is not limited solely to environmental issues; it also encompasses social and economic matters (Berglund and Gericke 2022). These three elements constitute the tripartite dimensions of SD. Therefore, they must be addressed in an integrated and holistic manner to ensure an equitable SD. By delving into each of these dimensions, we can observe that the social dimension of SD promotes equity, social justice, and well-being (United Nations 2016;

Padilla-Rivera et al. 2020). This implies that access to quality education, adequate healthcare services, and opportunities for personal and professional growth should be guaranteed (UNESCO 2020). Consequently, inclusive and equitable education should be prioritized to enable the acquisition of relevant skills for employment, promote creativity and innovation, and develop socio-emotional competencies that foster positive interaction with others (OECD 2023). As for the economic dimension of SD, it advocates for sustainable and equitable economic prosperity (Shi et al. 2019), ensuring equal opportunities in terms of employment, entrepreneurship, and access to financial resources (Bauer et al. 2011; United Nations 2016). Thus, we should have access to fair and sustainable economic opportunities that allow

This is an open access article under the terms of the [Creative Commons Attribution](https://creativecommons.org/licenses/by/4.0/) License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited.

© 2025 The Author(s). *Sustainable Development* published by ERP Environment and John Wiley & Sons Ltd.

us to develop our potential and contribute to economic growth, fostering a culture of responsible consumption and sustainable entrepreneurship (Fidlerová et al. 2022), where we are aware of the impact our economic decisions have on the environment and society. Lastly, the environmental dimension of SD seeks the protection and conservation of the environment for present and future generations (Shi et al. 2019). This objective underscores the importance of individuals being aware of the environmental challenges society faces, such as climate change, biodiversity loss, or the scarcity of natural resources (United Nations 2016). Therefore, the importance of SD today seems indisputable; however, its implementation requires collective commitment, where both individual actions and political strategies are crucial (OECD 2020). Within this set of actions, certain social sectors, such as Education, acquire crucial importance, becoming one of the essential foundations for achieving planetary sustainability in the future (United Nations 2016). Therefore, education for sustainable development (ESD) encompasses a series of educational actions aimed at raising students' awareness of sustainability (SA) while simultaneously developing the necessary competencies to effectively address problems that respond to the needs of the three SD dimensions (UNESCO 2022a). Thus, ESD is interpreted as the educational sector's response, according to UNESCO, to the urgent and dramatic challenges our planet is facing (UNESCO 2017a).

1.1 | Awareness and Education for Sustainable Development: Two Essential Elements for the Planet's Prosperity

To address the climate and socioeconomic crisis we are facing, improving students' SA, as future citizens, should be at the core of our collective priorities (UNESCO 2022b). This increase in SA could be one of the objectives of ESD, as it seems clear that transmitting knowledge about SD is as important as action (European Environment Agency 2023). What is needed is a deeper understanding of environmental and socioeconomic problems, which will enable responsible and pro-sustainability behaviors and attitudes (Baena-Morales and Fröberg 2023). Another essential factor for reinforcing the ESD-SA connection is maintaining a constant focus on the inherent demands of the three dimensions of sustainable development: social, economic, and environmental (Purvis et al. 1987). Therefore, these dimensions represent the foundation for addressing the global challenges our society faces. However, this also highlights the significant challenge for both students and educators in responding to these multidimensional demands. This, once again, underscores the importance of implementing strategies to foster SA from an early age within the educational system (Rieckmann 2017). As observed, ESD and SA are two elements that could inevitably be interconnected and play a crucial role in shaping young people for the pursuit of a more sustainable future (Sinakou et al. 2019). Therefore, in an increasingly complex and globalized society, it may be essential for students to acquire the knowledge, behaviors, and skills necessary to address the challenges they face (Gericke et al. 2019). Providing them with a comprehensive understanding of sustainable development needs, fostering a critical and reflective view of global and local problems, and understanding their individual and collective impact on the world could be fundamental

(Bascopé et al. 2019). For this reason, schools are currently implementing programs and activities that promote the understanding of environmental issues and encourage the adoption of sustainable practices (Ministry of Education and Vocational Training 2021). Through these programs, students learn about the importance of reducing waste, reusing, and recycling, as well as conserving energy and water (United Nations 2016; United States Environmental Protection Agency 2024). Furthermore, they are also taught about sustainable agriculture, ecosystem protection, and promoting environmentally friendly lifestyles (United Nations 2016; United States Environmental Protection Agency 2024).

In addition to formal education, it appears that adolescents are being influenced by the growing amount of information available through social media and the media (Best et al. 2014; Guo and Cheung 2023). It is increasingly common to find relevant information about the damage being done to the planet through environmental awareness campaigns, documentaries, and news about the climate crisis, which is now more accessible to the public than ever before (Nerlich et al. 2009). This allows them to learn about current environmental issues and the actions they can take to contribute to sustainability, thus fostering sustainability awareness. This awareness should be assessed using measurement tools to monitor changes in SA across the three dimensions of SD (Gericke et al. 2019), aiming toward a more prosperous and sustainable future.

Therefore, ESD is grounded in the search for appropriate and feasible educational strategies for each context to foster greater awareness and understanding of these challenges (UNESCO 2017b). It is clear that education has the potential to induce a paradigm shift toward ecosystem conservation, energy efficiency, proper waste management, and the adoption of sustainable daily practices (Urbańska et al. 2022). However, it is essential to evaluate the effect that educational designs have on students' SA (Yakar-Pritchard et al. 2024). Without this, we cannot confirm the effectiveness of the didactic strategies used, and consequently, we will not know if we are contributing to creating students who are more aware of these issues. Therefore, the use of measurement tools to assess the impact of our interventions is essential for ESD.

1.2 | Measuring Sustainability Awareness Across Its Three Dimensions: An Approach to the SCQ-S Questionnaire

The development of assessment tools capable of measuring the three dimensions of sustainable development in students is an effective strategy for understanding and quantifying their level of awareness and commitment to this topic (Gericke et al. 2019). These tools not only provide an objective assessment of the impact of educational and environmental awareness programs but also serve as valuable tools for communication and sensitization (Redvers et al. 2022). Quantifying the knowledge acquired by adolescents and evaluating their behaviors and attitudes toward sustainability allows for the identification of both areas for improvement and individual strengths (Yakar-Pritchard et al. 2024). This, in turn, provides a framework for more effectively adapting educational programs and strategies

(Mian et al. 2020), ensuring that relevant topics are addressed and their impact on the population is maximized. These tools also offer the opportunity to actively engage adolescents in the process of evaluating and monitoring their own progress (WHO 2020; Villavivencio 2004) acting as change agents. This is because these tools provide a space to reflect on their commitment to sustainability and to identify areas for improvement (UNESCO 2017a). Similarly, to determine the effectiveness of our educational interventions, it is essential to conduct periodic evaluations to observe changes (Raković et al. 2022). In this context, various current studies focusing on this specific issue have been examined.

Gericke et al. (2019) developed the Sustainability Consciousness Questionnaire (SCQ) to measure awareness related to sustainable development. This instrument covers the three dimensions of sustainable development and 15 subtopics proposed by UNESCO, through three key psychological constructs: knowledge, attitudes, and behavior. It is available in two versions: the long version (SCQ-L) with 49 questions and the short version (SCQ-S) with 27 questions, which were developed with the help of experts in biology, pedagogy, and sustainability research. A year later, in 2020, Marcos-Merino et al. validated the questionnaire for a specific sample of 151 primary education students in Spain, using the short version SCQ-S. However, a limitation of their study was the relatively small sample size. In 2023, Morales-Baños et al. continued this line of research and studied sustainability awareness in a sample of 170 future graduates in Sports Sciences. They administered the SCQ-S questionnaire using "Google Forms." While this method allowed for efficient data collection, it may have posed some limitations, as online form data collection can be subject to self-selection bias. In the same year, Ogishima et al. conducted a validation effort in the Japanese adult population using the long version of the questionnaire, SCQ-L. They conducted three distinct studies, each with samples ranging from 302 to 456 participants. This work is notable for its meticulous attention to the factorial validity of the questionnaire, but it is also important to highlight that, although they translated and adapted the questionnaire into Japanese, cultural and linguistic differences may have influenced the interpretation of the questions, which could be considered a limitation.

All these studies emphasize the importance of properly validating these instruments based on the cultural characteristics of the population where the questionnaire will be applied. However, the aforementioned limitations in the application and validation of these instruments in other samples and contexts should be considered. With this in mind, our hypothesis is that the Spanish version of the SCQ-S is culturally and developmentally appropriate for the Spanish adolescent population, and thus the aim of this research is to validate the SCQ-S for this specific demographic group.

2 | Method

This study employed a cross-sectional approach and was conducted with the aim of translating and culturally adapting the original instrument created by Gericke et al. (2019) into Spanish. As part of this process, the reliability of the adapted

instrument was verified and its validity was assessed. The study design adheres to the ethical considerations outlined in the Helsinki Declaration. This research was approved by the Ethics Committee of the University of Alicante under code UA-2022-03-17. Participation in the study was voluntary and uncompensated.

2.1 | Participants

The target population ($N=2,755,980$) were students between 11 and 18 years of age of high school (Spanish school system = "ESO and Bachillerato"), this data were taken from the Ministry of Education and Professional Development of Spain (2021). Additionally, the criterion of selecting a minimum of 10 participants per item in educational research was compiled (Ferrando and Anguiano-Carrasco 2010).

Firstly, the schools were contacted to arrange a meeting with the head teachers, and then another meeting was held with the physical education department to explain how the study would work and to set the dates for administering the questionnaire to the students. The data collection process involved gathering information through questionnaires, consisting of 29 questions about sustainability awareness and 7 questions about sports, in both paper format and via Google Forms. This process was conducted between March 2022 and May 2023. A total of 1040 questionnaires were received from students in compulsory secondary education (ESO). After a first review, 57 questionnaires were excluded due to deficiencies in their completion. The sample was thus reduced to 983. Then, after a more in-depth review, two control questions were added to verify that the questionnaire was read and understood (the inverse of item 1 in position 10 and the inverse of item 10 in position 20). If both questions were answered inconsistently, the questionnaire was excluded. For this reason, the final sample consisted of 690 ESO students enrolled in Physical Education from various schools in Spain, specifically from the province of Alicante. Of the participants included in the study, 361 were female and 329 were male. The mean age of the sample was 14.83 years, with a standard deviation of 1.61 years. In terms of academic level, the students were distributed as follows: first year of ESO (16.38%), second year of ESO (4.35%), third year of ESO (30.72%), fourth year of ESO (17.39%), first year of high school (21.59%), and second year of high school (9.57%).

Sampling size was checked following quantitative and qualitative criteria according to scientific literature for adapting cross-cultural questionnaires. The ideal sample size to minimize the estimation error ($< 5\%$) was estimated according to the mathematical formula proposed by Krejcie and Morgan (1970). Finally, the final sample size yielded an estimation error of 3.73%. For a better view of the time structure, see Figure 1. Next, the Equation (1) is shown:

$$d2 = \frac{X2 NP(1 - P)}{S ((N - 1) + X2 P(1 - P))}$$

$$d2 = \frac{3.841 (2,755,980 \times 0.5) (1 - 0.5)}{690 ((2,755,980 - 1) + 3.841 \times 0.5 (1 - 0.5))}$$

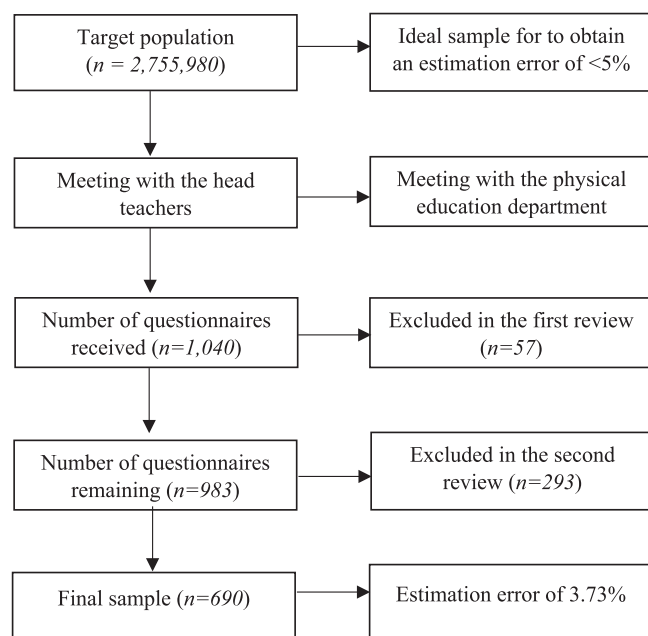


FIGURE 1 | Flow chart of sample collection.

$$d2 = 2,665,634 \div 1,918,202,152$$

$$d = \sqrt{(2,665,634 \div 1,918,202,152)}$$

$$d = 0.3727 \quad (1)$$

s =sample size required; X^2 =denote the table value of chi-square for 1° of freedom at the desired confidence level (3.841); N =population size; P =is the population of a proportion with a desired attribute (assumed to be 0.5 which maximizes the sample size to be determined); d =denote the degree of accuracy expressed as a proportion (0.05).

2.2 | Original Questionnaire

In this research, the validated short version of the Sustainability Awareness Questionnaire (SCQ-S) (Gericke et al. 2019) was used, which consists of 27 questions and was supplemented with two reverse control questions. The choice of the short version was based on its ability to keep participants focused, as it contains fewer questions compared to the full version. In this context, environmental awareness refers to a complex function encompassing cognitive, affective, and evaluative aspects. The questionnaire includes the three essential dimensions of sustainable development: environmental, social, and economic. Participants expressed their responses using a five-point Likert scale, ranging from “strongly disagree” (1) to “strongly agree” (5). A relevant aspect is that this questionnaire is not only linked to the UNESCO framework but also aligns with the 17 most recent Sustainable Development Goals declared in the UN’s Global Action Programme (Gericke et al. 2019). Thus, the questionnaire is a valuable tool for assessing and understanding sustainability awareness comprehensively in various study contexts.

2.3 | Spanish Translation and Cultural Adaptation

The adaptation and cultural translation of the Spanish questionnaire for this study were carried out following the guidelines provided by the relevant literature (Epstein et al. 2015; Maneesriwongul and Dixon 2004). The forward-backward translation method, widely used in survey and inventory translation (Maneesriwongul and Dixon 2004), was employed. Initially, a bilingual translator translated the 27 items of the original questionnaire into Spanish. Then, another bilingual translator, with no prior knowledge of the original instrument, performed a backward translation of the reconciled Spanish version. Subsequently, two bilingual experts in Physical Education with knowledge of the Spanish language compared the forward and backward translations with the original English version, making necessary modifications, improvements, and cross-cultural adaptations. They also provided feedback and evaluations to correct potential inaccuracies. Based on the consensus reached by the two Spanish Physical Education experts regarding the adaptations and comments, an “intermediate version” of the questionnaire was finalized.

The “intermediate version” of the questionnaire, now translated and culturally adapted, underwent a cognitive evaluation process for further improvement. This process allowed for the identification of potential language issues and assessed the respondents’ understanding of the items (Irwin et al. 2009). To carry out this process, a structured interview was conducted with five students, who provided valuable feedback on the interpretation of the items and suggested possible translation alternatives. During the interview, participants expressed their opinions on the clarity of each item, its relevance to their particular situation, the ease of understanding the instructions, and whether they were able to complete it independently. The valuable observations collected during this stage were used by the principal investigator to refine and finalize the Spanish version of the questionnaire. For reference, the template of this structured interview is available in Table 1.

The final version of the questionnaire, now translated and culturally adapted, retained the same number of items and subscales, aiming to capture students’ awareness of sustainability.

2.4 | Data Quality Control

Items response was assessed from two perspectives (Ortega et al. 2008; Ortega Toro et al. 2008): (i) Frequency of response “do not know no answer” (if it exceeded 5% the item would be examined); and (ii) Frequency of high response (to maintain the questionnaire’s discrimination index, the items that showed the same response by over 90% of the participants would be reworded). Response analysis mentioned above is displayed in Table 1.

Table 2 display excellent values in both criteria frequency of response “do not know no answer and frequency of high response.” Therefore, the items assessed assure the data quality control.

TABLE 1 | Data quality control of items response.

SCQ-S			% of response by item (Liker scale)					% do not know no answer
			1	2	3	4	5	
I1	Env	Reducing water consumption is necessary for sustainable development	14.76	9.69	20.11	19.10	36.32	0
I2		Preserving the variety of living creatures is necessary for sustainable development (preserving biological diversity)	2.60	1.88	14.18	25.32	56.00	0
I3		For sustainable development, people need to be educated in how to protect themselves against natural disasters	2.31	2.84	15.05	31.14	48.52	0
I4	Soc	A culture where conflicts are resolved peacefully through discussion is necessary for sustainable development	2.17	2.89	16.35	26.34	52.24	0
I5		Respecting human rights is necessary for sustainable development	2.31	2.17	9.12	22.85	63.53	0
I6		To achieve sustainable development, all people in the world must have access to good education	1.73	2.60	8.10	22.29	65.27	0
I7	Ec	Sustainable development requires that companies act responsibly toward their employees, customers, and suppliers	1.73	2.60	13.75	30.82	51.08	0
I8		Sustainable development requires a fair distribution of goods and services among people in the world	2.17	2.60	17.07	30.39	47.75	0
I9		Wiping out poverty in the world is necessary for sustainable development.	3.47	4.92	18.38	26.48	46.74	0
I10	Env	I think that using more natural resources than we need does not threaten the health and well-being of people in the future.	37.33	13.45	16.50	15.63	16.93	0
I11		I think that we need stricter laws and regulations to protect the environment	1.73	2.60	13.60	32.99	49.06	0
I12		I think that it is important to take measures against problems which have to do with climate change	0.72	2.02	9.55	20.84	66.86	0
I13	Soc	I think that everyone ought to be given the opportunity to acquire the knowledge, values and skills that are necessary to live sustainably	1.73	0.43	6.80	20.40	70.62	0
I14		I think that we who are living now should make sure that people in the future enjoy the same quality of life as we do today	1.45	2.17	12.30	22.00	62.10	0
I15		I think that women and men throughout the world must be given the same opportunities for education and employment	1.45	1.88	6.37	12.30	78.00	0
I16	Ec	I think that companies have a responsibility to reduce the use of packaging and disposable articles	1.88	2.60	16.79	29.52	49.20	0
I17		I think it is important to reduce poverty	1.59	2.17	8.83	26.63	60.78	0
I18		I think that companies in rich countries should give employees in poor nations the same conditions as in rich countries	2.60	3.62	17.37	29.38	47.03	0

(Continues)

TABLE 1 | (Continued)

SCQ-S			% of response by item (Likert scale)					% do not know no answer
			1	2	3	4	5	
I19	Env	I always separate food waste before putting out the rubbish when I have the chance	6.22	5.93	19.68	28.94	39.22	0
I20		I have changed my personal lifestyle in order to reduce waste (e.g., throwing away less food or not wasting materials)	11.72	6.65	20.26	26.77	34.59	0
I21		When I use a computer or mobile to chat, to text, to play games and so on, I always treat others as respectfully as I would in real life	7.96	7.38	21.27	29.81	33.57	0
I22	Soc	I support an aid organization or environmental group	4.63	4.19	15.63	26.63	48.91	0
I23		I show the same respect to men and women, boys and girls	27.06	8.25	26.19	16.06	22.43	0
I24		I do things that help poor people	1.88	2.46	7.09	13.17	75.40	0
I25	Ec	I often purchase second-hand goods over the internet or in a shop	6.51	7.81	27.78	30.69	27.21	0
I26		I avoid buying goods from companies with a bad reputation for looking after their employees and the environment	17.65	13.46	24.89	24.75	19.24	0
I27		I recycle as much as I can	9.84	5.93	31.11	22.72	30.39	0

Abbreviations: Ec = economic; Env = environment; Soc = social.

2.5 | Statistical Analysis

The statistical analysis to SCQ-S transcultural adaptation for Spanish Adolescents was stepped split into two parts according to traditional and actual psychometrics analysis. Traditional psychometric analysis was divided into four steps: (i) Descriptive analysis; (ii) internal consistency scale reliability; (iii) convergent validity; (iv) exploratory factor analysis.

For descriptive analysis, standard deviation, skewness and by item was calculated to know parameters of central tendency, dispersion, and distribution.

As recommended, several studies for assessing total scales and subscales internal consistency reliability used McDonald's ω (IC 95%) and Guttman's λ_2 (IC 95%) according to the criteria established by several studies (Sedere and Feldt 1977; Trizano-Hermosilla and Alvarado 2016; van der Ark et al. 2011; Ventura-León and Caycho-Rodríguez 2017; Viladrich et al. 2017): ≥ 0.90 —Excelente, ≥ 0.80 —Bueno, ≥ 0.70 —Aceptable, ≥ 0.60 —Moderado, ≥ 0.50 —Pobre.

The convergent validity was checked by item-retest correlation. For interpreting the size of correlations, the rule Thumb was followed (Mukaka 2012). Overall, if the item-total correlation is very low (i.e., less than 0.2 or 0.3), it is considered that the item does not significantly contribute to the total score and may be a candidate for elimination.

An exploratory factorial analysis was conducted to examine the structural validity. Previously, Mardia's test of

multivariate normality and Bartlett's test for homogeneity of variances and the Kaiser–Meyer–Olkin Test (KMO) were compiled. The analyses performed indicated that an exploratory factor analysis can be useful with data (For Mardia's test and Bartlett's test α values below 0.005 and KMO values near 1.00) (IBM Corporation 2024). To assess structural validity, an exploratory factorial analysis (EFA). The number of factors was manually selected (three); besides, the factoring method weighted least squares was used due to the distribution of the sample, with direct oblimin rotation due to the existence of oblique factors (Aedo et al. 2010). In addition, Eigenvalues were indicated by factor, and goodness of fit RMSEA (90% CI) values between 0.05 and 0.08 may be considered acceptable, while values below 0.05 were considered good.

The estimation of the relationships between all the items was conducted using a relatively new method called psychometric network analysis. This new perspective has applied for the following reasons:

- Non-latent model: Unlike factor analysis, which assumes the existence of latent factors to explain correlations between items, network analysis considers the relationships between items as direct interactions. This approach allows for a more realistic representation of psychological systems, where variables can mutually influence each other (Borsboom and Cramer 2013).
- Reduction of Spurious Connections: Identification of Central Items: Network analysis utilizes centrality measures such as strength, closeness, and betweenness to

TABLE 2 | Values of descriptive analysis, internal consistency scale, convergent validity and analysis factorial exploratory.

SCQ-S		M	SD	Sk	Kur	If item dropped		Item-rest correlation	AFE
						McDonald's ω	Guttman's λ_2		Factor weight
Sustainability knowingsness									
I1	Env	3.525	1.435	−0.532	−1.041	0.804	0.806	0.178+	0.138 ^a
I2		4.302	0.960	−1.474	1.949	0.743	0.746	0.464	0.441
I3		4.208	0.959	−1.259	1.360	0.736	0.742	0.494	0.462
I4	Soc	4.236	0.971	−1.249	1.151	0.729	0.737	0.527	0.543
I5		4.431	0.915	−1.858	3.369	0.733	0.738	0.514	0.612
I6		4.467	0.881	−1.900	3.540	0.734	0.740	0.514	0.620
I7	Ec	4.269	0.915	−1.309	1.564	0.727	0.732	0.563	0.649
I8		4.190	0.956	−1.166	1.097	0.735	0.743	0.483	0.547
I9		4.081	1.075	−1.074	0.494	0.739	0.746	0.460	0.494

(Continues)

TABLE 2 | (Continued)

SCQ-S		If item dropped					AFE		
		M	SD	Sk	Kur	McDonald's ω	Guttman's λ_2	Item-rest correlation	Factor weight
Sustainability attitudes									
I10	Env	3.387	1.523	0.322	-1.390	0.811	0.812	0.099+	0.976
I11		4.250	0.909	-1.282	1.574	0.729	0.729	0.393	0.400
I12		4.511	0.806	-1.748	2.852	0.704	0.705	0.580	0.595
I13	Soc	4.577	0.784	-2.335	6.330	0.710	0.709	0.555	0.642
I14		4.411	0.891	-1.582	2.224	0.708	0.707	0.535	0.583
I15		4.635	0.804	-2.534	6.471	0.711	0.709	0.546	0.658
I16	Ec	4.216	0.942	-1.171	1.075	0.712	0.711	0.514	0.541
I17		4.428	0.862	-1.749	3.187	0.721	0.720	0.458	0.527
I18		4.146	1.002	-1.138	0.871	0.720	0.720	0.447	0.505

(Continues)

TABLE 2 | (Continued)

SCQ-S			If item dropped					AFE		
			M	SD	Sk	Kur	McDonald's ω	Guttman's λ_2	Item-rest correlation	Factor weight
Sustainability behavior										
I19	Env	I recycle as much as I can	3.890	1.173	-0.936	0.089	0.715	0.718	0.557	0.687
I20		I always separate food waste before putting out the rubbish when I have the chance	3.658	1.325	-0.742	-0.548	0.711	0.713	0.559	0.758
I21		I have changed my personal lifestyle in order to reduce waste (e.g., throwing away less food or not wasting materials)	3.737	1.222	-0.782	-0.268	0.702	0.720	0.553	0.647
I22	Soc	When I use a computer or mobile to chat, to text, to play games and so on, I always treat others as respectfully as I would in real life	4.110	1.104	-1.235	0.863	0.752	0.762	0.268+	0.303
I23		I support an aid organization or environmental group	2.986	1.492	-0.059	-1.352	0.727	0.738	0.458	0.524
I24		I show the same respect to men and women, boys and girls	4.577	0.872	-2.317	5.104	0.745	0.756	0.296+	0.523
I25	Ec	I do things that help poor people	3.643	1.150	-0.612	-0.288	0.719	0.731	0.505	0.502
I26		I often purchase second-hand goods over the internet or in a shop	3.145	1.356	-0.226	-1.109	0.763	0.769	0.261+	0.270 ^a
I27		I avoid buying goods from companies with a bad reputation for looking after their employees and the environment	3.579	1.250	-0.562	-0.531	0.733	0.746	0.410	0.419

Abbreviations: + = below desirable item-rest correlation; Ec = economic; Env = environment; Kur = Kurtosis; r = reverse-scaled item; Sk = skewness; Soc = social.

^aBelow desirable factor weight.

identify the most influential items within the system. This not only enhances the understanding of the questionnaire's structure but also facilitates optimization by focusing on the most relevant items (Hevey 2018).

- Through techniques such as regularized partial correlations (e.g., Graphical LASSO), network analysis minimizes spurious connections that may arise due to uncontrolled variables. This results in more stable and interpretable models (Epskamp, Borsboom, and Fried 2018).
- Flexibility in Data Handling: Network analysis can adapt to different types of data (continuous, ordinal, binary, or mixed), making it applicable across a wide range of psychometric contexts. Moreover, it allows for data analysis at both group and individual levels, providing personalized insights that factor analysis cannot offer (Schmittmann et al. 2013).
- Dynamic Perspective: While factor analysis tends to be static, network analysis allows exploration of how relationships between items evolve over time, which is particularly useful for longitudinal studies or for evaluating the impact of specific interventions (Costantini et al. 2019).
- Analysis of Complex Networks: Instead of assuming that all items are connected through a single factor, network analysis allows the exploration of the existence of communities or subnetworks within the questionnaire, providing a richer and more detailed understanding of the instrument's structure (Hevey 2018).
- Compatibility with Complex Systems: Network analysis is particularly suited for modeling complex phenomena that emerge from interactions between multiple variables, such as psychoeducational factors, where different constructs may influence each other rather than relying on a common latent cause (Borsboom and Cramer 2013).

These advantages position network analysis as an innovative and robust methodology that complements and, in many cases, surpasses the capabilities of traditional factor analysis in the validation and development of questionnaires in psychometry.

Based on these advantages, the Fruchterman–Reingold algorithm was specifically applied to control for spurious correlations that might arise due to multiple comparisons (Fonseca-Pedrero 2018). The discrete nature of the data required the use of the EBICglasso Estimator, as indicated by the scientific literature (Borsboom and Cramer 2013; Fried et al. 2016). The network model was displayed as a Gaussian graphical model according to Lauritzen (1996), each node representing observed variables and edges representing partial correlation coefficients between variables after conditioning on all other variables (Epskamp, Maris, et al. 2018). This analysis was conducted using partial correlation methods, normalized centrality measures, and the network was represented as weighted and signed. The network structure was analyzed through centrality measures (betweenness, closeness, and strength) to assess the importance of each node within the network based on the pattern of connections (Costantini et al. 2019). The criteria for interpreting the centrality measures were those developed by Costantini et al. (2019) and are as follows: (i) Strength centrality represents the magnitude of

a node's association with the rest; a node with high strength centrality significantly influences others; (ii) Closeness centrality is the inverse of the sum of distances from a node to others; a node with high closeness centrality effectively predicts other nodes; (iii) Betweenness centrality is the number of times a node lies between two other nodes; thus, a node with high betweenness centrality is well-connected with the rest of the nodes in the network. The centrality measures were expressed as Z-scores. In addition to the analyses performed, a non-parametric bootstrap technique (number of bootstraps = 100) was used to determine the edgeweights accuracy (red points represent edge weights in the network, the gray area is the 95% confidence interval for the edge weight, so less gray shading indicates higher precision). Furthermore, bootstrap by cases (number of bootstraps = 100) was used for correlation stability for edge and centrality network (retain a correlation of 0.7 in at least 95% of the samples or preferably above 0.50 and should not be below 0.25) (Epskamp, Maris, et al. 2018). The generated analyses were conducted using Goss-Sampson (2024) guide for JASP (Version 0.18.3) (Computer software).

2.6 | Reliability Assessment

Although Cronbach's alpha coefficient is widely used as a measure of reliability, it has faced significant criticism (Peters 2014). Various studies have pointed out that its statistical assumptions (tau equivalence, continuous items with normal distributions, uncorrelated errors, unidimensionality) do not align with current statistical knowledge and practices (Peters 2014). Therefore, alternative reliability measures have been proposed.

In our study, to assess internal consistency and the reliability of the created scale, as well as subdomains composed of more than two items, two coefficients were reported: Guttman's lambda-2 and McDonald's ω .

Since this study was a pilot test of a newly translated and culturally adapted questionnaire, cut-off points based on an “empirical rule” were used to interpret reliability results according to different studies (McDonald 2013; Sedere and Feldt 1977; Viladrich et al. 2017).

3 | Results

The results will be structured based on traditional psychometric tests and current psychometric tests.

3.1 | Traditional Psychometric Tests

The EFA results, internal consistency indices, and convergent validity metrics for the SCQ-S items are summarized in Table 2. The table presents the factor weights, internal consistency values (McDonald's ω , Guttman's λ_2), item-rest correlations, and descriptive statistics (mean, standard deviation, skewness, and kurtosis) for the items across the three constructs: sustainability knowingness, sustainability attitudes, and sustainability behavior.

Descriptive values show compliance values corresponding to the upper third of the five-point Likert scale used. Regarding the reliability analysis of the scale used across the three factors addressed, the McDonald's ω coefficient values are (Sustainability knowingness, $\omega=0.764$ [0.738–0.791], Sustainability attitudes $\omega=0.748$ [0.720–0.777], Sustainability behavior, $\omega=0.751$ [0.724–0.779]) and Guttman's λ_2 values are (Sustainability knowingness, $\lambda_2=0.770$ [0.735–0.802], Sustainability attitudes $\lambda_2=0.748$ [0.703–0.786], Sustainability behavior, $\lambda_2=0.762$ [0.734–0.788]). All item values are above 0.70, meeting the criteria of the scientific literature. Additionally, if an item is removed from the factor, the internal consistency values of the scale remain stable. The lowest and highest values per test are as follows: McDonald's ω (item 21 = 0.702—item 10 = 0.811) and Guttman's λ_2 (item 12 = 0.705—item 10 = 0.812).

The exploratory factor analysis, structured into three factors, reveals that the explained variance is 33.80% (Eigenvalues: Sustainability knowingness = 6.91, Sustainability attitudes = 2.460, Sustainability behavior = 1.280). Accordingly, the Overall KMO test value was 0.903, with a minimum item value of 0.780 (item 20) and a maximum of 0.951 (item 16). Table 2 shows that in the sustainability knowingness factor, neither item 1 nor item 26, and in the sustainability behavior factor, neither item 26 reaches the minimum factorial weight of 0.30 established by the scientific literature. However, it is true that the factorial weight of item 26 is very close to the 0.30 value associated with a significant factor value. Conversely, the item with the highest factorial weight corresponds to item 10, which is within the sustainability attitudes factor. The rest of the values show factorial weights above 0.3, thus meeting the criteria of the scientific literature. To conclude the exploratory factor analysis, the goodness-of-fit index RMSEA [0.058, 90% CI (0.054–0.063)] shows acceptable goodness values.

3.2 | Current Psychometric Tests

The estimated network structure for the SCQ-S items is detailed in Table 3 and Figure 2, which provide the network weights for each pair of nodes. These weights represent the strength of partial correlations after controlling for all other nodes in the network, offering insights into the relationships within and across the constructs of sustainability knowingness, sustainability attitudes, and sustainability behavior.

The correlation coefficients observed in Figure 2 and Table 3 are highest among the nodes of the “sustainability knowingness” construct for the following node pairs: I5-I4, I1-I2, and I6-I7. Similarly, the highest correlation coefficients for the “sustainability attitudes” construct are found between the following pairs: I13-I15, I12-I14, and I11-I12. Regarding the “sustainability behavior” construct, the nodes with the highest correlation coefficients are: I20-I21, I23-I27, and I25-I26. The highest correlation coefficients between node pairs from different constructs are: I9-I17 and I24-I15. On the other hand, node I10 correlates negatively with I2, causing this node to be displaced away from the nodes of the “sustainability attitudes” construct to which it belongs.

Figure 3 displays the three centrality indicators of the network, with a graph representing each indicator.

The items represented in Figure 3 that received the highest betweenness centrality coefficients were I2, I12, and I24. Each of these belongs to a different construct, so they are nodes that lie between other nodes through which the shortest connecting paths pass. The items with the highest strength centrality are I15 and I12, indicating that their activation will likely trigger the activation of the other nodes within their construct. Thus, the items from the “sustainability attitudes” construct appear to have the strongest connections. The closeness centrality coefficients for items I12 and I24 seem to correctly predict other nodes.

The accuracy and stability of the network are represented in Figures 4–6.

The precision of the edge weights is shown to be optimal, as the gray area corresponding to the 95% confidence interval of the edge weight is minimal.

Figures 5 and 6 show that the correlation values with the original sample, both in centrality stability and edge stability, range between 0.70 and 0.50 in 95% of the cases in the sample.

4 | Discussion

This study focused on exploring the psychometric structure of sustainability awareness among a sample of Spanish adolescents, using a novel network analysis approach to address a specific gap identified in the current scientific literature. This gap pertains to the limited understanding of how interactions between different items in sustainability questionnaires reflect the complexity of the sustainability awareness construct (Marcos-Merino et al. 2020). It is observed that in the questionnaire there are two items (I1 and I26) that do not obtain more than 0.3 in the AFE, while in Gericke's et al. (2019) study no value was lower than 0.45. On the contrary, Table 2 shows how both the two previous items as well as I2, I11, I22 and I27 obtain values lower than 0.45. Furthermore, it can be seen that the item with the highest factorial weight is I10 with 0.976, while in Gericke's study it is 0.644. These data could be due to cultural differences, since, as it states Morales-Baños et al. (2023), gender differences in sustainability awareness emphasize how demographic variables, such as gender, can influence perceptions and attitudes toward sustainability. This observation extends to other demographic factors, such as age, educational level, and previous exposure to sustainability education, which can result in significant variations in the obtained results.

A detailed and nuanced structure was identified, in which, except for anomalies in item 10 that exhibited negative correlations with others, most items showed notable stability and precision in their interrelationships, suggesting an inherent richness and complexity in the evaluated construct (Marcos-Merino et al. 2020). The results confirmed the existence of three main factors: knowledge, attitudes, and behaviors

TABLE 3 | Network weights matrix.

I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	I14	I15	I16	I17	I18	I19	I20	I21	I22	I23	I24	I25	I26	I27
I1	0.000	0.228	0.031	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.031	0.000	0.000	0.000	0.029	0.053	0.000	0.000	0.000	0.000
I2	0.228	0.000	0.143	0.068	0.000	0.000	0.080	0.046	0.000	−0.090	0.105	0.000	0.000	0.040	0.100	0.039	0.000	0.000	0.016	0.000	0.060	0.000	0.000	0.000	0.000	0.011
I3	0.031	0.143	0.000	0.133	0.000	0.076	0.013	0.097	0.177	0.006	<0.001	0.000	0.000	0.000	0.000	0.000	0.059	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.012
I4	0.000	0.068	0.133	0.000	0.381	0.024	0.075	0.000	0.000	<0.001	0.028	0.000	0.000	0.011	0.048	0.060	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
I5	0.000	0.000	0.000	0.381	0.000	0.118	0.166	0.000	0.061	0.000	0.065	0.096	0.007	0.055	0.000	0.013	0.000	0.000	0.000	0.000	0.037	0.000	0.000	0.000	0.000	0.000
I6	0.000	0.000	0.076	0.024	0.118	0.000	0.197	0.009	0.090	0.000	0.023	0.099	0.000	0.093	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.149	0.000	0.000	0.000
I7	0.000	0.080	0.013	0.075	0.166	0.197	0.000	0.195	0.000	0.000	0.000	0.000	0.030	0.179	0.072	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
I8	0.000	0.046	0.097	0.000	0.000	0.009	0.195	0.000	0.174	0.000	0.090	0.061	0.005	0.000	0.037	0.000	0.102	0.049	0.000	0.020	0.000	0.000	0.000	0.000	0.000	0.053
I9	0.000	0.000	0.177	0.000	0.061	0.090	0.000	0.174	0.000	0.000	0.000	0.004	0.000	0.000	0.000	0.274	0.054	0.000	0.000	0.033	0.000	0.000	0.000	0.035	0.000	0.008
I10	0.000	−0.090	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	−0.038	0.000	0.000	−0.037	−0.021	0.000	0.000	0.000	0.000	0.052	0.000	0.016	0.000	0.000	0.000	0.000
I11	0.000	0.000	<0.001	<0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.183	0.091	0.098	0.000	0.083	0.030	0.000	0.005	0.000	0.024	0.000	0.000	0.000	0.000	0.000	0.090
I12	0.000	0.105	0.000	0.028	0.065	0.023	0.000	0.090	0.000	−0.038	0.000	0.061	0.211	0.011	0.150	0.076	0.052	0.078	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
I13	0.000	0.000	0.000	0.000	0.096	0.099	0.000	0.061	0.004	0.000	0.061	0.000	0.168	0.298	0.000	0.086	0.000	0.000	0.000	0.026	0.020	0.000	0.000	0.000	0.000	0.000
I14	0.000	0.000	0.000	0.000	0.007	0.000	0.030	0.005	0.000	0.000	0.211	0.168	0.000	0.111	0.037	0.000	0.117	0.000	0.000	0.000	0.000	0.000	0.084	0.000	0.000	0.000
I15	0.000	0.040	0.000	0.011	0.055	0.093	0.179	0.000	0.000	−0.037	0.011	0.298	0.111	0.000	0.094	0.004	0.098	0.000	0.000	0.000	0.000	−0.025	0.212	0.000	0.000	0.000
I16	0.000	0.100	0.000	0.048	0.000	0.000	0.072	0.037	0.000	−0.021	0.083	0.150	0.000	0.037	0.094	0.080	0.030	0.017	0.000	0.008	0.000	0.000	0.126	0.000	0.000	0.006
I17	0.000	0.039	0.000	0.060	0.013	0.000	0.000	0.000	0.274	0.000	0.030	0.076	0.086	0.000	0.004	0.080	0.155	0.000	0.000	0.020	0.038	0.000	0.060	0.000	0.000	0.000
I18	0.031	0.000	0.059	0.000	0.000	0.000	0.102	0.054	0.000	0.000	0.052	0.000	0.117	0.098	0.030	0.155	0.000	0.000	0.000	0.028	0.032	0.000	0.039	0.020	0.045	0.003
I19	0.000	0.000	0.000	0.000	0.000	0.000	0.049	0.000	0.000	0.000	0.078	0.000	0.000	0.000	0.017	0.000	0.000	0.000	0.498	0.092	0.000	0.070	0.060	0.117	0.000	0.020
I20	0.000	0.016	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.498	0.000	0.291	0.000	0.103	0.000	<0.001	0.000	0.059
I21	0.000	0.000	0.000	0.000	0.000	0.000	0.020	0.033	0.052	0.024	0.000	0.026	0.000	0.000	0.008	0.020	0.028	0.092	0.291	0.000	0.070	0.076	0.000	0.111	0.000	0.149
I22	0.029	0.060	0.000	0.000	0.037	0.000	0.000	0.000	0.000	0.000	0.000	0.020	0.000	0.000	0.000	0.038	0.032	0.000	0.000	0.070	0.000	0.000	0.263	0.034	0.000	0.000
I23	0.053	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.016	0.000	0.000	0.000	0.000	−0.025	0.000	0.000	0.000	0.070	0.103	0.076	0.000	0.000	0.000	0.226	0.108	0.104
I24	0.000	0.000	0.000	0.000	0.000	0.149	0.000	0.000	0.000	0.000	0.000	0.000	0.084	0.212	0.126	0.060	0.039	0.060	0.000	0.000	0.263	0.000	0.000	0.066	0.000	0.050
I25	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.035	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.020	0.117	<0.001	0.111	0.034	0.226	0.066	0.000	0.168	0.015
I26	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.045	0.000	0.000	0.000	0.000	0.108	0.000	0.168	0.000	0.079
I27	0.000	0.011	0.012	0.000	0.000	0.000	0.053	0.008	0.000	0.090	0.000	0.000	0.000	0.000	0.006	0.000	0.003	0.020	0.059	0.149	0.000	0.104	0.050	0.015	0.079	0.000

Note: The unshaded items correspond to the sustainability knowingness construct, the light shaded items correspond to the sustainability attitudes construct, and the dark shaded items correspond to the sustainability behavior construct.

toward sustainability. This three-dimensional structure aligns with previous research and adds evidence to the discussion on cultural variability in the perception and evaluation of sustainability awareness (Ogishima et al. 2023). Therefore, the study significantly contributes to advancing theoretical knowledge in the field of education for sustainable development, providing a more detailed and complex perspective on how Spanish youth understand and relate to sustainability concepts. Additionally, it highlights the importance of

adapting assessment tools to adequately capture this complexity, promoting more effective and relevant educational interventions for fostering sustainable awareness among the youth (Lestari et al. 2022; Morales-Baños et al. 2023; Romero et al. 2021; Saleem et al. 2023; Yoon et al. 2022).

ESD and the (SA) emerge as increasingly relevant topics in light of the current global climate and socioeconomic crisis, highlighting the urgent need to adopt proactive and committed approaches to sustainability (International Commission on the Futures of Education 2022). This awareness not only encapsulates the understanding of environmental challenges but also encompasses a broader spectrum including knowledge, attitudes, and responsible behaviors toward sustainable development (Leiva-Brondo et al. 2022). In this context, ESD positions itself as a vital mechanism for equipping young people with the necessary tools to face global challenges, fostering a critical and reflective view on both global and local issues and understanding individual and collective impacts on the world (Bascopé et al. 2019; Gericke et al. 2019). The relevance of validating instruments like the reduced version of the SCQ-S in different linguistic and cultural contexts lies in its ability to effectively measure the three dimensions of sustainable development: social, economic, and environmental. These dimensions, fundamental for addressing global challenges in our society, must be understood and developed in an integrated and holistic manner to ensure a prosperous, just, and balanced future for our planet (Berglund and Gericke 2022; Purvis et al. 1987). The adaptation and validation of the SCQ-S for the Spanish adolescent population, as described in the provided study, not only highlights the importance of this instrument in assessing sustainability awareness among youth but also underscores the critical role of formal and informal education in developing sustainable awareness. Global institutions,

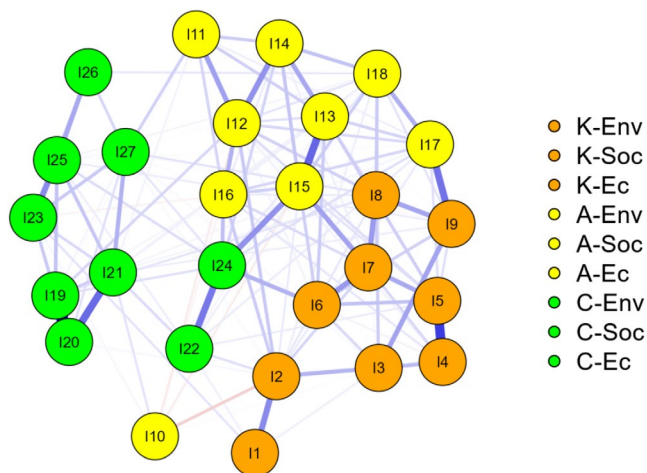


FIGURE 2 | Network analysis. *Note:* The node numbers represent the items on the questionnaire. Orange nodes make up the construct “sustainability knowingness,” yellow nodes correspond to the construct “sustainability attitudes,” and green nodes correspond to the construct “sustainability behavior.” The edges (lines) represent the association between nodes. A blue line indicates a positive relationship, while a red line indicates a negative relationship between nodes. The thickness of the edge indicates the strength of the association.

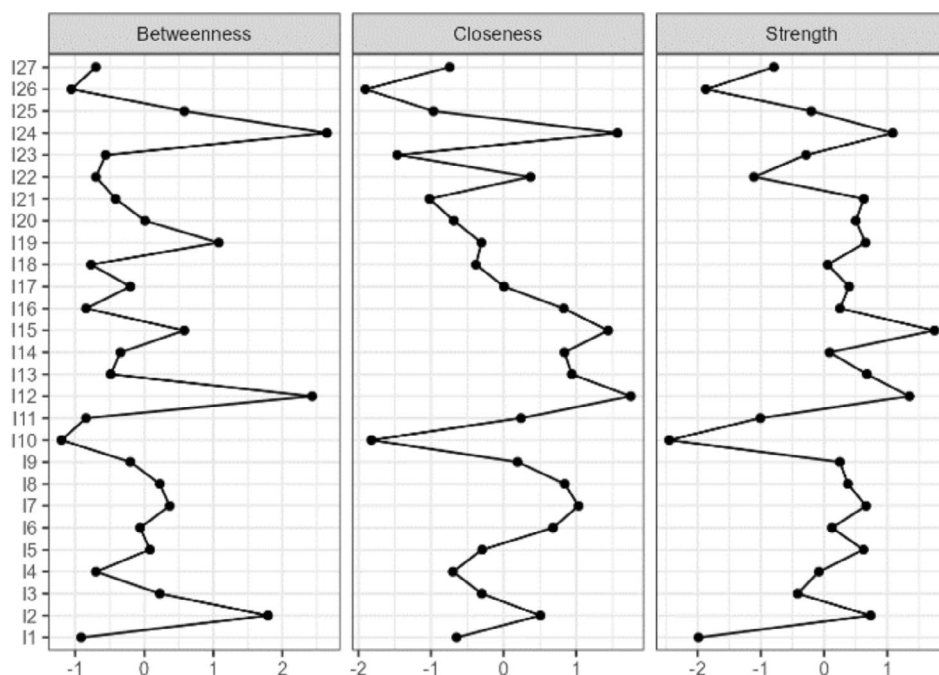


FIGURE 3 | Centrality plot. *Note:* The values on the X-axis are standardized to Z-scores. The numbers correspond to the items in the questionnaire (see Appendix A). The “sustainability knowingness” construct is made up of the nodes from I1 to I9, nodes from I10 to I18 are part of the “sustainability attitudes” construct, and the remaining nodes correspond to the “sustainability behavior” construct.

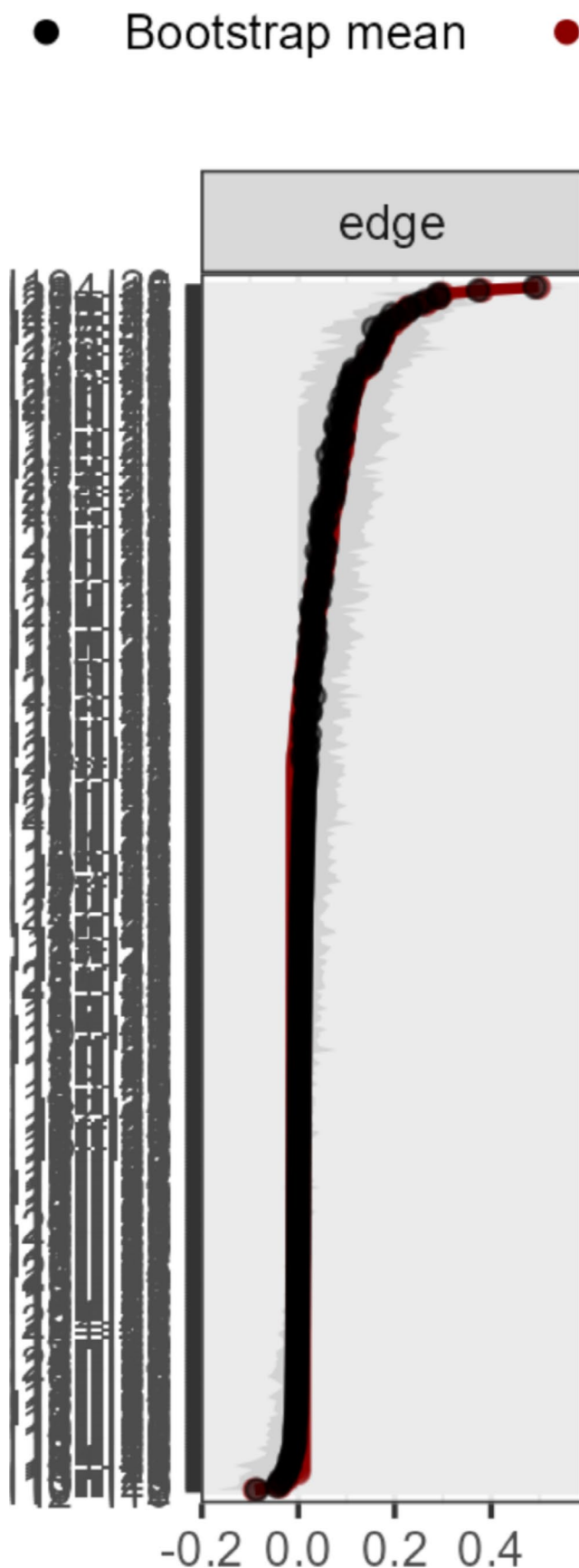


FIGURE 4 | Edge-weights accuracy. *Note:* The X-axis displays standardized scores. The red dots represent the weight of the edges in the network, while the gray area corresponds to the 95% confidence interval of the edge weight.

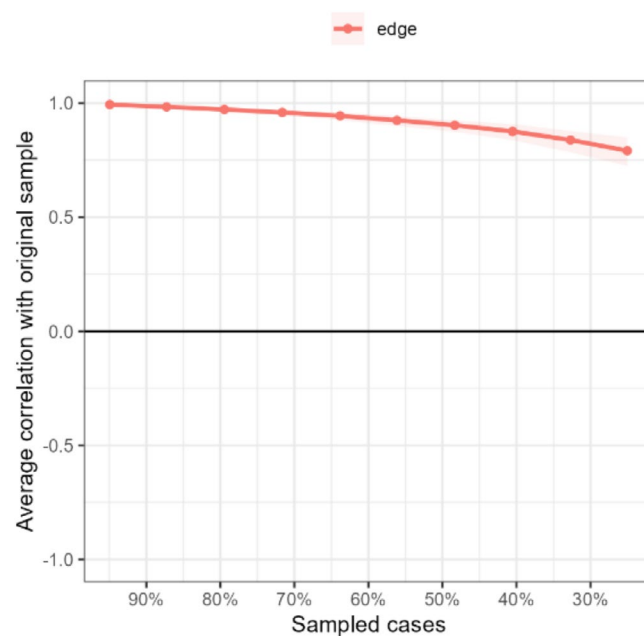


FIGURE 5 | Edge stability.

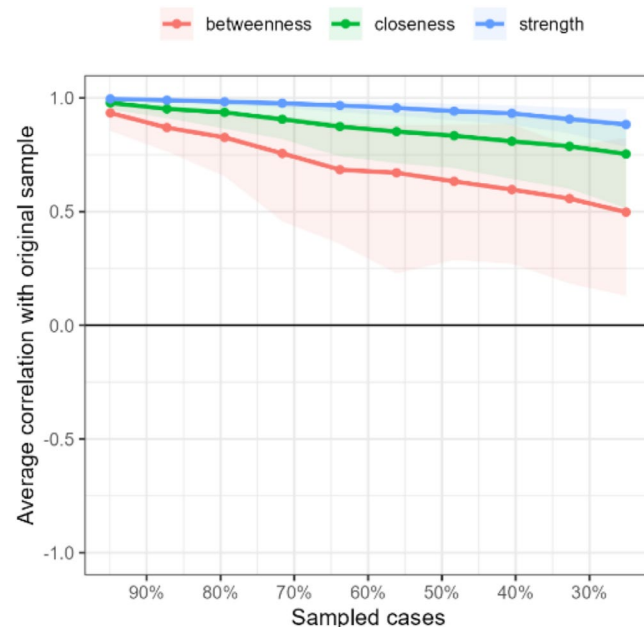


FIGURE 6 | Central stability.

governments, and the education sector play a crucial role in promoting sustainable development through policies, regulations, educational programs, and activities that foster the understanding and adoption of sustainable practices (Ministerio de educación y formación profesional 2021a, 2021b; United Nations 2016).

4.1 | Comparison With the Original Questionnaire

Comparing our results with those obtained from the original questionnaire developed by Gericke et al. (2019), several key areas of similarity and divergence shed light on the complexity

of measuring sustainability awareness in different contexts. First, our methodologies present significant divergences in the operationalization of this construct. While Gericke et al. (2019) developed the SCQ in two versions, long (SCQ-L) and short (SCQ-S), aiming to provide a psychometrically valid and reliable instrument for researchers and practitioners, our study has focused on exploring item-item interactions through psychometric network analysis, revealing complex and specific correlation patterns that reflect the cultural and contextual particularities of sustainability awareness among Spanish adolescents. A notable difference is our finding of unusual negative correlations in certain items, suggesting that the perception and valuation of sustainability may vary significantly depending on cultural and educational context. This aspect highlights the need to consider cultural and contextual differences when applying assessment instruments like the SCQ to diverse populations. Regarding practical applications, both studies agree on the importance of using the SCQ to evaluate the effectiveness of educational interventions in sustainable development and to guide the development of sustainability policies and practices. However, our analysis suggests that cultural adaptations and item revisions may be necessary to accurately capture sustainability awareness in specific contexts, emphasizing the importance of a flexible and adaptive approach in sustainability research. Therefore, while our study and Gericke et al. (2019) share a common theoretical framework around sustainability awareness, methodological differences and specific findings underscore the complexity of measuring this construct in different cultural and educational contexts. These divergences not only enrich our understanding of sustainability awareness but also highlight the need for research approaches capable of addressing the inherent cultural and contextual variability in this field of study.

4.2 | Comparison With Other Research

Our psychometric network analysis provides an in-depth view of the structure of sustainability awareness among Spanish adolescents, highlighting a network that, for the most part, demonstrates stability and precision in the interactions between SCQ items, with the notable exception of one item (item 10) that showed unusual negative correlations. This peculiarity suggests an inherent complexity in the perception of sustainability among youth, warranting further examination to understand its causes and implications. In this regard, the research conducted by Marcos-Merino et al. (2020) presents an interesting parallel, as it also identifies three main latent factors that align with our findings. However, our network analysis approach stands out by revealing a denser and more complex network of relationships among these factors, highlighting the influence of cultural or contextual particularities in the formation of sustainability awareness. Additionally, the discrepancy with the results of Ogishima et al. (2023), who found limitations in the three-level and nine-factor structure in a Japanese sample, reinforces the idea of cultural variability in sustainability perceptions. This variability further underscores the relevance of our analytical approach, which allows for a detailed appreciation of how sustainability awareness manifests in specific contexts, emphasizing the need to adapt assessment tools to these differences. Similarly, the study by Morales-Baños et al. (2023) complements our research by highlighting gender differences in sustainability

awareness, resonating with our observations about the complex item interactions that may reflect divergent sustainability perceptions between genders. This convergence of findings suggests underlying patterns in sustainability awareness that transcend cultural barriers, while emphasizing the importance of considering these differences in designing educational interventions. Additionally, the work of Romero et al. (2021) and Lestari et al. (2022) underscores the effectiveness of the SCQ in measuring sustainability awareness in various educational settings, corroborating the utility of this instrument despite the complexities identified in our analysis. These studies reinforce the validity of the SCQ while highlighting the capacity of network analysis to deepen our understanding of how young people engage with sustainability concepts. Therefore, by intertwining our findings with previous research, we not only demonstrate the validity of the SCQ in different cultural and educational contexts but also highlight the crucial importance of adapting our tools and approaches to the rich diversity of sustainability perceptions. Our study significantly contributes to both the theoretical body on sustainability awareness and educational practice, suggesting the need for sustainable development education programs that are sensitive to cultural and contextual particularities to foster a deeper understanding and commitment to sustainability among future generations.

However, some discrepancies observed between our results and previous studies may be attributed to a range of intrinsic and extrinsic factors, reflecting the depth and complexity of the field of sustainability awareness. Firstly, cultural and contextual diversity emerges as a determining influence on the perception and response to sustainability concepts. As evidenced by Ogishima et al. (2023), the factorial structure of the SCQ did not hold in a Japanese sample, highlighting how cultural differences can significantly alter the interpretation and relevance of questionnaire items. This phenomenon suggests the existence of a broad spectrum of understanding of sustainability, emphasizing the need to adapt assessment instruments to the cultural and linguistic particularities of each studied population. Additionally, the methodology adopted in each research significantly contributes to the discrepancies between studies. Our approach, centered on psychometric network analysis, deviates from traditional factorial analyses by exploring item interconnections in detail. This method allows for a richer appreciation of how different aspects of sustainability awareness interrelate, revealing complex patterns that might be overlooked in more conventional approaches. Thus, this granular approach may be responsible for identifying unique correlations and specific interaction patterns that diverge from previous research findings. On the other hand, the demographic characteristics of the studied samples also play a crucial role in the observed discrepancies.

In this regard, discrepancies between our findings and those of previous studies can be understood as the result of the interaction of multiple factors, including cultural and contextual differences, research methodologies, and demographic characteristics of the samples. Furthermore, this panorama suggests the importance of adopting a flexible and adaptive approach in sustainability awareness research, capable of addressing the complexity and heterogeneity of this construct. In summary, these reflections highlight the need for ongoing dialog among researchers to deepen our understanding of sustainability awareness and

develop educational strategies that are inclusive, relevant, and effective in diverse cultural and demographic contexts.

4.3 | Limitations and Prospects

With regard to the limitations presented in the study, it should be noted that the sample used, although large, was limited to a particular region of Spain, which may limit the results and their generalisability to national or other cultural and demographic contexts. Furthermore, despite collecting the data anonymously, the data collected may be subject to bias due to a lack of understanding or reasoning of the different items. This could be because students may feel embarrassed to ask questions due to a lack of understanding of certain items. On the other hand, it has been observed that the performance of some items has not been as expected, such as I10, which showed a sub-optimal performance despite being the value with the highest factorial weight, which shows the need for further analysis and possible adaptations of the instrument. It should also be noted that neither I1 nor I26, corresponding to sustainability knowledge and sustainability behavior, respectively, reached the minimum factor weight of 0.30 established by the scientific literature.

Certain policy implications of this work can be highlighted when addressing ESD in adolescence. The importance of a multidimensional approach to SA by integrating sustainability knowledge, attitudes, and behaviors across disciplines into curricula can be highlighted. Another aspect to bear in mind is the use of validated tools to determine the effectiveness of interventions at the educational level and thus be able to make decisions based on reliable results. In this sense, it is also important to adapt evaluation tools both culturally and contextually in order to ensure their relevance and effectiveness in all educational settings. In addition, it is important to promote holistic educational strategies in which students combine theoretical knowledge with practical, action-oriented learning experiences. These interventions must be evaluated to demonstrate their effectiveness, which is why governments should invest in funding longitudinal research to analyse the evolution of SA over time. Ensuring equal access to high-quality sustainability education, particularly in the most disadvantaged or marginalized communities, is crucial in order to create more resilient and inclusive societies. The development of such initiatives will empower future generations to make an active contribution and address the global challenges they face today.

Future research could, therefore, focus on a comparative analysis of educational interventions in ESD to determine their impacts on students' sustainability awareness, thus facilitating the creation of a knowledge base that supports the implementation of effective pedagogical strategies globally. In conclusion, this study not only contributes to the theoretical understanding of sustainability awareness but also proposes a practical agenda for sustainability education. Through the validation and adaptation of measurement instruments, along with the development of inclusive and contextualized educational strategies, it is possible to advance toward achieving sustainable development education that motivates concrete and effective actions toward sustainability, preparing future generations to lead the change toward a more sustainable future.

5 | Conclusion

The completion of this analysis highlights the intricate network of factors shaping sustainability awareness among Spanish adolescents, revealed through an advanced psychometric approach. Notably, the reliability indices, including McDonald's ω and Guttman's λ_2 , confirmed the robustness of the instrument, although some items exhibited suboptimal factor weights. The peculiarity observed in item 10, showing unexpected negative correlations, underscores the complexity and need for further investigation into the dynamics influencing this construct. The application of advanced network psychometric approaches further enriched the understanding of the relationships between items, revealing that centrality indicators, such as betweenness and closeness, can identify influential items both within and across constructs. Items such as I12 and I24 emerged as critical nodes in the network, highlighting their central role in the structure of sustainability awareness. This study emphasizes the need to continue exploring and understanding sustainability awareness through methodological approaches that appreciate the rich interconnection of its components, thereby ensuring the relevance and effectiveness of educational strategies directed at future generations. The evidence suggests that a holistic and adaptive approach is essential to capture the multidimensionality of sustainability awareness, considering cultural, contextual, and methodological variables. These findings underscore the importance of culturally and contextually adapting these instruments to ensure their effectiveness in diverse educational and demographic contexts.

Acknowledgments

We wish to note that this research was conducted without external financial support or assistance. All aspects of the study, including data collection and analysis, were carried out by the authors independently.

Conflicts of Interest

The authors declare no conflicts of interest.

References

- Aedo, S., S. Pavlov, and F. Clavero. 2010. "Riesgo relativo y Odds ratio ¿Qué son y cómo se interpretan?" *Reviews in Obstetrics and Gynecology* 5, no. 1: 51–54.
- Baena-Morales, S., and A. Fröberg. 2023. "Towards a More Sustainable Future: Simple Recommendations to Integrate Planetary Health Into Education." *Lancet Planetary Health* 7, no. 10: e868. [https://doi.org/10.1016/S2542-5196\(23\)00194-8](https://doi.org/10.1016/S2542-5196(23)00194-8).
- Bascopé, M., P. Perasso, and K. Reiss. 2019. "Systematic Review of Education for Sustainable Development at an Early Stage: Cornerstones and Pedagogical Approaches for Teacher Professional Development." *Sustainability* 11, no. 3: 719. <https://doi.org/10.3390/su11030719>.
- Bauer, S., G. Finnegan, N. Haspels, International Labour Office, and ILO Subregional Office for Central America. 2011. *Género y emprendimiento: guía de formación para mujeres empresarias: paquete de formación y herramientas*. OIT.
- Berglund, T., and N. Gericke. 2022. "Diversity in Views as a Resource for Learning? Student Perspectives on the Interconnectedness of Sustainable Development Dimensions." *Environmental Education Research* 28, no. 3: 354–381. <https://doi.org/10.1080/13504622.2021.1980501>.

- Best, P., R. Manktelow, and B. Taylor. 2014. "Online Communication, Social Media and Adolescent Wellbeing: A Systematic Narrative Review." *Children and Youth Services Review* 41: 27–36. <https://doi.org/10.1016/j.chilcyouth.2014.03.001>.
- Borsboom, D., and A. O. J. Cramer. 2013. "Network Analysis: An Integrative Approach to the Structure of Psychopathology." *Annual Review of Clinical Psychology* 9: 91–121. <https://doi.org/10.1146/annurev-clinpsy-050212-185608>.
- Costantini, G., J. Richetin, E. Preti, E. Casini, S. Epskamp, and M. Perugini. 2019. "Stability and Variability of Personality Networks. A Tutorial on Recent Developments in Network Psychometrics." *Personality and Individual Differences* 136: 68–78. <https://doi.org/10.1016/j.paid.2017.06.011>.
- Epskamp, S., D. Borsboom, and E. I. Fried. 2018. "Estimating Psychological Networks and Their Accuracy: A Tutorial Paper." *Behavior Research Methods* 50, no. 1: 195–212. <https://doi.org/10.3758/s13428-017-0862-1>.
- Epskamp, S., G. K. J. Maris, L. J. Waldorp, and D. Borsboom. 2018. "Network Psychometrics." In *Handbook of Psychometrics*, edited by P. Irwing, D. Hughes, and T. Booth, 953–986. Wiley. <http://arxiv.org/abs/1609.02818>.
- Epstein, J., R. M. Santo, and F. Guillemin. 2015. "A Review of Guidelines for Cross-Cultural Adaptation of Questionnaires Could Not Bring out a Consensus." *Journal of Clinical Epidemiology* 68, no. 4: 435–441. <https://doi.org/10.1016/j.jclinepi.2014.11.021>.
- European Environment Agency. 2023. "The Case for Public Participation in Sustainability Transitions." <https://www.eea.europa.eu/publications/the-case-for-public-participation>.
- Ferrando, P. J., and C. Anguiano-Carrasco. 2010. "El análisis factorial como técnica de investigación en psicología." *Papeles Del Psicólogo* 31, no. 1: 18–33. <http://www.cop.es/papeles>.
- Fidlerová, H., A. Stareček, N. Vraňáková, C. Bulut, and M. Keaney. 2022. "Sustainable Entrepreneurship for Business Opportunity Recognition: Analysis of an Awareness Questionnaire Among Organisations." *Energies* 15, no. 3: 849. <https://doi.org/10.3390/en15030849>.
- Fonseca-Pedrero, E. 2018. "Análisis de redes en psicología." <https://www.redalyc.org/articulo.oa?>
- Fried, E. I., C. D. van Borkulo, S. Epskamp, R. A. Schoevers, F. Tuerlinckx, and D. Borsboom. 2016. "Measuring Depression Over Time...Or Not? Lack of Unidimensionality and Longitudinal Measurement Invariance in Four Common Rating Scales of Depression." *Psychological Assessment* 28, no. 11: 1354–1367. <https://doi.org/10.1037/pas0000275>.
- Gericke, N., J. Boeve-de Pauw, T. Berglund, and D. Olsson. 2019. "The Sustainability Consciousness Questionnaire: The Theoretical Development and Empirical Validation of an Evaluation Instrument for Stakeholders Working With Sustainable Development." *Sustainable Development* 27, no. 1: 35–49. <https://doi.org/10.1002/sd.1859>.
- Global Sustainable Development Report. 2023. "Times of Crisis, Times of Change: Science for Accelerating Transformations to Sustainable Development." https://sdgs.un.org/sites/default/files/2023-09/FINAL%20GSDR%202023-Digital%20-110923_1.pdf.
- Goss-Sampson, M. A. 2024. Statistical Analysis in JASP. A Guide for Students. <https://jasp-stats.org/wp-content/uploads/2024/03/Statistical-Analysis-in-JASP-2024.pdf>.
- Guo, S., and C. K. Cheung. 2023. "Social Media and Adolescents' Well-Being." *Health* 11, no. 16: 2297. <https://doi.org/10.3390/healthcare11162297>.
- Hevey, D. 2018. "Network Analysis: A Brief Overview and Tutorial." *Health Psychology and Behavioral Medicine* 6, no. 1: 301–328. <https://doi.org/10.1080/21642850.2018.1521283>.
- IBM Corporation. 2024. "Prueba de KMO y Bartlett." SPSS Statistics. <https://www.ibm.com/docs/es/spss-statistics/29.0.0?topic=detection-kmo-bartletts-test>.
- International Commission on the Futures of Education. 2022. "Transforming Education Together for Just and Sustainable Futures." <https://en.unesco.org/futuresofeducation/>.
- Irwin, D. E., J. W. Varni, K. Yeatts, and D. A. DeWalt. 2009. "Cognitive Interviewing Methodology in the Development of a Pediatric Item Bank: A Patient Reported Outcomes Measurement Information System (PROMIS) Study." *Health and Quality of Life Outcomes* 7: 3. <https://doi.org/10.1186/1477-7525-7-3>.
- Krejcie, R. V., and D. W. Morgan. 1970. "Determining Sample Size for Research Activities." *Educational and Psychological Measurement* 30, no. 3: 607–610.
- Lauritzen, S. 1996. *Graphical Models*. Oxford Science Publications.
- Leiva-Brondo, M., N. Lajara-Camilleri, A. Vidal-Meló, A. Atarés, and C. Lull. 2022. "Spanish University Students' Awareness and Perception of Sustainable Development Goals and Sustainability Literacy." *Sustainability* 14, no. 8: 4552. <https://doi.org/10.3390/su14084552>.
- Lestari, H., M. Ali, W. Sopandi, A. R. Wulan, and I. Rahmawati. 2022. "The Impact of the RADEC Learning Model Oriented ESD on Students' Sustainability Consciousness in Elementary School." *Pegeim Egitim Ve Ogretim Dergisi* 12, no. 2: 113–122. <https://doi.org/10.47750/pegegog.12.02.11>.
- Maneesriwongul, W., and J. K. Dixon. 2004. "Instrument Translation Process: A Methods Review." *Journal of Advanced Nursing* 48, no. 2: 175–186. <https://doi.org/10.1111/j.1365-2648.2004.03185.x>.
- Marcos-Merino, J. M., I. Corbacho-Cuello, and M. Hernández-Barco. 2020. "Analysis of Sustainability Knowingness, Attitudes and Behavior of a Spanish Pre-Service Primary Teachers Sample." *Sustainability* 12, no. 18: 7445. <https://doi.org/10.3390/SU12187445>.
- McDonald, R. P. 2013. "Test Theory: A Unified Treatment." *Test Theory: A Unified Treatment*, 1–485. <https://doi.org/10.4324/9781410601087>.
- Mian, S. H., B. Salah, W. Ameen, K. Moiduddin, and H. Alkhalefah. 2020. "Adapting Universities for Sustainability Education in Industry 4.0: Channel of Challenges and Opportunities." *Sustainability* 12, no. 15: 6100. <https://doi.org/10.3390/su12156100>.
- Ministerio de Educación y Formación Profesional. 2021a. "Datos y cifras. Curso escolar 2021/2022."
- Ministerio de educación y formación profesional. 2021b. "Plan de Acción de Educación Ambiental para la Sostenibilidad (2021–2025)."
- Ministry of Education and Vocational Training. 2021. Plan de Acción de Educación Ambiental para la Sostenibilidad (2021–2025). <https://www.miteco.gob.es/es/ceneam/plan-accion-educacion-ambiental.html>.
- Morales-Baños, V., F. J. Borrego-Balsalobre, A. Díaz-Suárez, and J. M. López-Gullón. 2023. "Levels of Sustainability Awareness in Spanish University Students of Nautical Activities as Future Managers of Sports and Active Tourism Programmes." *Sustainability* 15, no. 3: 2733. <https://doi.org/10.3390/su15032733>.
- Mukaka, M. M. 2012. "Statistics Corner: A Guide to Appropriate Use of Correlation Coefficient in Medical Research." *Malawi Medical Journal* 24, no. 3: 69–71. www.mmj.medcol.mw.
- Nerlich, B., N. Koteyko, and B. Brown. 2009. "Theory and Language of Climate Change Communication." *Wiley Interdisciplinary Reviews: Climate Change* 1, no. 1: 97–110. <https://doi.org/10.1002/wcc.002>.
- OECD. 2020. "A Territorial Approach to the Sustainable Development Goals: Synthesis Report (OECD Urban Policy Reviews)." OECD Publishing, Paris. <https://doi.org/10.1787/e86fa715-en>.
- OECD. 2023. *Equity and Inclusion in Education: Finding Strength Through Diversity*. OECD Publishing. <https://doi.org/10.1787/e9072e21-en>.
- Ogishima, H., A. Ito, S. Kajimura, and T. Himichi. 2023. "Validity and Reliability of the Japanese Version of the Sustainability Consciousness Questionnaire."

- Ortega Toro, E., J. M. Jiménez, J. M. Andrés, and P. Sainz. 2008. "Diseño y validación de un cuestionario para valorar las preferencias y satisfacciones en jóvenes jugadores de baloncesto." *Cuadernos de Psicología Del Deporte* 8, no. 2: 39–58.
- Ortega, E., A. Calderón, J. M. Palao, and M. C. Puigcerver. 2008. "Nuevas tendencias en Educación Física, Deporte y Recreación (14)." www.retos.org.
- Padilla-Rivera, A., S. Russo-Garrido, and N. Merveille. 2020. "Addressing the Social Aspects of a Circular Economy: A Systematic Literature Review." *Sustainability* 12, no. 19: 7912. <https://doi.org/10.3390/SU12197912>.
- Peters, G.-J. Y. 2014. "The Alpha and the Omega of Scale Reliability and Validity: Why and How to Abandon Cronbach's Alpha and the Route Towards More Comprehensive Assessment of Scale Quality." *European Health Psychologist* 16, no. 2: 56–69.
- Purvis, B., Y. Mao, and D. Robinson. 1987. "The Concept of Sustainable Economic Development." *Environmental Conservation* 14, no. 2: 681–695. <https://doi.org/10.1017/S0376892900011449>.
- Raković, M., M. L. Bernacki, J. A. Greene, et al. 2022. "Examining the Critical Role of Evaluation and Adaptation in Self-Regulated Learning." *Contemporary Educational Psychology* 68: 102027. <https://doi.org/10.1016/j.cedpsych.2021.102027>.
- Redvers, N., Y. Celidwen, C. Schultz, et al. 2022. "Personal View the Determinants of Planetary Health: An Indigenous Consensus Perspective." www.thelancet.com/.
- Rieckmann, M. 2017. "Education for Sustainable Development Goals: Learning Objectives."
- Romero, M., J. De Boeve-Pauw, D. Olsson, P. Van Petegem, G. Parra, and N. Gericke. 2021. "Promoting Environmental Citizenship in Education: The Potential of the Sustainability Consciousness Questionnaire to Measure Impact of Interventions." *Sustainability* 13, no. 20: 11420. <https://doi.org/10.3390/su132011420>.
- Saleem, A., S. Aslam, G. Sang, P. S. Dare, and T. Zhang. 2023. "Education for Sustainable Development and Sustainability Consciousness: Evidence From Malaysian Universities." *International Journal of Sustainability in Higher Education* 24, no. 1: 193–211. <https://doi.org/10.1108/IJSHE-05-2021-0198>.
- Schmittmann, V. D., A. O. J. Cramer, L. J. Waldorp, S. Epskamp, R. A. Kievit, and D. Borsboom. 2013. "Deconstructing the Construct: A Network Perspective on Psychological Phenomena." *New Ideas in Psychology* 31, no. 1: 43–53. <https://doi.org/10.1016/j.newideapsych.2011.02.007>.
- Sedere, M. U., and L. S. Feldt. 1977. "The Sampling Distribution of the Kristof Reliability Coefficient, the Feldt Coefficient, and Guttman's Lambda-2." *Journal of Educational Measurement* 14: 53–62.
- Shi, L., L. Han, F. Yang, and L. Gao. 2019. "The Evolution of Sustainable Development Theory: Types, Goals, and Research Prospects." *Sustainability* 11, no. 24: 7158. <https://doi.org/10.3390/su11247158>.
- Sinakou, E., V. Donche, J. B. Pauw, and P. Petegem. 2019. "Designing Powerful Learning Environments in Education for Sustainable Development: A Conceptual Framework." *Sustainability* 11, no. 21: 5994. <https://doi.org/10.3390/su11215994>.
- Trizano-Hermosilla, I., and J. M. Alvarado. 2016. "Best Alternatives to Cronbach's Alpha Reliability in Realistic Conditions: Congeneric and Asymmetrical Measurements." *Frontiers in Psychology* 7: 168007.
- UNESCO. 2017a. *Educación para los Objetivos de Desarrollo Sostenible*. Unesco Publishing. <https://unesdoc.unesco.org/ark:/48223/pf00000252423>.
- UNESCO. 2017b. "Education for Sustainable Development Goals: Learning Objectives. UNESCO." <https://doi.org/10.54675/CGBA9153>.
- UNESCO. 2020. "Informe de seguimiento de la educación en el mundo, 2020, América Latina y el Caribe: inclusión y educación: todos y todas sin excepción."
- UNESCO. 2022a. "Berlin Declaration on Education for Sustainable Development." <http://www.unesco.org/open-access/terms-use-ccbysa-en>.
- UNESCO. 2022b. *Reimaginar juntos nuestros futuros: un nuevo contrato social para la educación*. UNESCO.
- United States Environmental Protection Agency. 2024. "Reduce, Reuse, Recycle Resources for Students and Educators." <https://www.epa.gov/recycle/reduce-reuse-recycle-resources-students-and-educators>.
- United Nations. 2016. *Objetivos de Desarrollo Sostenible*. <https://www.un.org/es/impacto-académico/page/objetivos-de-desarrollo-sostenible>.
- Urbańska, M., P. Charzyński, H. Gadsby, T. J. Novák, S. Şahin, and M. D. Yilmaz. 2022. "Environmental Threats and Geographical Education: Students' Sustainability Awareness – Evaluation." *Education in Science* 12, no. 1: 1. <https://doi.org/10.3390/educsci12010001>.
- van der Ark, L. A., D. W. van der Palm, and K. Sijtsma. 2011. "A Latent Class Approach to Estimating Test-Score Reliability." *Applied Psychological Measurement* 35, no. 5: 380–392. <https://doi.org/10.1177/0146621610392911>.
- Ventura-León, J. L., and T. Caycho-Rodríguez. 2017. "El coeficiente Omega: un método alternativo para la estimación de la confiabilidad." *Revista Latinoamericana de Ciencias Sociales, Niñez y Juventud* 15, no. 1: 625–627.
- Viladrich, C., A. Angulo-Brunet, and E. Doval. 2017. "Un viaje alrededor de alfa y omega para estimar la fiabilidad de consistencia interna." *Anales de Psicología* 33, no. 3: 755–782. <https://doi.org/10.6018/analesps.33.3.268401>.
- Villavivencio, L. 2004. "La participación de los estudiantes en la evaluación del aprendizaje."
- WHO. 2020. "Life Skills Education School Handbook." Prevention of Noncommunicable Diseases. <http://apps.who.int/bookorders>.
- Yakar-Pritchard, G., M. U. Mazhar, A. R. Domingues, and R. Bull. 2024. "Measuring the Impact of Student Knowledge Exchange for Sustainability: A Systematic Literature Review and Framework." *Cleaner Production Letters* 6: 100056. <https://doi.org/10.1016/j.clpl.2024.100056>.
- Yoon, J. H., G. M. Lee, and S. M. Lim. 2022. "Eco-Friendly Exercise Plogging: Meaning of the Motivation and Experience of Green Generation Plogging Participants." *Korean Journal of Physical Education* 61: 343–354.

Appendix A

The SCQ-S Questionnaire Without Control Questions

SCQ-S			1	2	3	4	5
I1	Env	Reducing water consumption is necessary for sustainable development					
I2		Preserving the variety of living beings is necessary for sustainable development (preserving biological diversity)					
I3		To achieve sustainable development, the population must be educated to protect against natural disasters					
I4	Soc	A culture in which conflicts are resolved peacefully through debate is necessary for sustainable development					
I5		Respect for human rights is necessary for sustainable development					
I6		For sustainable development, all people in the world must have access to good education					
I7	Ec	Sustainable development requires that companies act responsibly toward their employees, customers, and suppliers					
I8		Sustainable development requires a fair distribution of goods and services among the world's inhabitants					
I9		Ending poverty in the world is necessary for sustainable development					
I10	Env	I believe that using more natural resources than we need does not threaten the health and well-being of people in the future					
I11		I believe we need stricter laws and regulations to protect the environment					
I12		I believe it is important to take action against problems related to climate change					
I13	Soc	I believe everyone should have the opportunity to acquire the knowledge, values, and skills needed to live sustainably					
I14		I believe that those of us living now must ensure that people in the future enjoy the same quality of life as we do					
I15		I believe that women and men around the world should have the same opportunities for education and employment					
I16	Ec	I believe that companies have the responsibility to reduce the use of packaging and disposable items					
I17		I believe it is important to reduce poverty					
I18		I believe that companies from rich countries should give employees in poor countries the same conditions as in rich countries					
I19	Env	I recycle everything I can					
I20		Whenever I have the chance, I separate food waste before throwing away the trash					
I21		I have changed my personal lifestyle to reduce waste (e.g., throwing away less food or not wasting materials)					

SCQ-S			1	2	3	4	5
I22	Soc	When I use the computer or mobile to chat, send text messages, play, etc., I always treat others with the same respect as in real life					
I23		I support a relief organization or an environmental group					
I24		I show the same respect to men and women, boys and girls					
I25	Ec	I do things that help poor people					
I26		I usually buy second-hand products online or in a store					
I27		I avoid buying products from companies with a bad reputation for caring for their employees and the environment					