

IMPACT OF ACTIVE METHODOLOGIES ON SUSTAINABILITY IN INITIAL TEACHER TRAINING: AN EDUCATIONAL INNOVATION

Mercedes Llorent-Vaquero, Juana M^a Ortega-Tudela, & Elena M^a Díaz-Pareja
Department of Pedagogy, University of Jaén (Spain)

Abstract

The training of committed and skilled professionals to face environmental, economic and social challenges is an unavoidable need in the current context. Education for Sustainable Development (ESD) is presented as a key pillar for transforming society, promoting essential skills such as systems thinking, anticipation, collaboration, critical thinking, strategic action and responsibility. In this sense, university students, as future graduates, play a central role in building a more sustainable world, so their training in this area is essential. An Innovation Project was carried out with the aim of analyzing how university students perceive the sustainability training they have received and its link with the use of active methodologies in their degrees. For this purpose, a quantitative study was carried out, with a descriptive and inferential design, in which 460 students of the Education degrees of the University of Jaén participated. This paper presents the final results obtained from a questionnaire developed specifically for this study, with Likert-type questions on a scale of 1 (strongly disagree) to 5 (strongly agree). The data were then analyzed using SPSS software. The study shows the positive impact of active methodologies on the development of knowledge, competences and satisfaction of university students in relation to the Sustainable Development Goals (SDGs) and sustainability. The innovation experience carried out highlights the beneficial effect of active methodologies in training on SDGs and sustainability together with a sense of satisfaction among students. In addition, the training has had an egalitarian impact as no gender or age differences were found.

Keywords: *Sustainability education, active methodologies, higher education, sustainable development, student perceptions.*

1. Introduction

The Sustainable Development Goals (SDGs) constitute a strategic framework promoted by the United Nations to address the major social, economic and environmental challenges of the 21st century. Their implementation in higher education is essential to train citizens capable of leading significant changes in society (UNESCO, 2021). Universities have a central role in promoting these goals, as they not only provide knowledge, but also develop competences that enable students to act ethically and responsibly in their professional fields (Sterling, 2023).

The incorporation of the SDGs into university curricula not only raises students' awareness, but also strengthens their critical and analytical capacity in the face of global problems. Mainstreaming sustainability in higher education requires a rethinking of teaching and learning methods, prioritizing innovative and participatory approaches that allow students to be actively involved in solving real problems (Barth et al., 2020).

The use of active methodologies in sustainability education has proven to be an effective strategy for the development of key competences such as systems thinking, problem solving and decision-making. Strategies such as project-based learning, service-learning and case studies connect theory with practice and enhance student engagement with environmental and social issues (Bessant et al., 2021).

Experiential learning is another approach that has gained prominence in sustainability education. Through practical activities, such as simulations, fieldwork and collaborations with external organizations, students can apply the concepts they learn in a real-life context, promoting greater understanding and engagement with the SDGs (Lange, 2019). In addition, participation in community initiatives and social impact projects reinforces the connection between academic knowledge and social reality, facilitating the internalization of sustainability values.

The role of teachers in the implementation of sustainability education is crucial. Teachers should not only transmit knowledge, but also act as facilitators of learning, promoting critical thinking and social

responsibility (Rieckmann, 2018). To this end, it is essential that educators receive specific training in active methodologies and innovative approaches that enable them to integrate sustainability into their pedagogical practices.

Teacher motivation and commitment also have a significant influence on students' attitudes towards the SDGs. Recent studies have shown that students feel more engaged with sustainability when they perceive that their teachers are committed to these values and use participatory methodologies that foster meaningful learning (Barth et al., 2020). It is therefore essential for universities to foster teachers' professional development in the field of sustainability by providing tools and resources that enable them to design more effective and transformative learning experiences (Martin et al., 2021).

2. Design & methods

In order to obtain the data, a quantitative research study was carried out, with a descriptive and inferential design, in which 460 students from the Education degrees of the University of Jaén participated. Data collection was carried out by means of a questionnaire developed specifically for this study, with Likert-type questions on a scale of 1 (strongly disagree) to 5 (strongly agree). Subsequently, the data were analyzed using SPSS software.

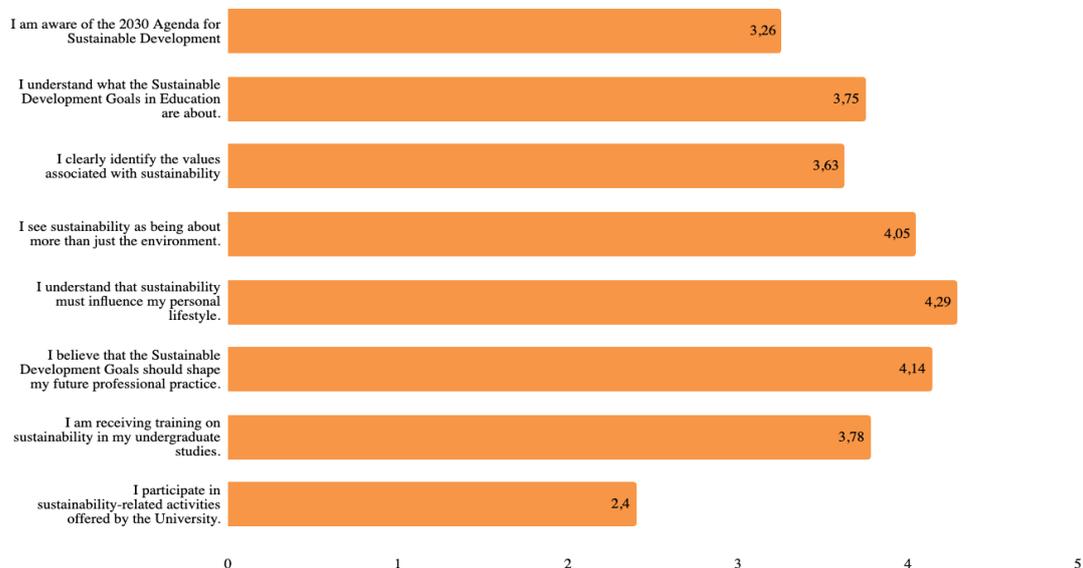
3. Results

The results are then grouped into three areas: knowledge about SDGs, the relationship between active methodologies and SDGs and sustainability, and overall satisfaction with both issues.

3.1. Knowledge on SDGs and sustainability

Figure 1 shows the results of the averages of the most relevant items in relation to the knowledge of the participating students about the SDGs. In this sense, they show a high level of knowledge about the SDGs and sustainability, highlighting their high awareness of the influence of their lifestyle on sustainability. Furthermore, according to the dispersion of the data, there is a high level of consensus on this last item ($SD = 0.87$). In contrast to this, it can be seen that although most of them are receiving training on sustainability in their university studies, they do not participate to a large extent in sustainability-related activities offered at the university.

Figure 1. Mean scores for the items on SDG and sustainability knowledge.



The results for most of the items vary significantly depending on the grade and year in which the students are enrolled. Table 1 shows the results, highlighting only those with significant differences. This is evidence of the impact of the innovation experiences carried out, since all of them were carried out in the first year of Pre-school Education. It should also be noted that there are no significant differences in relation to student age or gender, with the exception of the item 'I am receiving training in sustainability in my undergraduate studies' ($p=0.027$), although it does not show a significant linear pattern ($p=0.673$), and the likelihood ratio test does not support a clear relationship ($p=0.239$).

Table 1. Chi-square analysis results for SDG and sustainability knowledge vs. grade and year.

Analyzed Variables	χ^2	Df	p
Degree vs. I am aware of the 2030 Agenda for Sustainable Development	33.498	8	0.000
Degree vs. I understand what the Sustainable Development Goals in Education entail	90.741	8	0.000
Year vs. I understand what the Sustainable Development Goals in Education entail	26.352	8	0.001
Degree vs. I can clearly identify the values associated with sustainability	55.971	8	0.000
Year vs. I can clearly identify the values associated with sustainability	16.708	8	0.033
Degree vs. I believe that sustainability applies to various areas beyond the environment	18.070	8	0.021
Degree vs. I think the Sustainable Development Goals should guide my future professional practice	13.757	8	0.088
Year vs. I think the Sustainable Development Goals should guide my future professional practice	4.181	8	0.840
Degree vs. I am receiving training on sustainability in my undergraduate studies	89.293	8	0.000
Year vs. I am receiving training on sustainability in my undergraduate studies	29.436	8	0.000
Degree vs. I participate in sustainability-related activities offered by the University	17.878	8	0.022

In all the cases shown in table 1, the observed and expected counts reflect the highest proportion of students in the highest values (4 and 5) in Infant Education, standing out from the students in Primary Education and Social Education. This fact shows the benefits of the innovation project carried out, especially in terms of developing knowledge about the SDGs and sustainability.

3.2. Active methodologies, SDGs and sustainability

The active methodologies most frequently used by the teachers who teach the participants are those based on cooperative learning and self-learning and research, both obtaining an average of 4.22 and a SD of 0.74 and 0.78 respectively (scale 1-5). Other frequently used methodologies are those related to play-based learning (3.97), social awareness (3.91) and critical thinking and communication (3.88).

In terms of the relationship between active methodologies and the achievement of the SDGs, the analysis focused on SDG 4 which seeks to 'ensure inclusive and equitable quality education and promote lifelong learning opportunities for all'. In this sense, participants consider that achieving this goal is facilitated through active methodologies, obtaining values higher than 4 in all items (1-5). Specifically, they highlight their relationship with educational quality, autonomous learning and creativity. However, the integration of ICT, the roles of both the teacher as facilitator and the students as active learners, and the connection between theory and practice could be improved. It should be noted that in all items the dispersion of the data is low, reaching standard deviations ranging between 0.6 and 0.8, so the students' opinion is quite uniform.

Regarding the connection between active methodologies and sustainability competences, students also affirm that these competences are enhanced through them, obtaining values above 4 in all the items of the scale (1-5). Furthermore, the dispersion of the data is low for all items, with standard deviations varying between 0.6 and 0.8, indicating that students have similar opinions. To a greater extent, participants note how active methodologies favor problem-solving skills, the understanding of our norms and values, and the promotion of reflection, respect and tolerance. However, aspects related to more complex global knowledge or the connection to current problems are not so clearly appreciated.

In order to refine the contrast analysis, two variables were created for each of the dimensions presented in this sub-section (active methodologies and SDGs; active methodologies and sustainability). Using the Mann Whitney U and Kruskal Wallis H test statistics, possible relationships between these dependent variables and the gender (0.260, 0.169), age (0.613, 0.192), year (0.918, 0.857) or grade (0.414, 0.624) of the student body were ruled out.

3.3. Overall satisfaction

In general, students are satisfied with the use of active methodologies used in their degree studies to address sustainability, obtaining a mean value of 4.09 (SD=0.87). However, it appreciates with a lower value (3.93) the training received on sustainable development in the university framework.

More specifically, with regard to the teaching staff, they affirm that they are teachers who promote equity and inclusion (4.24) and the involvement of students in the community in order to transform it (4.21), considering to a lesser extent the role they observe in the teaching staff as agents of social change for the creation of a sustainable world (3.9).

It should also be noted that there are some significant differences in overall satisfaction depending on the course and grade in which the participants are enrolled. Table 2 shows the summary of the contrasting

results that showed significant differences. Given the ordinal and nominal characteristics of the variables, the Chi-square statistic was used for the analysis.

Table 2. Results of the Chi-square analysis for overall satisfaction vs. identification data.

Analyzed Variables	χ^2	Df	p	Interpretation
Degree vs. Satisfaction with SD training	55.866	8	0.000	The observed and expected counts show that Early Childhood Education students have the highest proportion in the highest values.
Year vs. Satisfaction with SD training	27.141	8	0.001	The observed and expected counts indicate the most significant difference in a higher concentration of Early Childhood Education students at value 4, while other degrees have lower values.
Degree vs. Satisfaction with the use of active methodologies for sustainability	24.666	8	0.002	The observed and expected counts show that the most significant difference is found in Social Education students, who report lower satisfaction compared to Early Childhood and Primary Education students.

According to table 2, the results show a higher satisfaction among the students who have participated in the innovation project, especially in terms of the training received in Sustainable Development.

4. Conclusions

Students perceive a clear relationship between achieving SDG 4 and the use of active methodologies, highlighting cooperative learning and self-learning in particular. However, aspects such as the integration of ICT, the connection between theory and practice—especially when applied to current issues—and a deeper focus on global aspects need improvement when using these methodologies.

Regarding their training, students are satisfied with the use of active methodologies for sustainability but slightly less so with the training received in sustainable development. In this regard, the innovation experience has led Early Childhood Education students to be more satisfied with their training. It is also important to note that although most students receive sustainability-related education, participation in sustainability activities within the university remains low.

Overall, the innovation project has had a positive impact on Early Childhood Education students, increasing their knowledge, satisfaction, and competencies related to the SDGs and sustainability. However, it is essential to, on the one hand, encourage greater participation in university sustainability activities by expanding the availability of workshops, activities, and seminars related to sustainability or by creating academic incentives to motivate students. On the other hand, strengthening the connection between theory, practice, and current sustainability issues is crucial. This could be achieved through activities or projects that link sustainability to practical cases and local problems or by promoting collaboration with external associations to apply knowledge to real-world contexts.

References

- Barth, M., Godemann, J., Rieckmann, M., & Stoltenberg, U. (2020). Developing key competencies for sustainable development in higher education. *International Journal of Sustainability in Higher Education*, 21(3), 492-505. <https://doi.org/10.1108/14676370710823582>
- Bessant, S., Robinson, Z., & Ormerod, M. (2021). *Active learning in sustainability education: A guide for university educators*. Palgrave Macmillan. <http://hdl.handle.net/10396/20681>
- Lange, E. A. (2019). Transformative learning for sustainability. In W. Leal Filho (Ed.), *Encyclopedia of sustainability in higher education* (pp. 1954-1966). Springer.
- Martín, M. L., Díaz, E., & García, C. (2021). Puesta en Práctica de ODS en Educación Superior a través de la competencia “Sensibilidad hacia temas Medioambientales y Sociales”. In M. L. Sein-Echaluze, A. Fidalgo, & F. J. García (Eds.), *Innovaciones docentes en tiempos de pandemia. VI Congreso Internacional sobre Aprendizaje, Innovación y Cooperación (CINAIC 2021)* (pp. 48-52). Universidad de Zaragoza. <https://doi.org/10.26754/CINAIC.2021.0010>
- Rieckmann, M. (2018). *Learning to transform the world: Key competencies in education for sustainable development*. UNESCO. <https://unesdoc.unesco.org/ark:/48223/pf0000261802>
- Sterling, S. (2023). *Sustainable education: Re-visioning learning and change*. Green Books.