

Design and Validation of an Instrument to Assess Competencies for Sustainability in University Students

Valdez-Tribolet, María del Socorro¹, Ramírez-García, Adán Guillermo²

¹Dr. in Education, Professor at Universidad Tecnológica del Sur de Sonora, Mexico.

²Consejo Nacional de Humanidades, Ciencias y Tecnologías, Research Professor at Universidad Autónoma Chapingo, Mexico.

ABSTRACT: The objective of the research was to design and validate an instrument that delimits the degree of knowledge, attitudes and behaviors for sustainability among students entering the University. The methodology used has a non-experimental, transversal and descriptive design of a diagnostic and quantitative nature. The results highlight the design and validation of a 33-item instrument that can be used in different contexts and educational levels. It is concluded that knowledge alone is not enough, but also a positive change in people's attitudes, demonstrating behaviors, customs and lifestyles in favor of the environment.

KEYWORDS: University, knowledge, attitudes, behavior, pro-environmental.

INTRODUCTION

Social impact: Education for sustainable development is fundamental to contribute to the achievement of the Sustainable Development Goals.

The Sustainable Development Goals (SDGs) and sustainability education provided in Universities can be understood through several aspects: In SDG 4: Quality Education, a specific target is included (4.7) that focuses on ensuring that all students acquire the knowledge and skills necessary to promote sustainable development, including education for sustainability [1,2]. To this end, in the case at hand, it is necessary to assess students' environmental knowledge, attitudes and behaviors from their entry to the University, which, allows identifying gaps in their previous education and designing educational programs that strengthen their understanding and commitment to critical issues such as climate change, biodiversity loss and pollution, ensuring that future professionals not only have technical competencies, but also a commitment to sustainability [3]. Given that, students entering university represent a new generation their preparation is key to face the current global challenges, therefore, promoting attitudes, behaviors and knowledge about socio-environmental problems requires diagnoses that allow the generation of comprehensive intervention strategies [4,5].

Beyond knowledge, the assessment of knowledge, attitudes and behaviors is crucial to foster a culture of sustainability in the university and, by extension, in society. By understanding how students perceive and act on environmental issues, universities can implement initiatives and policies that reinforce sustainable behaviors, contributing to the fulfillment of the SDGs [6,7]. In addition, monitoring and measuring progress towards the SDGs requires regular assessment of students' environmental knowledge and behaviors as it provides essential data to measure progress towards achieving the SDGs in the educational setting. These data can also be used to adapt and improve the curriculum, ensuring that it is aligned with global sustainability goals [8].

Environmental knowledge is defined as the quantity and quality of information and knowledge available to an individual about his or her environment and related environmental problems. For Mexico, school is the main source of this knowledge. Meanwhile, the environmental attitude is manifested in favorable or unfavorable feelings, thus pro-environmental action and regulations together influence the subject's behavior. Pro-environmental behavior is defined as the set of actions that people develop in favor of the environment, its conservation and preservation [9,10]. Behavioral changes depend, among other factors, on the social context, knowledge and pro-environmental attitudes that the individual possesses; in this sense, it is necessary to point out that few instruments of this type have been carried out at the university level [11].

The purpose of this research was to design and validate an instrument that measures the degree of knowledge, attitudes and behaviors for sustainability among students entering college.

METHODOLOGY

The Technological University of Southern Sonora (UTS) is a public institution of higher education located in the municipality of Cajeme, Sonora, Mexico. The sample is made up of students in the first quarter of the following careers: Industrial Processes, Information and Communication Technologies, Mechatronics, Marketing, Automotive After-Sales Service and Aeronautics.

Design and Validation of an Instrument to Assess Competencies for Sustainability in University Students

The methodology used has a non-experimental, transversal and descriptive design of diagnostic type, since it identifies a fact, phenomenon, individual or group in order to establish its structure or behavior to collect, examine and evaluate in the field the factors and relationships established in a studied situation, in order to reach its true understanding and propose possible resolution alternatives. The sample was of 295 students, of simple random type, a margin of error of 3% was used, a heterogeneity of 50% with a 95% confidence level.

RESULTS AND IMPLICATIONS

The proposed instrument covers the dimensions of knowledge, attitudes and behaviors, evaluated by means of a Likert scale. To measure the reliability of the instrument, Cronbach's Alpha coefficient (α) and the multiple correlation coefficient (R2) were used. While for validity, a Pearson bivariate correlation analysis was performed to evaluate the representativeness of the content in the measurement instrument (Table 1). The results of the tests performed are shown below:

Table 1 Reliability and validity results of the proposed instrument.

Dimensions	Cronbach's alpha (α)	Multiple correlation (R2)	r de Pearson
Behavior	0.865	0.636	0.606
Knowledge	0.700	0.438	0.602
Attitude	0.721	0.724	0.535
Instrument	0.864	0.599	0.581

Source: Own elaboration.

The aforementioned dimensions present a fairly acceptable Cronbach's Alpha (α), multiple correlation (R2) and Pearson's r, indicating an acceptable internal consistency for a unidimensional scale. The initial proposal contained 44 items, after the reliability test it was reduced to 33 items (Table 2). The proposed instrument is shown below.

Instructions: Below are a series of statements for you to answer as honestly as possible. Write an X in the option that best fits your way of thinking, feeling or acting. Select only one option: 1. strongly disagree; 2. disagree; 3. have my doubts; 4. agree; 5. strongly agree.

Table 2 Pro-environmental knowledge, attitudes and behaviors in university students.

Ítem	Preguntas	1	2	3	4	5
1	The impact of detergents on the environment is positive, as they degrade and release nutrients to plants.					
2	The melting of the polar ice caps may cause coastal and island flooding.					
3	Fossil fuels such as gasoline, diesel and coal emit CO ₂ into the atmosphere when burned.					
4	The global climate is likely to change massively if CO ₂ continues to be emitted into the atmosphere in such large quantities as it is now.					
5	Oil is considered a renewable natural resource, since its existence is unlimited.					
6	When natural resources are overexploited, polluted or deteriorated, an environmental impact is said to exist.					
7	Environmental impacts can be potentiated, as nature is interconnected, and even affect the entire planet.					
8	I use water wisely in my home.					
9	I reuse the notebooks and sheets of paper left over at the end of each school year.					
10	I participate as a volunteer in some action to conserve the environment.					
11	I ask my parents to buy environmentally friendly products.					
12	I use energy-saving light bulbs.					
13	I walk, cycle or take public transport to walk in my locality.					

Design and Validation of an Instrument to Assess Competencies for Sustainability in University Students

14	I deposit paper or glass using recycling containers.					
15	I consider it foolish to worry about using paper on both sides.					
16	I'm not willing to use several different garbage cans, it's a drag.					
17	The use and abuse of plastic bags should be controlled.					
18	I agree with the idea of the polluter pays.					
19	It seems to me that in nature everything is recycled and that there is no need to worry about waste.					
20	I do not consider the accumulation of garbage to be a big problem since it degrades naturally.					
21	I believe that the only problem that garbage causes is that it takes up a lot of space and it is difficult to find places to accumulate it.					
22	As my contribution to saving natural resources is insignificant, I am not concerned about their consumption.					
23	I have never been affected by pollution since it is so exaggerated.					
24	I have never participated in an event that was concerned about environmental issues.					
25	I don't want to do anything to reduce pollution, it is a government obligation.					
26	Although there is continuous pollution of lakes, rivers and air, nature's purification processes soon return them to normal.					
27	I give away used clothing that I no longer wear but is in good condition.					
28	I expect to have a full load of clothes before I put them in the washer.					
29	I leave garbage strewn around the house.					
30	I turn off the lights in a room that will no longer be used.					
31	I take out the garbage for the collection truck to pick it up.					
32	I leave the water faucet running while I brush my teeth.					
33	I leave the refrigerator door open after getting something to eat.					

Implications

The assessment of these criteria in incoming students is a key tool for advancing education for sustainability. This assessment allows educational institutions to train citizens committed to sustainable development, ensuring that future generations are prepared to address global environmental challenges. The proposed instrument presented here has the virtue that it can be adapted and applied to different educational contexts and levels. Among the limitations, the generality of the topics addressed stands out, so it is suggested to emphasize the topic of interest, depending on the problem to be addressed. This type of instruments should be complemented with other ways of obtaining information such as class discussions, dialogues, open-ended questions and direct observation, in order to obtain more reliable conclusions about the real behaviors and attitudes of students.

Ethics statements

This work does not involve human or animal subjects.

Declaration of Competing Interest

The authors declare that there is no conflict of interest in the conduct of this research.

ACKNOWLEDGMENTS

The authors acknowledge the active participation of the students who were part of the sample for the validation of the instrument presented here and the authorities of the Universidad Tecnológica del Sur de Sonora and the Universidad Autónoma Chapingo for the facilities provided for this study.

REFERENCE

- 1) Cebrián, G. (2020). Education for sustainable development in the university curriculum: a cooperative action-research with faculty. *Iberoamerican journal of higher education*, 11(30), 99-114.
<https://doi.org/10.22201/iissue.20072872e.2020.30.590>

Design and Validation of an Instrument to Assess Competencies for Sustainability in University Students

- 2) Ramos Torres, D. (2021). Contribution of higher education to the Sustainable Development Goals from teaching. *Spanish Journal of Comparative Education*, 2020(37), 89-110.
- 3) Osorio-Vélez, B., & Durango-Marín, J. (2022). Global competence for sustainable development: an opportunity for higher education. *Lattice*, 18(1), e7641.
- 4) Martínez-Aznar, J., Calvo Sevillano, G., & Sánchez-León, N. (2022). Environmental literacy and ecosocial crisis: design and validation of a questionnaire for 4th ESO. *Journal of research in education*, 20(2), 257-273.
- 5) Apanovich, N., Asare Okyere, S., Mensah, S., & Kusi Frimpong, L. (2023). Education for sustainable development: Societal benefits of a community garden project in Tucson, Arizona. *Societal Impacts*, 1(2023), 100011. <https://doi.org/10.1016/j.socimp.2023.100011>
- 6) Schmitt Figueiró, P., Mülling Neutzling, D., & Lessa, B. (2022). Education for sustainability in higher education institutions: A multi-perspective proposal with a focus on management education. *Journal of Cleaner Production*, 339(2022), e130539. <https://doi.org/10.1016/j.jclepro.2022.130539>
- 7) Ahmed, G. Abo-Khalil. (2024). Integrating sustainability into higher education challenges and opportunities for universities worldwide. *Heliyon*, 10(2024), e2994. <https://doi.org/10.1016/j.heliyon.2024.e2994>
- 8) Guerrero Fernández, A., Rodríguez Marín, F., Solís Ramírez, E., & García Díaz, J. E. (2022). Validation of an Environmental Literacy questionnaire through expert judgment. *Eureka Journal on Science Education and Outreach*, 19(3), 310101-310121. https://doi.org/10.25267/Rev_Eureka_ensen_divulg_cienc.2022.v19.i3.3101
- 9) Simangele, D., Solomon G., & Tesfamichael T. (2021). Socio-demographic determinants of environmental attitudes, perceptions, place attachment, and environmentally responsible behaviour in Gauteng province, South Africa, *Scientific African*, 12(2021), e00772. <https://doi.org/10.1016/j.sciaf.2021.e00772>
- 10) Mendoza, M., Castillo, I., Montes-Rentería, R. (2022). Youth learning agriculture in rural communities of Veracruz, Mexico. *Revista Temario Científico*, 2(1), 39-49. DOI: <https://doi.org/10.47212/rtcAlinin.1.2.4>
- 11) Rentería-Vera, J. A., Hincapi-Montoya, E. M., Rodríguez-Caro, Y. J., Vélez-Castaneda, C. K., Olivera Carhuaz, E., Pulido Capurro, V., & Yupanqui Lorenzo, D. (2020). Responsible environmental behavior and attitude among university students in Lima, Peru. *Apuntes Universitarios*, 11(1), 123-139. <https://doi.org/10.17162/au.v11i1.559>