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Education Teachers' Perception of Effective Resources and Methodologies for Environmental Education for Sustainability

Percepción Docente sobre los Recursos y Metodologías Eficaces para la Educación Ambiental para la Sostenibilidad

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KEYWORDS:

Education for sustainable development

Media literacy

Social justice

Social participation

Social welfare

ABSTRACT:

Climate change requires a systemic approach that involves all actors capable of intervening and promoting urgent action to reduce its consequences. Media literacy strategies that promote fair, critical and effective environmental education for sustainability can be implemented in schools. This research analyses teachers' perceptions of the characteristics of the application and effective use of tools, techniques, resources and methods aimed at increasing awareness, sensitivity and environmental literacy in relation to recycling and the circular economy. Using a questionnaire administered with LimeySurvey and validated by an expert judgement and a pilot test, 271 responses were collected from general education teachers in the Community of Madrid (error: ±5%; confidence level: 95%). The results evaluate the spaces, resources and strategies for teaching recycling and circular economy, taking into account the teachers' perceptions. The conclusion is that continuous training of teachers in active methodologies and in the use of pedagogical-communicative content related to recycling and circular economy is essential. It is recommended to develop activities aimed at the educational community around the centre, promote participatory methods and use the potential of digital resources to promote critical environmental literacy and education for sustainability

DESCRIPTORES:

Educación para el desarrollo sostenible

Alfabetización informacional

Justicia social

Participación social

Bienestar social

RESUMEN:

El cambio climático requiere un abordaje sistémico que involucre a todos los actores capaces de intervenir y promover medidas urgentes para minorar sus consecuencias. Desde la escuela pueden implantarse estrategias educomunicativas que favorezcan una Educación Ambiental para la Sostenibilidad justa, crítica y efectiva. Esta investigación analiza la percepción docente sobre las características de aplicación y uso eficaz de las herramientas, técnicas, recursos y metodologías dirigidos a la sensibilización, concienciación y alfabetización ambiental sobre el reciclaje y la economía circular. Mediante un cuestionario administrado con LimeySurvey, validado mediante juicio de expertos y prueba piloto, se recogieron 271 respuestas de docentes de Enseñanzas de Régimen General de la Comunidad de Madrid (error: ±5 %; confianza: 95 %). Los resultados evalúan los espacios, recursos, y estrategias para la enseñanza del reciclaje y la economía circular considerando la percepción del profesorado. Se concluye que es esencial proporcionar formación continua al profesorado en metodologías activas y en el uso de contenidos educomunicativos relacionados con el reciclaje y la economía circular. Se recomienda desarrollar actividades dirigidas a la comunidad educativa del entorno del centro, fomentar las metodologías participativas y aprovechar el potencial de los recursos digitales para fomentar la alfabetización ambiental crítica y la educación para la sostenibilidad.

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1. Introduction

The climate and environmental crisis not only represents a real threat to humanity and life on Earth, but has also reached such a scale that we are now at a point of no return (IPCC, 2023). In the Anthropocene era, changes in climate patterns and temperature shifts exacerbated by industrial and human activities have made climate change a global, multidimensional and interconnected threat that impacts social development and progress (Gabric, 2023; Steffen et al., 2015).

In recent years, various governmental and international bodies have declared a climate emergency (MITECO, 2020; European Parliament, 2019). These declarations underline both the seriousness and urgency of the environmental problem and the need to look for solutions and take concrete measures to reduce and mitigate the consequences of climate change.

Its current impact poses a short, medium and long-term global threat to life on the planet (World Economic Forum, 2024). In a highly complex global context, this wicked problem is intertwined with other geopolitical, social and economic challenges that directly or indirectly affect the development of societies (Equihua Zamora et al., 2016). The negative effects of climate change jeopardize the continuity of human life on Earth and are inherently uncertain (Arora, 2019). The consequences of climate change affect natural, social and territorial levels all over the world. The impacts lead to a scenario of climate apartheid and climate injustice, where the world's most vulnerable populations suffer from these consequences in a catastrophic and unequal way. (European Commission, 2024a; Sultana, 2022). Therefore, urgent, coordinated and universal action is needed to promote systemic change towards sustainable and durable development (Whalen et al., 2018).

Given the finite nature of natural resources and their limited future availability due to climate change, it is necessary to reform current production processes in order to reduce resource consumption and promote their reuse (Ward et al., 2016). The European Union has advocated a 'resource-efficient Europe' (Barroso, 2013, p. 4) as a growth strategy, which requires the identification of models that contribute to this goal. However, our current consumption model remains linear. It is based on the production of goods through the extraction of raw materials and follows the 'take-produce-consume-dispose' pattern. Products are manufactured, bought, used and thrown away without having a second life (MITECO, 2023). This approach promotes a culture of blind abundance that privileges the immediate gratification of consumption, acquisition and waste, as opposed to reflective and sustainable models. This linear model increases pollution, generates large amounts of waste and exacerbates environmental degradation.

In response, innovative models have emerged that aim to make efficient use of resources and promote sustainable production systems that maximize the lifespan of products. The Circular Economy (CE) represents a transformative economic model that focuses on the reduction, reuse, recycling, recovery and reintegration of materials into production processes (Ellen MacArthur Foundation, 2017; Kirchherr et al., 2017). This circular approach offers a wide range of benefits for addressing today's economic, environmental and social challenges (Sariatli, 2017). Furthermore, the cradle-to-cradle (C2C) framework proposed by McDonough and Braungart (2002) envisions an industrial model that prioritizes reuse while ensuring the safety and quality of production processes and materials used in manufacturing.

Over the past decade, the European Union has deepened its commitment to these frameworks, particularly the circular economy, by developing strategies to promote a sustainable environment and lifestyle and to build a resilient future (European Commission, 2024b). Notable initiatives include the European Green Deal (European Commission, 2019), which aims to achieve climate neutrality by 2050, and the New European Bauhaus, which promotes sustainable solutions to improve the quality of urban life. In March 2020, the new Circular Economy Action Plan was launched to support a cleaner and more competitive Europe through sustainability initiatives and a monitoring plan based on education and lifelong learning on the circular economy. In July 2021, the EU Climate Law (Regulation EU 2021/1119) was adopted to align European policies with the Paris Agreement and the Sustainable Development Goals (SDGs) and to mitigate the effects of climate change.

In Spain, the Ministry of Ecological Transition and the Demographic Challenge (MITECO) has promoted policies and guidelines that are in line with EU strategies. These include the 'España Circular 2030' report, which outlines strategic objectives, actions and evaluation indicators for the transition to a circular and sustainable model, the First Action Plan for the Circular Economy 2021-2023 (MITECO, 2021) and the National Plan for Adaptation to Climate Change 2021-2023 (PNACC), which includes the circular model as an innovative production framework to mitigate climate change (MITECO, 2020).

Despite institutional efforts to promote the circular model, numerous obstacles stand in the way of its effective implementation, such as energy dependency, age demographics and the enforcement of regulatory measures (Almeida Neves & Cardoso Marques, 2022). Coordinated actions are needed to raise public awareness through integrated solutions involving different public and private actors. Furthermore, as De Pascale et al. (2023) argue, the transition should be bottom-up and take into account the local context to achieve an effective transition to the circular economy.

In this regard, education and communication are important tools to raise public awareness and promote a paradigm shift in production and consumption models (Andrews, 2015; Gonella et al., 2024). This includes the implementation of environmental education initiatives (Lethone et al., 2019) that promote critical thinking, raise climate awareness and support citizen participation in environmental issues.

In recent years, a shift in educational approaches to sustainable development and environmental issues has been observed. Through Environmental Education (EE), Education for Sustainable Development (ESD) and Environmental Education for Sustainability (EES), initiatives have been developed to raise awareness and sensitize communities, promote responsible consumption habits and teach skills and values necessary to face the climate crisis through education (Benayas & Marcém, 2019; CENEAM, 2021; Gough, 2020; Martínez Castillo, 2010). This study is situated within the framework of the EES and is based on a critical environmental education perspective that emphasizes the need to empower teachers as key agents of change, especially in the local context.

Environmental Education for Sustainability is conceived as a holistic process that empowers citizens through an ethical commitment to their environment. As Sauvé (2005), Anderson (1992) and Bonil, Pujol and Vilches (2010) have noted, schools must serve as drivers of this change and go beyond purely disciplinary or didactic approaches. Within this pedagogy of climate change, advocated by Kagawa and Selby (2010), teachers play a crucial role in teaching students social justice, complex thinking

and collective engagement goals that require active methods linked to sustainability and supported by adequate resources and materials.

Although the contributions of ecosocial education to global justice (Gutiérrez Bastida, 2025) and structural change (González Reyes et al., 2021; Murga-Menoyo & Bautista-Cerro, 2022) are recognized, this is not the primary theoretical focus of the present study.

Within the context of the 2030 Agenda and the SDGs (UNESCO, 2017), media and digital technologies are essential tools to promote education about the circular economy and sustainability and to encourage behavioral changes in consumption models (Heras Hernández, 2016). This requires the adoption of new edu-communicative models and the promotion of the use of digital platforms and social media to showcase best practices and generate a positive narrative about the circular model (Voukkali et al., 2023).

From the perspective of Environmental Education for Sustainability, the goal is to empower citizens to critically engage with environmental media content in order to promote ethical and global citizenship (Carbonell-Alcocer et al., 2022; López, 2019). This is not only about understanding the dimensions of environmental issues, but also about developing dynamic skills and systemic, interdisciplinary thinking that enables responsible, conscious action through the use of digital technologies (López, 2023).

To achieve this, it is crucial to conceive education as a comprehensive process, to position schools as catalysts of change, to train teachers in appropriate methodologies and to equip them with up-to-date resources that foster their critical environmental literacy and commitment to sustainability (Molina-Motos, 2019). In this regard, it is the role of schools to raise awareness and provide students with skills in sustainability, in line with the principles of Environmental Education for Sustainability.

To empower students as agents of change, teachers must be adequately trained and truly committed to student development (Murga-Menoyo, 2015) by creating teaching and learning experiences that lead to meaningful outcomes (Hawley et al., 2023). There are various initiatives to promote CE and sustainability at all levels of education, including game-based interventions (Kirchherr & Piscicelli, 2019), virtual learning environments (Keramitsoglou et al., 2023) and STEM-related projects (Nguyen, 2023).

Beyond pedagogical interventions, it is important to understand the role of teachers in raising student awareness (Tiippana-Usvasalo et al., 2023). Other studies have focused on teachers' engagement in sustainability-oriented classroom experiences (Mendoza Carretero & Gonzalo Muñoz, 2022) and have consistently emphasized the need to strengthen teachers' knowledge to address the environmental, social and economic challenges facing humanity (Sáenz-Rico de Santiago et al., 2023).

The present study focuses on assessing the current state of educational spaces, resources, tools, teaching strategies and methods used by teachers and their relationship with Environmental Education for Sustainability with the aim of developing effective and innovative educational interventions and communication campaigns on circular economy, sustainability and environmental issues.

2. Objectives and Research Questions

The main objective of this study is to analyze teachers' perceptions regarding the application and effective use of tools, techniques, resources, and methodologies within edu-communicative projects aimed at raising awareness, promoting engagement and

disseminating knowledge about recycling and the circular economy. To achieve this, the following specific objectives are proposed:

- Specific objective 1. To analyze the level of integration, readiness, perceived importance and satisfaction of teachers in the Community of Madrid (CAM) in terms of educational spaces, resources, didactic tools and teaching techniques to address content related to recycling and circular economy.
- Specific objective 2. To investigate the level of integration and satisfaction and the relationship between the level of education and the inclusion of environmental issues by teachers in the Community of Madrid.

Table 1 shows the correspondence between the specific objectives and the research questions.

Table 1

Relationship between Specific Objectives and Research Questions

	Research Questions
Specific objective 1.	What educational spaces are used by teachers in the Community of Madrid to carry out their teaching work? What educational resources are used by teachers in the Community of Madrid? What are the most frequently used didactic tools among teachers in the Community of Madrid? What teaching techniques are perceived as enhancing the teaching-learning process? What topics related to sustainable development are being addressed by teachers in the Community of Madrid?
Specific objective 2.	Is there a relationship between educational level and the degree of incorporation/satisfaction with environmental content? Does the educational stage influence the approach to sustainability-related topics? At which educational stages are topics such as climate change and sustainability being addressed?

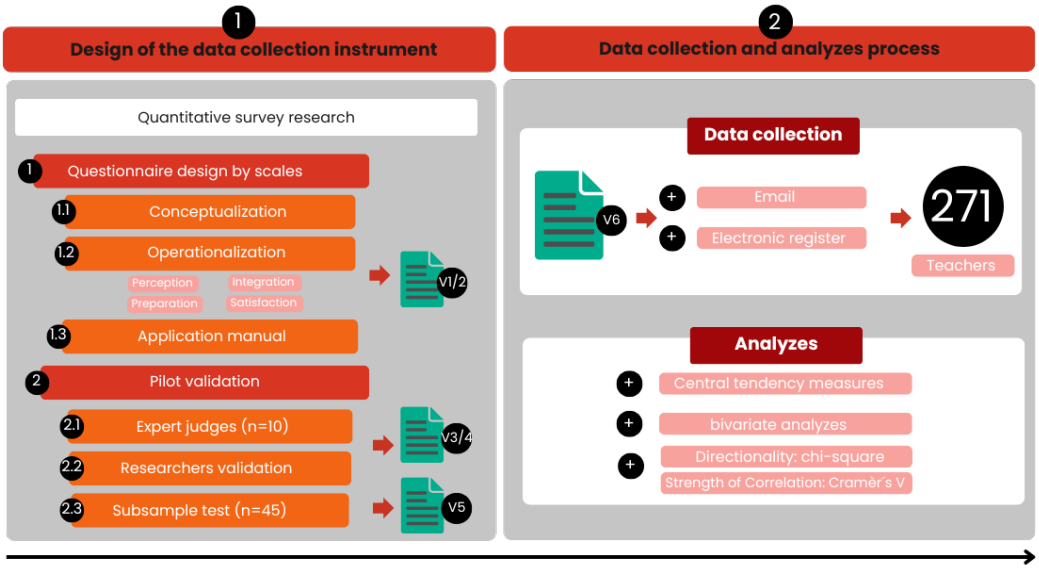
3. Method

This study follows a quantitative methodological approach and uses a specially developed questionnaire based on a Likert scale from 0 to 10. The instrument was developed, validated and applied according to a structured and systematic research design to collect data from teachers on a specific social phenomenon (Fernández Núñez, 2007). The study was approved by the Ethics Committee of the Rey Juan Carlos University (ID-0706202324623). Figure 1 provides a visual summary of the methodological process. All data and procedures corresponding to each phase are available in Carbonell-Alcocer and Gertrudix (2024).

The use of a quantitative methodology with a survey as the primary data collection tool is common in this area of research. Recent studies have conducted similar surveys of teachers to investigate aspects such as their perceptions of climate education (Howard-Jones et al., 2021; Tibola da Rocha et al., 2020), their awareness of climate change (Natalia et al., 2023), and the integration of circular economy content into STEM practices (Nguyen, 2023).

Figure 1

Methodological process



3.1. Instrument Design and Validation

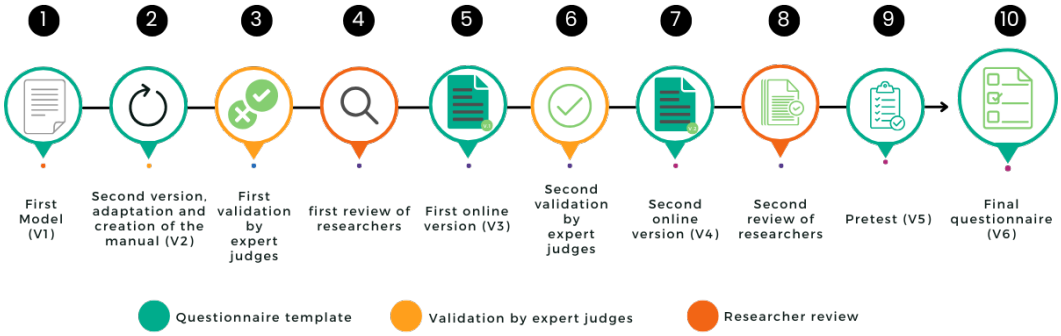
A self-administered questionnaire consisting of closed questions measured on Likert scales was developed as a data collection instrument (García Muñoz, 2003). The questionnaire underwent a multistage validation process to ensure its systematic and rigorous construction, with the aim of ensuring its reliability and robustness (Alvira Martín, 2004; Martínez Olmo, 2002).

Four conceptual variables were defined: Perception level, Readiness level, Integration level and Satisfaction level. After operationalizing the variables and classifying them into theoretical constructs, the questionnaire was divided into three thematic blocks. The free and open-source software LimeSurvey was selected as the platform for administering the questionnaire.

Once the instrument was designed, it underwent a multistage pilot validation process (see Figure 2). An application manual was also created detailing the design of the instrument, the construction and implementation process, the sample and the administration protocol.

Figure 2

Questionnaire validation process



The validation was conducted on three levels. First, a double-blind review was conducted by a panel of expert judges (n=10) based on the criteria of uniqueness,

relevance and importance (Escobar-Pérez & Cuervo-Martínez, 2008). The experts were selected on the basis of having at least five years of experience in the field of education. Second, a group of researchers specializing in social research was commissioned to review and supervise the expert validation and instrument development. This group produced two reports with suggestions and recommendations for final implementation. Finally, the questionnaire was tested with a subsample of the target population, which confirmed the structural validity and the internal coherence of the theoretical dimensions with the study objectives.

3.2. Data Collection and Analysis

Once the instrument was finalized, a non-probabilistic chain sampling method was used. The questionnaire was distributed via email to all educational centers in the Community of Madrid and submitted through electronic register to the Madrid Regional Ministry of Education of the Community of Madrid and to the five directorates of the territorial areas. The survey remained open for four months.

At the end of the survey period, the responses were analyzed. A total of 485 responses were received, of which only 271 were complete and therefore valid. With this sample size, the margin of error is 5% at a confidence level of 95%. The analysis included univariate descriptive statistics (central tendency) as well as bivariate analyses using percentages and statistical tests such as Pearson's chi-square (for directionality) and Cramér's V (for strength of correlation).

3.3. Sample Characteristics

The study was aimed at teachers working in general education schools in the Community of Madrid. The sample consisted of 27.7% men and 70.1% women, with an average age of 46 years. In terms of employment status, 53.1% were permanent civil servants, 18.8% were temporary staff, 23.2% had a permanent contract and 4.8% had a temporary contract.

The distribution by educational level was as follows: 16.1% taught in early childhood education, 19.1% in primary education, 19.1% in compulsory secondary education (ESO), 13.5% in baccalaureate education, 19.3% in vocational education, divided into: 3.8% in basic vocational education, 6.6% in intermediate vocational education, 8.9% in advance vocational education, 12.8% in special education.

In terms of territorial distribution, the teachers were distributed among the different directorates of the territorial areas (DAT) as follows: 39.3% in Madrid Capital, 11.0% in Madrid North, 27.2% in Madrid South, 7.7% in Madrid East, 14.7% in Madrid West.

The subjects taught by the teachers surveyed were distributed as follows: arts (6.6%), humanities (7.0%), sciences (11.4%), languages (27.7%), health sciences (4.8%), social sciences (9.6%), technology (5.5%), mathematics (8.5%), physical education (4.4%) and professional technical disciplines (14.4%). The average number of years of teaching experience among participants was 17.66 years.

3.4. Statistical Analysis Model

Both descriptive and inferential techniques were used to analyze the data. Univariate analyses were used to describe the characteristics of the key variables using measures of central tendency (mean, median) and dispersion (standard deviation). Bivariate analyses were performed to examine the relationships between the variables. Pearson's chi-square test was used to assess the direction of the relationship and Cramér's V to

measure the strength of the association. All tests were performed with a significance threshold of $p < .05$ using SPSS statistical software.

4. Results

4.1. Spaces, Resources, and Strategies for Teaching Recycling and the Circular Economy

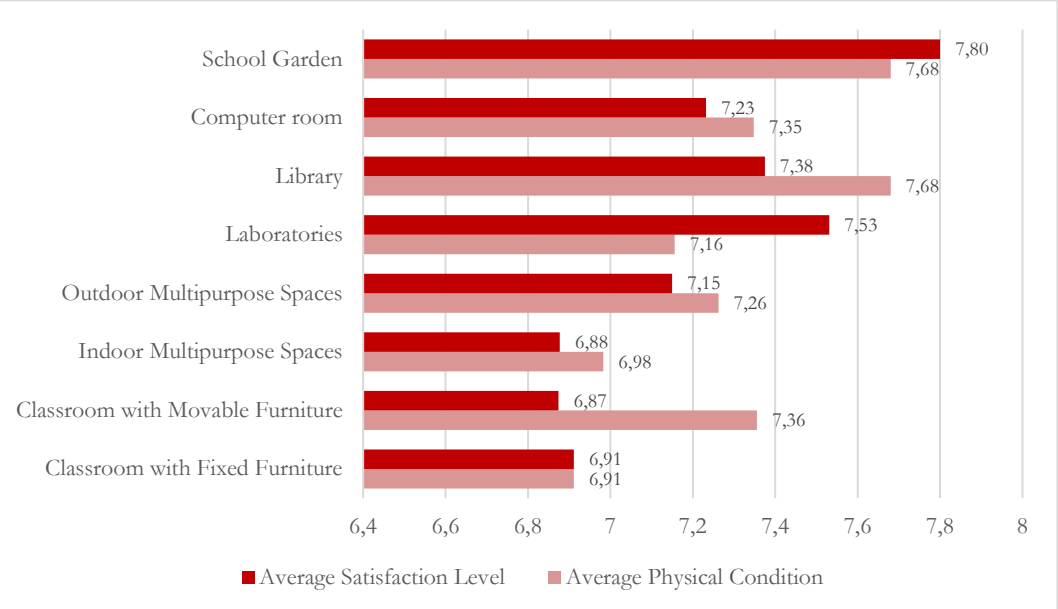
Among the available spaces for carrying out educational activities, 30.8% of respondents reported using classrooms with fixed furniture, 19.0% used classrooms with movable furniture, 12.8% selected computer rooms, 11.1% used multifunctional outdoor spaces such as playgrounds or sports areas, 10.4% used multifunctional indoor spaces such as halls, auditoriums, or indoor sports facilities, 6.0% used laboratories, 4.6% used libraries, and 4.6% used school gardens.

As shown in Figure 3, when individually assessing both the physical condition and level of satisfaction with these spaces, teachers gave the highest ratings to the school garden, while classrooms with fixed furniture received the lowest evaluation.

Among the most preferred resources used by teachers in their educational practice were: computers (19.5%), whiteboards (19.0%), projectors (16.9%), internet connectivity in the school (16.6%), interactive whiteboards (12.2%), tablets (6.9%), mobile phones (3.3%), advanced technologies such as robotics, 3D printers, and virtual reality glasses (1.2%), recycling bins (2.7%), and vermicomposters (1.0%).

Figure 3

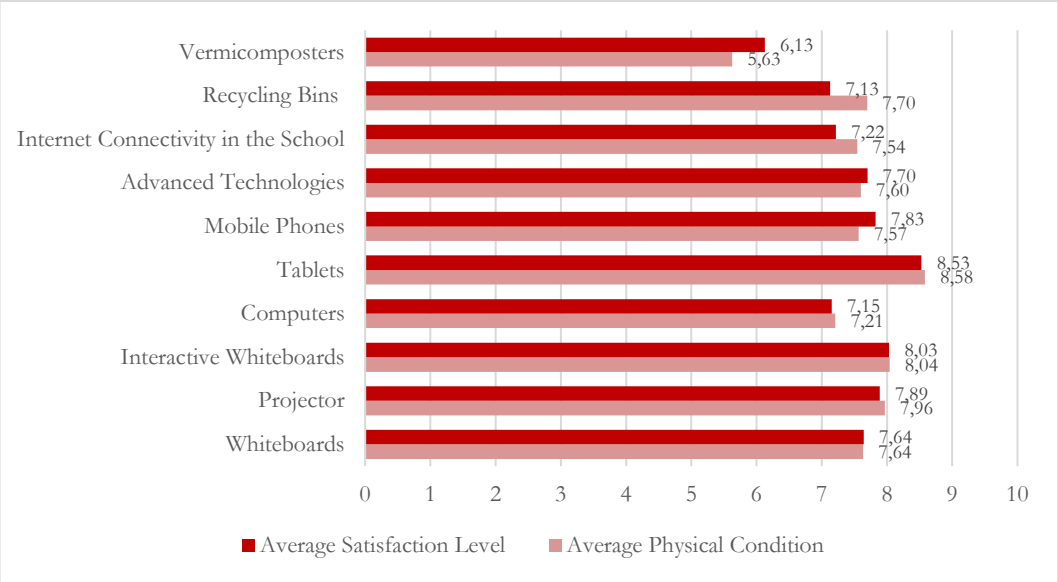
Comparison of physical condition and satisfaction level of educational spaces



In the individual assessment of the physical condition and level of satisfaction with the resources selected by teachers, the results showed that the highest-rated resource was the tablet, while the vermicomposter received the lowest rating (see Figure 4).

Figure 4

Average comparison between the evaluation of physical condition and satisfaction level of resources

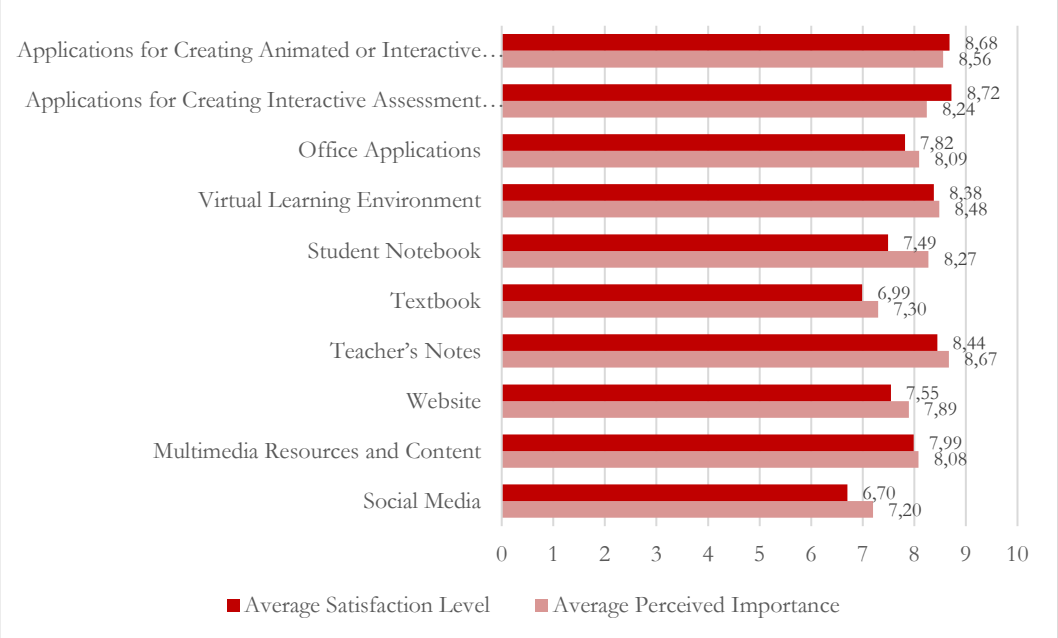


The most commonly used didactic tools by teachers in their teaching practice were multimedia resources and content (21.9%), virtual learning environments such as virtual classrooms (15.8%), textbooks (12.0%), office applications (10.7%), web pages (10.4%), teacher's notes (10.1%), student notebooks (7.1%), applications for creating interactive assessment quizzes such as Kahoot or Socrative (5.1%), tools for creating animated or interactive presentations such as Genially or Prezi (3.6%), and social media platforms (1.4%).

As shown in Figure 5, the results indicate that the most highly rated didactic tools in terms of average satisfaction level were the applications for creating interactive assessment quizzes, while teacher's notes were considered the most important. On the other hand, the lowest-rated tools were social media platforms and textbooks.

Figure 5

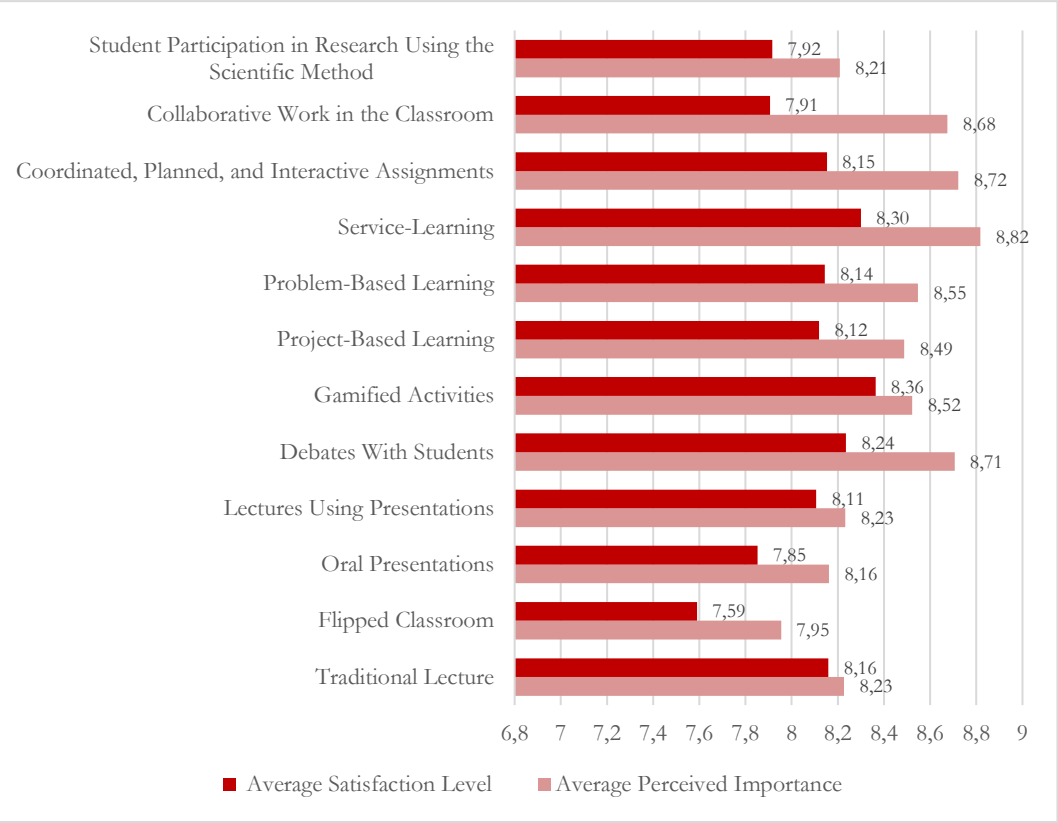
Comparison between satisfaction level and perceived importance of didactic tools



With regard to pedagogical techniques that enhance the teaching-learning process, the results indicated that teachers most preferred lectures using presentations (14.2%), followed by gamified activities (12.0%), in-class project development (11.5%), collaborative work in the classroom (10.5%), and coordinated, planned, and interactive assignments (10.0%). Other techniques included oral presentations and debates with students (9.3%), traditional lectures and flipped classroom approaches (6.0%), problem-based learning, involving unresolved problems to be solved by students (5.7%), partial or full participation of students in research using the scientific method (3.3%), and community-based activities (service-learning) (1.5%). Figure 7 presents the average ratings of both perceived importance and satisfaction level with these pedagogical techniques, as reported by the teachers.

Figure 6

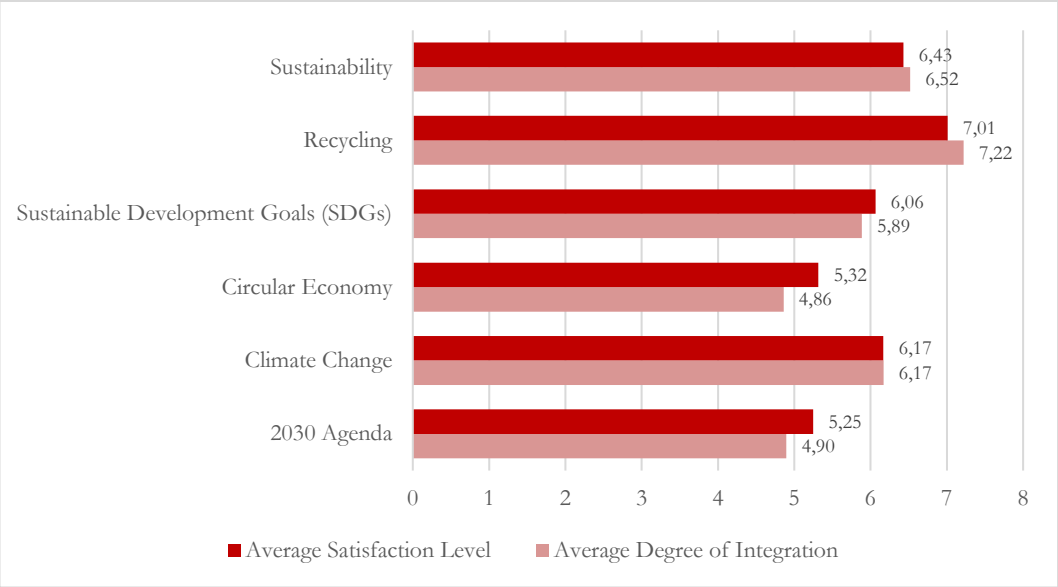
Comparison between satisfaction level and perceived importance of pedagogical techniques



According to Figure 7, teachers' perceptions regarding the degree of integration of content related to the Sustainable Development Goals, the circular economy, and the 2030 Agenda were among the lowest-rated items. The average rating for the degree of integration was deemed insufficient, whereas the average satisfaction level reached a sufficient score. In contrast, only the content related to recycling achieved an average satisfaction level and degree of integration above 7.

Figure 7

Comparison between satisfaction leven and degree of integration of content related to sustainable development



On the other hand, teachers in the Community of Madrid expressed an average level of interest of 6.98 out of 10 in receiving training on topics related to climate change and sustainability. This contrasts with higher interest levels reported for training in active methodologies (8.14), the use of information and communication technologies (7.85), training in digital tools (7.77), and training in educational affectivity (7.76).

4.2. Incorporation and satisfaction of teachers with environmental content

Regarding the degree of integration of content related to climate change across different educational levels (see Table 2), the results revealed uneven incorporation depending on the stage. In general, the grade of notable was the most frequent, particularly in primary education (46.6%) and basic vocational education (41.7%), whereas a high percentage of 'Insufficient' ratings persisted in intermediate vocational education (33.3%) and advance vocational education (31.3%). In early childhood education, although 36.8% of teachers rated integration as 'Good,' 22.8% rated it as 'Insufficient,' indicating the need for greater incorporation at the initial stages. In special education, the distribution was balanced, although 'Good' was the most common rating (35.6%). With respect to teacher satisfaction regarding climate change content, the results followed a similar trend, though with some notable variations. 'Good' stood out particularly in primary education (41.7%), followed by baccalaureate (41.2%) and compulsory secondary education (ESO) (37.1%). In contrast, satisfaction was lower in basic and advance vocational education, where 'Insufficient' ratings reached 23.1% and 30.0%, respectively. In the case of advance vocational education, satisfaction with climate change content showed a weak association (Cramér's V= .188; p= .034).

Table 2

Comparison between degree of integration and level of satisfaction with climate change-related content

Content related to climate change (Degree of integration /Level of satisfaction)				
Educational level	Insufficient	Sufficient	Good	Excellent
Early childhood education	22,80%/24,60%	22,98%/22,80%	36,80%/33,30%	17,50%/19,30%
Primary education	16,40%/18,10%	23,30%/26,40%	46,60%/41,70%	13,70%/13,90%
ESO	17,80%/21,40%	23,15%/30,00%	34,20%/37,10%	16,40%/11,40%
Baccalaureate	15,40%/19,60%	32,70%/27,50%	32,70%/41,20%	19,20%/11,80%
Basic vocational education	16,70%/23,10%	25,00%/30,80%	41,70%/38,50%	16,70% /7,70%
Intermediate vocational ed.	33,30%/20,80%	20,80%/20,80%	16,70%/25,00%	29,20%/33,30%
Advance vocational ed.	31,30%/30,00%	21,90%/20,00%	21,90%/16,70%	25,00%/33,30%
Special Education	22,20%/19,50%	20,00%/26,80%	35,60%/29,30%	22,20%/24,40%

The results showed that the integration of the circular economy across different educational levels was perceived largely as insufficient, especially at the initial stages (see Table 3). In early childhood and primary education, more than 40% of responses rated the integration as insufficient, with very low percentages in the 'Excellent' category. In compulsory secondary education (ESO) and baccalaureate, the evaluations improved slightly, although the perception of low integration continued to prevail. In contrast, in vocational education, particularly in basic vocational education, the results were more positive: 50.0% considered the integration to be sufficient, and 33.4% rated it as 'Good' or 'Excellent'. In special education, the percentages reflected a moderate level of integration, with 35.6% indicating insufficient, but 11.1% rating it as excellent. In primary education, the integration of circular economy content showed a moderate association (Cramér's V= .222; p= .009).

Regarding teacher satisfaction with the integration of circular economy content, the trend was similar. The early childhood and primary education stages showed the highest percentages of 'Insufficient' ratings, with 37.3% and 39.0%, respectively, while the upper levels displayed a greater diversity of responses. In basic vocational training, perceptions of satisfaction were more favorable, with 45.5% rating it as 'Sufficient' and 18.2% as 'Excellent.' In intermediate and higher vocational education, responses were more evenly distributed, with notable percentages in the 'Good' and 'Excellent' categories. In special education, although an intermediate perception predominated, 28.6% rated it as 'Good,' suggesting positive experiences in specific contexts. In primary education, satisfaction showed a weak association (Cramér's V= .196; p= .037).

Table 3

Comparison between degree of integration and level of satisfaction with circular economy-related content

Circular Economy (Degree of integration /Level of satisfaction)				
Educational level	Insufficient	Sufficient	Good	Excellent
Early childhood education	41,20%/37,30%	27,50%/27,50%	27,50%/19,60%	3,90%/15,70%
Primary education	47,60%/39,00%	20,60%/22,00%	31,70%/33,90%	0,00%/5,10%
ESO	38,90%/32,80%	31,90%/32,80%	18,10%/25,40%	11,10%/9,00%
Baccalaureate	33,30%/27,10%	25,50%/31,30%	25,50%/27,10%	15,70%/14,60%
Basic vocational education	16,70%/9,10%	50,00%/45,50%	16,70%/27,30%	16,70% /18,20%
Intermediate vocational ed.	31,80%/23,80%	27,30%/23,80%	22,70% /33,30%	18,20%/19%
Advance vocational ed.	32,30%/25,90%	19,40%/14,80%	32,30%/33,30%	16,10%/25,90%
Special Education	35,60%/28,60%	26,70%/26,20%	26,70%/28,60%	11,10%/16,70%

Regarding the degree of integration of the Sustainable Development Goals (SDGs) across different educational levels, the results showed considerable variation among the various stages (see Table 4).

Table 4

Comparison between degree of integration and level of satisfaction with SDG-related content

SDG (Degree of integration /Level of satisfaction)				
Educational level	Insufficient	Sufficient	Good	Excellent
Early childhood education	27,80%/22,60%	18,50%/22,60%	33,30%/35,80%	20,40%/18,90%
Primary education	22,20%/18,80%	16,70%/24,60%	41,70%/43,50%	19,40%/13,00%
ESO	25,00%/26,50%	25,00%/29,40%	29,20%/30,90%	20,80%/13,20%
Baccalaureate	20,00%/18,80%	20,00%/31,30%	38,00%/39,60%	22,00%/10,40%
Basic vocational education	16,70%/25,00%	50,00%/33,30%	16,70%/33,30%	16,70% /8,30%
Intermediate vocational ed.	30,40%/22,70%	8,70%/9,10%	34,80%/40,90%	26,10%/27,30%
Advance vocational ed.	32,30%/28,60%	12,90%/10,70%	32,30%/28,60%	22,60%/32,10%
Special Education	37,20%/28,20%	20,90%/28,20%	25,60%/23,10%	16,30%/20,50%

In early childhood and primary education, teachers' perceptions were mostly in the 'Good' category, with 33.3% and 41.1%, respectively, although there was also a significant percentage of 'Insufficient' ratings (27.8% and 22.2%, respectively). In compulsory secondary education (ESO) and baccalaureate, the 'Good' ratings also stood out (29.2% and 38.0%, respectively). In vocational education, the results showed greater disparity. In basic vocational education, the most frequent response was 'Sufficient' (50.0%), while in intermediate and higher vocational education, the ratings were mainly distributed among 'Insufficient,' 'Good,' and 'Excellent', reflecting more polarized perceptions. In special education, the overall perception was predominantly low, with 37.2% of teachers considering the integration of the SDGs to be insufficient. As for teacher satisfaction with the inclusion of SDG-related content, the results followed a similar pattern. In early childhood and primary education, positive responses predominated, with 'Good' ratings reaching 35.8% and 43.5%, respectively. In ESO and baccalaureate, responses were mainly concentrated in the 'Good' (30.9% and 39.6%) and 'Sufficient' (29.4% and 31.3%) categories. In contrast, vocational education and special education once again displayed a more dispersed distribution of responses. In higher vocational education, teacher satisfaction with SDG-related content showed a weak association (Cramér's V= .188; p= .034).

The results regarding the degree of integration of recycling content across educational levels (see Table 5) showed that its incorporation was very high across all levels, with particularly strong results in early childhood education, primary education, and higher vocational education, where most responses fell within the 'Good' and 'Excellent' categories (42.6%, 48.0%, and 46.9%, respectively). In compulsory secondary education (ESO) and baccalaureate, although there were also high percentages in these upper ranges, the number of 'Insufficient' and 'Sufficient' responses was greater compared to other levels. In terms of the relationship between variables, the degree of statistical significance for the integration of recycling content varied, showing a moderate association in baccalaureate (Cramér's V= .232; p= .003) and weak associations in ESO (Cramér's V= .198; p= .017) and higher vocational education (Cramér's V= .181; p= .036). With respect to teacher satisfaction with recycling content, the results indicated that, although a significant proportion of teachers were satisfied, variations were observed across educational levels. In early childhood and primary education, the majority of responses were in the 'Good' and 'Excellent' categories (75.4% in early childhood and 72.4% in primary education). In ESO and

baccalaureate, although 'Good' and 'Excellent' ratings were also prevalent, 'Insufficient' and 'Sufficient' responses were more frequent compared to the lower levels. In basic, intermediate, and higher vocational education, satisfaction levels were more uneven. In basic vocational education, 30.8% of teachers rated their satisfaction as 'Insufficient' and another 30.8% as 'Sufficient.' In higher vocational education, most responses fell into the 'Good' (27.6%) and 'Excellent' (44.8%) categories. In special education, the majority of teachers reported satisfaction levels of 'Good' (23.3%) and 'Excellent' (34.9%). Teacher satisfaction with recycling content showed a moderate association in both ESO (Cramér's V= .231; p= .004) and baccalaureate (Cramér's V= .249; p= .001).

Table 5

Comparison between degree of integration and level of satisfaction with recycling content

Recycling (Degree of integration /Level of satisfaction)				
Educational level	Insufficient	Sufficient	Good	Excellent
Early childhood education	4,90%/4,90%	9,80%/19,70%	42,60%/37,70%	42,60%/37,70%
Primary education	8%/10,80%	12%/16,20%	32%/33,80%	48%/39,20%
ESO	13,90%/21,40%	20,80%/28,60%	41,70%/31,40%	23,60%/18,60%
Baccalaureate	18%/22,40%	24%/28,60%	42%/38,80%	16%/10,20%
Basic vocational education	23,10%/30,80%	23,10%/30,80%	15,40%/23,10%	38,50%/15,40%
Intermediate vocational ed.	20,80%/17,40%	12,50%/17,40%	25% /34,80%	41,70%/30,40%
Advance vocational ed.	25%/20,70%	9,40%/6,90%	18,80%/27,60%	46,90%/44,80%
Special Education	14,90%/18,60%	21,30%/23,30%	25,50%/23,30%	38,30%/34,90%

The results regarding the integration of sustainability content across educational stages (see Table 6) showed that in early childhood and primary education, most responses were concentrated in the 'Good' (39.3% and 50.7%) and 'Excellent' (26.8% and 20.5%) categories. In compulsory secondary education (ESO) and baccalaureate, these upper ratings also predominated, although with a higher proportion of 'Sufficient' ratings (27.4% and 29.4%). In basic and intermediate vocational education, sustainability content was most often rated as 'Excellent' (34.8% and 43.8%, respectively). In contrast, in higher vocational education, 26.7% of respondents considered the integration to be 'Insufficient'. The degree of integration of sustainability content in primary education showed a weak association (Cramér's V= .189; p= .03).

With regard to teacher satisfaction with sustainability content, the results showed that in early childhood and primary education, most teachers expressed satisfaction, with a total of 63.6% of responses falling within the 'Good' and 'Excellent' categories. In compulsory secondary education (ESO) and baccalaureate, satisfaction levels were slightly lower, with 48.5% in ESO (41.4% 'Good' and 7.1% 'Excellent') and 50% in baccalaureate (42% 'Good' and 8% 'Excellent'). In basic vocational education, satisfaction was low, with 50% rating it as 'Insufficient' and 16.7% as 'Sufficient.' In contrast, in intermediate and higher vocational education, greater satisfaction was observed in the 'Good' and 'Excellent' categories (27.3% and 31.8% in intermediate; 25% and 39.3% in higher vocational education. Teacher satisfaction with sustainability content showed a moderate association in ESO (Cramér's V= .218; p= .01), and a weak association in basic vocational education (Cramér's V= .185; p= .041) and in higher vocational education (Cramér's V= .188; p= .034).

Table 6

Comparison between degree of integration and level of satisfaction with sustainability content

Sustainability (Degree of integration /Level of satisfaction)

Educational level	Insufficient	Sufficient	Good	Excellent
Early childhood education	14,30%/14,50%	19,60%/21,98%	39,30%/40,00%	26,80%/23,60%
Primary education	15,10%/18,30%	13,70%/19,70%	50,70%/42,30%	20,50%/19,70%
ESO	15,10%/20,00%	27,40%/31,40%	39,70%/41,40%	17,80%/7,10%
Baccalaureate	13,70%/18,00%	29,40%/32,00%	37,30%/42,00%	19,60%/8,00%
Basic vocational education	21,70%/50,00%	17,40%/16,70%	26,10%/25,00%	34,80%/8,30%
Intermediate vocational ed.	21,70%/22,70%	17,40%/18,20%	26,10%/27,30%	43,80%/31,80%
Advance vocational ed.	26,70%/25,00%	16,70%/10,70%	23,30%/25,00%	33,30%/39,30%
Special Education	19,10%/20,90%	25,50%/27,90%	25,50%/23,30%	29,80%/27,90%

Finally, the results showed that teachers expressed a particular interest in training related to environmental topics, especially at certain educational stages. In compulsory secondary education (ESO), 28.4% of teachers rated their interest as 'Good' and 33.8% as 'Excellent.' In baccalaureate, 30.2% rated it as 'Good' and 35.8% as 'Excellent.' In vocational education, both categories received equal interest, with 32.3% rating it as 'Good' and 32.3% as 'Excellent'.

5. Discussion and Conclusions

The new climate reality requires urgent action to promote awareness and behaviour change (Lee et al., 2015). Communication and education are important tools to help young people acquire green skills and sustainability competencies (Rodrigo-Cano et al., 2019). In addition, it is necessary to promote social and collective engagement that supports the adoption of good practices aimed at preserving natural resources in the long term and raising environmental awareness (Morillo Rodríguez et al., 2019). This commitment depends on strengthening an ecological culture that encompasses knowledge, perceptions, attitudes and behaviors (Pérez-Díaz & Rodríguez, 2016). In this context, teachers must be empowered to teach students from an eco-media perspective so that they can face the challenges of climate change (Howard-Jones et al., 2021).

The results of this study make it clear that the educational infrastructure for teaching environmental issues needs to be improved. Although spaces such as school gardens and resources such as recycling bins are rated highly by teachers in the Community of Madrid in terms of their satisfaction and material condition, their use is still limited. This highlights the importance of promoting accessible and appropriate spaces for environmental education. These findings are consistent with those of Mendoza Carretero and Gonzalo Muñoz (2022), who emphasize the occasional nature of teaching experiences on environmental awareness. Consequently, specific training initiatives for teachers at all levels of education should be strengthened to promote the interdisciplinary use of these resources. As Sáenz-Rico de Santiago et al. (2023) conclude, these resources are essential to promote knowledge about the 2030 Agenda and the SDGs from an environmental, social and economic perspective.

In addition, digital tools such as tablets, interactive whiteboards and smartphones are highly valued by teachers for use in the classroom. In line with López (2023), digital technologies support the teaching of environmental topics. However, to promote students' eco-media literacy, teachers need to use these tools critically, consciously, and responsibly, taking into account their impact on the environment. However, the limited use of advanced technologies such as robotics or virtual reality shows that targeted teacher training is needed to integrate these tools into the classroom. This is a promising area to enrich students' learning experiences.

To ensure the systematic and cross-cutting integration of environmental topics at all levels of education, institutions must promote the development of specialized educational programs that go beyond basic education in recycling and sustainability. This is especially important in phases where it is more difficult to address innovative topics such as the 2030 Agenda or circular economy principles, a new need highlighted by Krajnc et al. (2022). For this reason, it is important to promote models that incorporate Environmental Education for Sustainability while addressing global justice and structural change (Gutiérrez Bastida, 2025; Murga-Menoyo & Bautista-Cerro, 2022). These efforts, grounded in critical pedagogy, should aim to promote social awareness and train students in new strategies to combat climate change and reduce environmental impact by expanding their reach through connections with local communities, the educational environment, and social and environmental justice.

Educational methods emphasize the value of active methods, especially those that extend learning beyond the classroom, such as service learning. However, the use of such methods remains marginal, demonstrating both the need and the opportunity to increase their implementation in order to improve the connection between schools and their local communities. As Natalia et al. (2023) note, this is essential to generate collective engagement with the SDGs.

Similarly, public engagement must be promoted to support climate action, which necessarily involves the development of effective communication campaigns and educational activities that inform and empower citizens (Vivanco & Bravo-Benavides, 2022).

Although the sample size of this study limits the generalizability of the results, the findings support a validated model that identifies patterns, trends, and key elements in the field of ecomedia research. Based on these findings, future studies could expand the sample and apply inferential statistical analyses in combination with qualitative approaches to better understand teachers' practices, opinions, and experiences related to environmental education resources and methods. This line of research aligns with what Tibola da Rocha et al. (2020) highlight: the importance of new studies that improve the effectiveness of circular economy education in schools and identify the role of key stakeholders in promoting awareness and behaviour change. Ultimately, it is about understanding how to motivate these actors and how to increase their impact. This study provides initial insights that could prove valuable for future research in this area.

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