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Assessment of teachers' knowledge, attitudes, and practices in environmental education in a medium-sized Colombian city

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Abstract

The implementation of environmental education (EE) in primary, middle and secondary schools presents important challenges for teachers. This study analyzes the perceptions of practicing teachers regarding their knowledge, attitudes, and practices in EE in public schools in Florencia, Caquetá, an intermediate city located in Colombia's Amazon Region. A mixed-method cross-sectional design was used with a sample of 18 teachers. The study found that teachers' perception of their own knowledge is low in relation to legislation and pedagogical strategies. However, the research identified that teachers have a positive attitude towards EE while the delivery of successful pedagogical practices in the classroom are due to individual efforts. The authors conclude that there is a need to design continuous teacher training programs focused on environmental awareness that are adapted to local contexts and use an interdisciplinary approach combined with active methodologies. These actions will strengthen EE within school curricula and promote collaborative work, achieving a more significant and sustainable educational impact.

Keywords: environmental education, teacher training, pedagogical practices, intermediate cities

INTRODUCTION

In a world with a growing environmental crisis that includes climate change, biodiversity loss and overexploitation of natural resources, it is essential that we identify strategies to mitigate its effects and seek solutions. Environmental education (EE) emerges as a tool to address the crisis through the social dimension (Bautista-Cerro et al., 2019) while contributing to the development of citizens who act responsibly with the environment and nature. Multilateral entities such as UNESCO have highlighted the need to design and strengthen programs and strategies that disseminate knowledge and promote environmentally friendly values and attitudes (Vieira et al., 2023). In Latin America, EE has been promoted by governments through educational programs that have the objective of integrating this subject area into school curricula (Reyes et al., 2024).

Despite widespread recognition of the role and importance of EE in the context of the environmental crisis, there are still barriers that impede its full implementation. These include a lack of specific teacher training, rigid curricula and an absence of active methodologies that facilitate the integration of EE into classroom learning (Evans et al., 2017; Marcela, 2021; Marqués & Mazzarino, 2021). There are also important challenges related to limitations with infrastructure and educational resources (Akinsemolu & Arijeniwa, 2021; Fernández et al., 2023). This is evident in how EE is taught in a range of contexts, with notable differences between urban and rural contexts and large, intermediate and small cities. Romeiro and Méndez (2008) classify cities based on their population size: intermediate cities have between 100,000 and 500,000 inhabitants; small cities are those below this range; and large cities have more than 500,000 inhabitants.

It is important to focus on intermediate and small cities within the scope of EE, given that most educational policies are designed for schools in large cities. This generates significant gaps in the implementation of innovative educational approaches for EE, even though students in small and intermediate cities are no strangers to uncontrolled urban expansion and pressure on natural resources, which in turn cause environmental problems such as water and air pollution and

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Contribution to the literature

- The study provides empirical evidence that describes weaknesses in normative and practical knowledge among teachers in intermediate cities, a population that has not been extensively explored in the current scientific literature.
- This article proposes a contextualized and interdisciplinary approach to teacher training on EE with an emphasis on active methodologies and links to curricula.
- The authors identify significant correlations between KAP, highlighting the need for training programs that ensure articulated integration between these three components.

deforestation. This situation means that there is an urgent need to incorporate educational strategies that promote environmental sustainability in cities with less than half a million people (Martínez et al., 2016).

Designing EE strategies and training programs for local contexts requires educational processes that foster critical and transformative environmental awareness, especially in areas that are a focus of biodiversity conservation, such as the Amazon Region. This is a territory with enormous natural and cultural resources that is also experiencing an increase in anthropogenic pressure (Damoah et al., 2024; Jia & Wang, 2024). As a result, it is essential that the socio-cultural, ecological and economic realities of each region are considered in EE, especially in sensitive areas like the Amazon, where teachers have a fundamental role as agents of change (Loaiza, 2024).

Taking the above panorama into account, there is a need to identify and understand the levels of knowledge, attitudes and practices (KAP) held by teachers in relation to EE, given that these have a direct impact on the way in which environmental awareness is taught and promoted in the classroom (Aznar-Díaz et al., 2019).

Knowledge of EE allows teachers to design meaningful learning experiences that favor informed decision making among students (Arvai et al., 2004). However, previous studies have evidenced that the level of environmental literacy among teachers is heterogeneous and, in many cases, this lack of knowledge means that they are unable to design and implement effective teaching strategies (Álvarez-García et al., 2018). Subsequently, the attitudes held by teachers towards EE becomes a determining factor, given that they influence their willingness to innovate and apply active methodologies (Semanko & Ladbury, 2020). Finally, teaching practices reflect teachers' ability to translate knowledge and attitudes into concrete actions in the classroom. This becomes a significant challenge if educators do not have sufficient continuous training and institutional support (Moctezuma et al., 2022).

The current situation means that the integration of EE into educational curricula requires the incorporation of interdisciplinary approaches and the use of active methodologies, such as project-based learning (PBL) and experiential education (Sterling, 2011). Teacher training programs that use these approaches can contribute to generating pedagogical changes and enable the appropriation of EE into everyday teaching (Agudelo & Gonzáles-Reyes, 2024).

The objective of this study was to evaluate the self-perception of teachers regarding their KAP in relation to EE. These teachers are employed in public schools in the intermediate city of Florencia, Caquetá (Colombia). The goal of the study was to generate primary information that will contribute to the design of a teacher training programs that will improve the integration of EE into school curricula while strengthening teachers' competencies in this area.

METHODOLOGY

Research Design

A cross-sectional study was carried out, which involved collecting data at a single point in time (Hernández et al., 2014) using mixed method data collection techniques that combined Likert scale questionnaires and semi-structured interviews (Anjaria, 2022; Barrick, 2020).

Population and Sample

The study population consisted of teachers from primary, middle and high school levels at public education institutions in Florencia, Department of Caquetá, Colombia. Participants were selected by non-probabilistic convenience sampling (Andrade, 2021), given that access to these education professionals depended on their availability and willingness to engage with the study. The sample consisted of 18 teachers who completed questionnaires in the quantitative phase and 8 teachers who participated in semi-structured interviews. Teachers from different subject areas and schooling levels (primary, middle, and high school) were purposely selected for the study.

Techniques and instruments

Questionnaire

A five-point Likert scale questionnaire was designed for data collection. This consisted of a section with sociodemographic variables and 52 statements distributed into the categories of knowledge (17

Table 1. Categories with description of response levels and their scores

Score category	1	2	3	4	5
Knowledge	No knowledge	Little knowledge	Moderate knowledge	Good knowledge	Extensive knowledge
Attitudes	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Practices	Never	Almost never	Sometimes	Almost always	Always

Table 2. Expected minimum and maximum scores in categories and sub-categories

	Categories								
	Knowledge			Attitudes			Practices		
Sub-categories	N	EMS	MS	N	EMS	MS	N	EMS	MS
Environmental issues	5	360	450	4	288	360	2	144	180
SDGs	2	144	180				1	72	90
Pedagogical practices	2	144	180	5	360	450	4	288	360
Curriculum	4	288	360	2	144	180	2	144	180
Legislation	1	72	90				1	72	90
Impact on the local context	3	216	270	7	504	630	7	504	630
Category total	17	1,224	1,530	18	1,296	1,620	17	1,224	1,530

Note. N: Number of questions; EMS: Expected minimum score; & MS: Maximum score

statements), attitudes (18 statements), and practices (17 statements) (**Table 1**). The sociodemographic section of the questionnaire included questions on age, gender, type of teaching position, years of professional experience, professional training, name of undergraduate degree, most recent degree obtained, current field of study and previous training in EE (formal or through workshops and courses). It also included a question about whether the teachers would like to participate in an EE training program in the future and their preferred modality (face-to-face, online or blended). The statements used in the questionnaire were designed following a review of national and international scientific literature on EE and focused on studies that address the dimensions of KAP among teachers (e.g., Álvarez-García et al., 2018; Ardoin et al., 2020; Cini & Mifsud, 2018). The researchers also reviewed public policy documents and curricular guidelines from the Colombian Ministry of National Education and the national policy on EE to ensure contextual relevance.

The questionnaire was validated by a group of national and international experts who analyzed the adequacy and relevance of each of the statements. A pilot test was then conducted with 10 teachers who were later excluded from the sample. Cronbach's alpha reliability analysis was carried out, achieving a value of 0.955, which established the reliability of the instrument (George & Mallery, 2018).

The minimum expected score was obtained by calculating the number of items in the subcategory and multiplying them by the total number of respondents (18) and then by 4 (Likert category). Similarly, the maximum score was calculated by multiplying the number of items in each subcategory by the total number of teachers (18) and by the value of 5 (highest level on the Likert scale) (Torres Rivera et al., 2017) (**Table 2**). The minimum and maximum scores for each category were established using this method.

Interviews

The interview questions were based on the three components of the study: KAP in EE. Open-ended questions asking about teacher training, conceptual understanding of EE, perceptions of environmental issues, the role of teachers, pedagogical strategies they have used in the past and previous classroom experiences were also included. This structure allowed for a more in-depth interpretation of the results produced by the questionnaire, contextualizing teachers' responses and triangulating qualitative information with quantitative findings. The interviews lasted between 30 and 45 minutes and were recorded with participants' consent. They were then transcribed for subsequent analysis.

Data Analysis

The data obtained from the questionnaires was analyzed using Jamovi software (Project, 2022). A univariate descriptive analysis was carried out, obtaining absolute and relative measures and p-values for each of the variables. Interpretative levels (low, medium, high) were established based on the expected minimum and maximum scores calculated using the Likert scale, the number of items and the number of respondents. In order to explore the relationship between the KAP categories, Spearman's rank-order correlation (rho) was used. This non-parametric test is suitable for ordinal Likert-type data and small samples (n = 18) as it does not assume normal distribution.

The interviews were analyzed using a thematic content analysis technique and the Atlas.ti software (Friese, 2019). This software facilitated coding the

Table 3. Results of socio-demographic variables

Variable	Categories	Frequency (N)	Percentage (%)
Age	50-54	4	22.2
	40-44	5	27.8
	30-34	3	16.7
	35-39	2	11.1
	55-59	2	11.1
	25-29	1	5.6
	65-69	1	5.6
Gender	Male	3	16.7
	Female	15	83.3
Type of contract	Permanent	13	72.2
	Probationary	3	16.7
	Temporary	2	11.1
Professional background	Bachelor's degree	10	55.6
	Professional in non-education fields	8	44.4
Highest level of education	Master's degree	13	72.2
	Postgraduate diploma program	4	22.2
	Undergraduate degree	1	5.6
Subject area	Natural sciences and EE	3	16.7
	Spanish	5	27.8
	Technology	2	11.1
	Other subjects	8	16.7
Years of teaching experience	Over 25 years	5	27.8
	16- 20 years	2	11.1
	11–15 years	5	27.8
	6–10 years	5	27.8
	1–5 years	1	5.6
Formal training in EE	Yes	8	44.4
	No	10	55.6
Previous EE workshops/courses	Yes	15	83.3
	No	3	16.7
Willing to undertake training in EE	Yes	8	44.4
	No	10	55.6
Preferred modality	Face-to-face	9	50
	Blended (face-to-face and online)	8	44.4
	Online	1	5.6

interview transcripts, identifying categories and subcategories related to teachers' perceptions and experiences of EE. The coding process was inductive, allowing themes to emerge from the analyzed data (Braun & Clarke, 2006), which were then grouped into the three main categories: knowledge, attitudes, and practices. The authors then carried out a triangulation of the quantitative and qualitative results to achieve a comprehensive interpretation of the teachers' KAP.

RESULTS

Socio-Demographic Variables

The highest concentration of participating teachers was in the 40 to 44 years old and 50 to 54 years old age brackets, with a proportion of 27.8% and 22.2%, respectively (**Table 3**). A total of 83.3% of teacher respondents were female and 72.2% were tenured. Most of the teachers have a bachelor's degree (55.6%) and 72.2% have a master's degree. In terms of their subject areas, 27.8% of respondents teach Spanish, 16.7% teach natural sciences and EE, 11.1% teach Technology and 44.7% teach other subjects. Regarding their experience, 27.8% have been teaching for between 6 and 10 years, while others have taught for between 11 and 15 years and some have taught for more than 25 years. It was notable that 55.6% of respondents stated that they had not received training on EE during their undergraduate or graduate studies, while 83.3% stated that they had participated in professional development courses on the subject. When asked how they would prefer to study a teacher training program on EE, 50% responded that they would prefer a face-to-face modality.

Questionnaires

The results obtained in the questionnaires conducted in relation to the knowledge category did not reach the minimum expected score (1224) (**Table 2**). The low result of 874 (**Table 3**) highlights the need for training to increase teachers' knowledge of EE, especially in the

Table 4. Results of KAP questionnaires

Sub-categories	Knowledge score	Attitudes score	Practices score
Environmental issues	280	253	114
SDGs	91		49
Pedagogical practices	88	364	200
Curriculum	219	147	106
Legislation	41		44
Impact on the local context	155	501	389
Category total	874	1,265	902

Table 5. Proportion of levels by KAP categories

	Level	Frequency (N)	Proportion (%)
Knowledge	Low	2	11.1
	Medium	15	83.3
	High	1	5.6
Attitudes	Medium	1	5.6
	High	17	94.4
Practices	Low	4	22.2
	Medium	13	72.2
	High	1	5.6

Table 6. Correlation matrix between KAP categories

		Knowledge	Attitudes	Practices
Knowledge	Spearman's ρ	—		
	df	—		
	p-value	—		
Attitudes	Spearman's ρ	0.441	—	
	df	16	—	
	p-value	0.067	—	
Practices	Spearman's ρ	0.694**	0.391	—
	df	16	16	—
	p-value	0.001	0.109	—

Note. *p < .05; **p < .01; & ***p < .001

subcategories legislation and pedagogical practices with results of 41 and 88, respectively (**Table 4**).

In the analysis of teachers' scores for each category (**Table 5**), the study found that 5.6% of the teachers were classified as having a high level of knowledge of EE, 83.3% had a medium level and 11.1% a low level.

In the case of attitudes, teachers who completed the questionnaire obtained a score of 1265 (**Table 4**). Results for the subcategories show that results were above the expected minimum score in the areas of pedagogical, practices and curriculum (**Table 2**), while for environmental issues they had a score of 253 (**Table 4**), which was a value below the expected minimum score (**Table 2**). In the analysis of the attitudes categories based on teachers' individual scores (**Table 5**), 94.4% of the teachers achieved a high level and 5.6% had a medium level.

In relation to practices, the overall score obtained by respondents was 902 (**Table 4**), which was below the minimum expected score (**Table 2**). This same trend was evident when analyzing each of the subcategories where the topics of sustainable development goals (SDGs) and legislation had the lowest scores (**Table 4**) compared to the minimum expected score (**Table 2**). This shows that the pedagogical practices implemented for EE by teachers are limited and do not comply with the necessary standards to ensure environmentally-aware teaching. These results are supported by the teachers' individual scores in this category (**Table 5**), with just 5.6% achieving a high level, 72.2% a medium level and 22.2% a low level. Despite the positive attitudes of teachers, EE teaching practices can be affected by a lack of available time, resources and training (Redman et al., 2021).

The correlations observed indicate a direct relationship between the categories of knowledge and practices, given that the correlation coefficient is high (0.694) and significant ($p < 0.01$) (**Table 6**). There is also evidence of a correlation between attitudes and practices, in which the coefficient is 0.391. This shows that higher levels of knowledge and positive attitudes towards EE can lead to the development of better pedagogical practices in this area. These results emphasize the importance of strengthening teacher training on EE in both knowledge and attitudes, which will in turn improve teaching practices, given that new pedagogical strategies are effective in promoting environmentally-friendly education (Cini & Mifsud, 2018; Yaacob & Abdullah, 2024).

Interviews

Following an Atlas.ti analysis of the interviews, 11 subcategories associated with the KAP categories emerged as part of the elaboration of a concept map (**Figure 1**). Three sub-categories were identified in the knowledge category: "research", "understanding of concepts" and "fundamentals of ecology". These subcategories facilitate a comprehensive and broad understanding of EE, with each component contributing to the construction of a base of understanding, allowing teachers to address environmental issues in their teaching practice (Jia & Wang, 2024; Keleş et al., 2016). This was confirmed in the interviews, where one participant explained: "*EE for me is not just about teaching facts, but about building knowledge that transforms our behavior and relationship with the environment*" (teacher interview).

In the area of attitudes, three subcategories emerge: "negative feelings", "positive feelings" and "activities related to the environment". The links between these

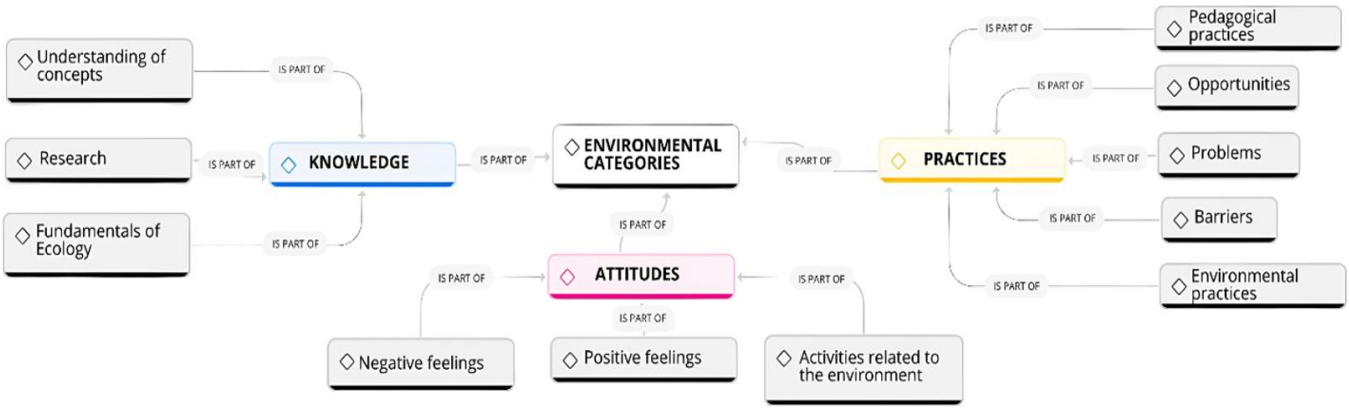

Figure 1. Concept map of categories and subcategories identified in the analysis of interviews (Source: Authors' own elaboration, using ATLAS.ti software)

subcategories reveal important aspects about the perceptions and level of interest of teachers in EE and the impact of these attitudes on their teaching. The results show that attitudes among teachers are not homogeneous but instead vary based on individual and contextual factors (Petkou et al., 2021). This was also evident in the interviews, where one participant expressed: *"What affects me most is the indifference. Sometimes you feel helpless, because even if you want to act, others don't collaborate or show interest"* (teacher interviewed). This testimony illustrates how emotions of frustration and professional loneliness can hinder sustained commitment to EE. Teachers with positive feelings may have a greater willingness to integrate EE into their pedagogical practice (Esa, 2010). On the other hand, negative feelings are more often associated with structural barriers, such as a lack of training, limited teaching resources and low levels of institutional support (Awayehu Gugssa, 2024; Ntona et al., 2024).

In the analysis of responses to questions about practices, the subcategories of "pedagogical practices", "problems", "barriers", "opportunities" and "environmental practices" emerge. The participating teachers stated that EE teaching practices function as a node, linking pedagogical strategies, environmental issues covered in the classroom with students and the implementation of environmentally-friendly actions. One illustrative example emerged from the interviews: "*We created an organic composting plant using dry leaves from the school. The students led the process and today we sell that compost*" (teacher interview). This project demonstrates how student-led initiatives can have a tangible environmental and community impact, even in resource-limited contexts. While these practices are limited by individual and institutional barriers, they are also strengthened by existing opportunities in local contexts. The successful implementation of EE practices depends on the ability of teachers to overcome limitations, take advantage of resources and design strategies that connect teaching with actions that contribute to environmental protection (dos Santos et al., 2021; Ruthanam et al., 2021).

The analysis of the interviews identified 80 codes in the three KAP categories. In the Sankey diagram (**Figure 2**), with cooccurrences equal to or greater than 10, significant patterns are evidenced in the interrelation of the teachers' KAP in the area of EE.

Three codes were identified as having the highest co-occurrence in the knowledge category: "context", "environmental issues" and "environmental awareness". The link between knowledge and "context" shows that teachers tend to interpret EE content in terms of its applicability to specific environments. This relationship reinforces the importance of situated learning, in which EE practices help students connect knowledge to real-world situations, improving their beliefs and environmental literacy (Deveci & Karteri, 2022).

The association between Knowledge and "environmental issues" indicates that EE teaching is focused on the recognition of current ecological challenges. This suggests that EE training programs should emphasize the identification of local environmental problems that generate a critical understanding of the environmental crisis among students (Hnatyuk et al., 2024). The relationship between knowledge and "environmental awareness" shows that the level of teachers' knowledge of EE influences their perception of the importance of environmental protection, leading to increased environmental awareness (Petkou et al., 2021).

In the area of attitudes, "environmental awareness" and "motivation" emerge as the codes with the highest level of co-occurrence, demonstrating that a teacher's willingness to integrate EE into their teaching practice does not exclusively depend on their level of knowledge, but is also mediated by their perception of environmental issues and personal commitment to teaching this content (Ruthanam et al., 2021; Sima et al., 2023).

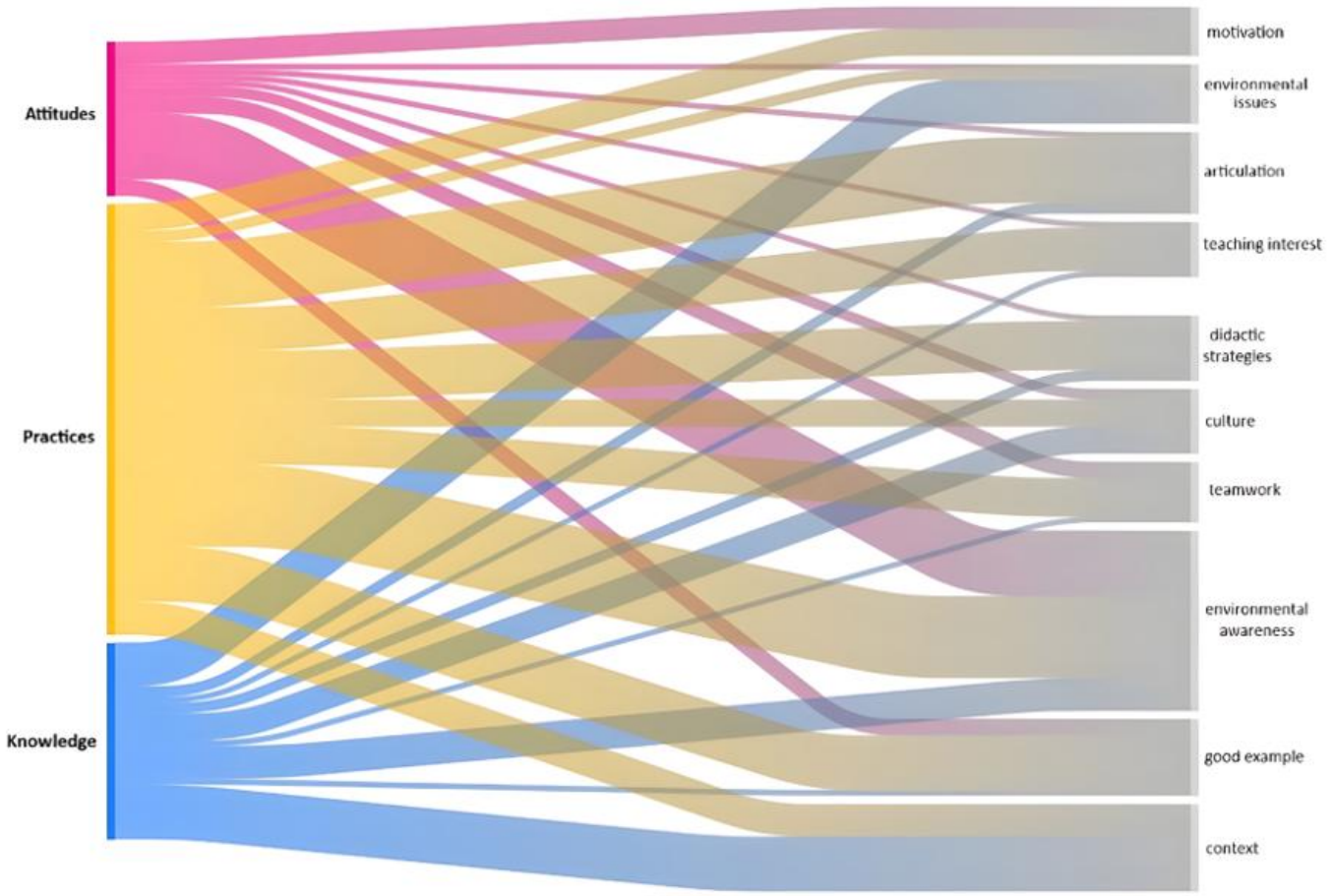

Figure 2. Sankey diagram (Source: Authors' own elaboration, using ATLAS.ti software)

Finally, in the area of practices, the codes with the highest levels of co-occurrence were "environmental awareness", "articulation", "good example" and "didactic strategies". This suggests that pedagogical practices reflect teachers' individual levels of environmental awareness. In order to be meaningful, these practices need to be supported by innovative teaching strategies like PBL, which allow students to connect theory with action. Articulation with real-life problems and other curricular components is required so that EE is not perceived as isolated knowledge but as part of a comprehensive education (Damoah et al., 2024; Loaiza, 2024).

The triangulation of the study's results shows that the main challenge faced by teachers in relation to EE is their lack of additional knowledge and limitations with the implementation of relevant pedagogical practices. This analysis evidenced the following needs: strengthen teachers' knowledge of EE, with an emphasis on environmental legislation and SDGs, given that the lowest scores in the questionnaire were in these areas; design training programs that combine theoretical knowledge with didactic strategies, which will allow teachers to implement meaningful environmental teaching practices in the classroom; create institutional spaces that reduce structural barriers, provide resources and support teachers in the area of EE; and articulate EE and curricula using an interdisciplinary approach that links environmental issues with different subject areas.

These results also highlight the importance of designing EE training programs that don't just increase teachers' knowledge but also generate conditions that are conducive to the implementation of sustainable practices, ensuring an impact on both EE teaching and students' environmental awareness.

Based on the results of this study, the central axis of an EE teacher training program should focus on building environmental awareness (**Figure 3**) through three conceptual areas: pedagogical practices, legislation, and the SDGs, with a focus on ecology, attitudes and environmental practices, as well as strengthening didactic strategies for the teaching of environmental issues.

DISCUSSION

The assessment of KAP in public primary, middle and secondary schools in the city of Florencia, Caquetá (Colombia) evidence that these teachers have a medium level of knowledge of EE. This coincides with the results of Cini and Mifsud (2018), who found that teachers have an acceptable level of general environmental knowledge but lack in-depth knowledge of normative and technical aspects. This study showed that deficiencies in training

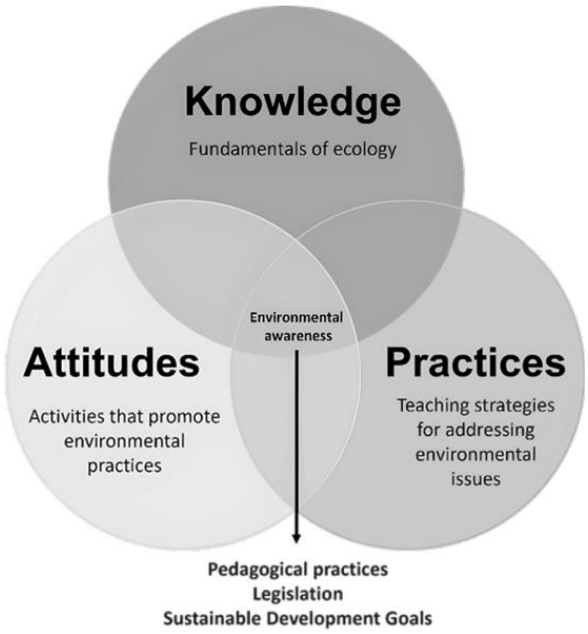

Figure 3. Pillars of an EE teacher training program (Source: Authors' own elaboration)

can translate into barriers for the successful implementation of EE in classrooms. This is consistent with Effeney and Davis (2013), who noted that teachers' understanding of sustainability tends to remain superficial in the absence of structured training. Torres Rivera et al. (2017) found that science teachers in Chile do not include the fundamental areas of EE (KAP) in their teaching of the subject, which impacts the quality of students' environmental learning. Research shows that teacher training in EE is heterogeneous and, in many cases, insufficient for teachers to implement quality educational strategies in this area (Liu et al., 2015).

This situation demonstrates that there is a need to strengthen teachers' environmental literacy, as well as providing sufficient resources and training on pedagogical strategies that favor experiential and contextualized learning (Deveci & Karteri, 2022). There is evidence that a teacher's environmental knowledge is influenced by the context in which they work, as observed in cities with higher levels of sustainable development, environmental literacy and support for environmental action. For teachers living in an intermediate city like Florencia, Caquetá, there is a link between their scores in the knowledge section and the lack of professional development programs on EE.

Most of the teachers who participated in this study stated that their initial academic training did not include sufficient content on EE, and that their learning in this field has either been self-taught or through sporadic training sessions. This coincides with what was stated by Cini and Mifsud (2018), who noted that most teachers acquire environmental knowledge in a fragmented manner, which affects their ability to design structured pedagogical strategies.

The low results among teachers regarding their knowledge of legislation is relevant and supported by Deveci and Karteri (2022), who recognize that a lack of regulatory knowledge limits teachers' ability to link EE concepts with real life situations in their educational and community context. Teachers possess general knowledge about environmental problems but find it challenging to link this with relevant didactic strategies. According to Keleş et al. (2016), the lack of connection between theory and practice in EE is a common obstacle faced during teacher training, which evidences the need for specific training that includes applied methodologies.

The results in the attitudes category were high. The finding that teachers manifest a positive attitude towards EE coincides with Petkou et al. (2021), who found that teachers in Greece have a favorable perception of EE and recognize its importance but face structural and methodological barriers that limit its practical application. Sima et al. (2023) showed that even though primary school teachers in Romania are motivated to include EE in their classes, the lack of institutional support and insufficient resources diminishes the impact of their commitment, coinciding with the results of this study.

Barriers perceived by teachers are not just related to the lack of resources, but also to a disjointed vision of EE within the school curriculum (Ntona et al., 2024). Educational policies in many countries continue to have EE as an optional or complementary subject instead of integrating it across all subjects as a crosscutting area (Redman et al., 2021). Despite the high scores in the area of attitudes, this study evidence that a favorable attitude does not guarantee the implementation of environmental teaching strategies in the classroom (Aznar-Díaz et al., 2019). Considering that teachers' attitudes play an important role in students' learning experiences, and that their collective level of self-belief can influence the quality of education they provide, there is a clear need to create opportunities for teacher training processes that continue to strengthen favorable opinions of EE (Aznar-Díaz et al., 2019). A positive attitude towards EE leads to the implementation of suitable pedagogical practices (Redman et al., 2021).

This was shown in the analysis of categories in practices, where significant shortcomings were found in the incorporation of the SDGs and environmental legislation into classroom activities, elements that are essential for EE and help students apply EE knowledge to their local contexts. Awayehu Gugssa (2024) blames the State for this situation, proposing that EE must be connected to the daily lives of students in order to generate significant changes in their environmental habits and perceptions.

The low scores of teachers in subcategories such as SDGs and environmental legislation in this study

support the findings of Ardoin et al. (2020), who found that teachers' lack of continuous EE training and limited institutional resources affect the full implementation of environmental pedagogical strategies. This study's finding that a low number of teachers incorporate EE into their teaching practice is consistent with Cini and Mifsud (2018), who identified that teachers tend to include environmental practices sporadically and without a clear methodological structure. This suggests that while teachers are willing to incorporate EE into their teaching practice, they face challenges related to the lack of specific training and the absence of curricular guides to facilitate its implementation.

In this study, participating teachers achieved a medium score for EE practices, a result that is consistent with dos Santos et al. (2021), who found that most teachers only occasionally carry out environmental activities without continuity or systematization. This prevents these actions from generating meaningful learning for students.

On the other hand, some studies have documented successful experiences of integrating EE into teaching. For example, Damoah et al. (2024) argue that the incorporation of an integrated environmental curriculum can improve the quality of environmental practices in classrooms. This approach is different from what has been observed in this study, with EE implemented in a fragmented manner and without a clear curricular structure.

Although much of the research cited has been conducted in either urban or national contexts, there is also relevant information about rural or intermediate-sized cities. For example, Moctezuma et al. (2022) implemented a teacher training experience in a rural community in Mexico, facing similar barriers in terms of limited resources and resistance to the implementation of environmental practices. Loaiza (2024) describes a transformative EE process in a rural Colombian municipality, a context that has structural characteristics with intermediate-sized cities. These studies support the relevance of the findings of this study for non-metropolitan territories.

Redman et al. (2021) identified that the lack of support from institutions and insufficient resources are factors that impede the integration of EE into teaching. This is consistent with teachers' testimonies collected in this study, which indicate that although there is an intention to promote EE, the lack of resources and work overload hinder its effective implementation. The interviews also identified that teachers associate EE with specific activities, such as the celebration of environmental days or implementing sporadic projects, and without sustained curricular articulation. This is supported by dos Santos et al. (2021), who warn that EE in many educational contexts is limited to awareness-raising actions that do not include a structured approach to ensure its continuity.

This fragmentation is not only pedagogical or institutional, but also epistemological. Sauvé (1999; 2005), argues that EE must transcend technical content and include ethical, affective, and political dimensions. In this study, the high attitudinal scores reported in the questionnaire contrast with testimonies that detail teachers' frustration, institutional isolation and limited collective action. These findings reinforce the value of integrating quantitative indicators with teachers' lived experiences. A critical and contextualized approach to teacher training in EE, particularly in intermediate-sized cities, must recognize both cognitive and emotional dimensions and promote collaboration as a way of overcoming structural barriers.

There are difficulties with the long-term sustainability of active methodologies, such as PBL and experiential education. This coincides with Ruthanam et al. (2021), who indicate that continuous training and access to appropriate teaching materials are important factors for the consolidation of environmental practices in the classroom.

This study has a number of methodological limitations that should be considered when interpreting the results. For example, convenience sampling is acceptable in exploratory and contextualized research (Andrade, 2021). However, it does not allow probabilistic inferences. The generation of self-reported data using Likert-type scales can be subject to social desirability biases, especially related to environmental attitudes and practices (Nederhof, 1985). Future research could overcome these limitations by including larger and more diverse samples, triangulating this data with classroom observations and developing longitudinal designs that allow for the identification of changes over time.

The findings of this research suggest that teacher training in EE shouldn't just focus on strengthening theoretical knowledge but must also provide methodological tools that facilitate the implementation of sustainable pedagogical strategies. A structured and multidisciplinary approach can improve the implementation of EE in the school curriculum (Damoah et al, 2024). It is essential that educational institutions deliver increased support to teachers through the provision of teaching materials, planning time and collaborative spaces for the sharing of good practices. Ardoin et al. (2020) emphasize the importance of creating learning communities where teachers can share experiences and strategies for teaching EE.

CONCLUSIONS

Teachers' lack of knowledge directly impacts the implementation of effective EE practices. Even when teachers show willingness and interest, they lack

continuous training and adequate institutional support, stifling their ability to develop innovative pedagogical frameworks that promote EE in the classroom. This confirms that a positive attitude alone, without a good theoretical and methodological framework, is not enough to transform the teaching of EE.

Pedagogical barriers include the absence of educational materials, limited specialized training and a lack of curricular frameworks that prioritize EE. As a result, EE in intermediate cities continues to be a fragmented initiative, strongly dependent on the self-motivation of teachers instead of a coherent and long-term systemic approach.

It is important to design teacher training programs in EE that incorporate an interdisciplinary approach, active methodologies and practical elements, particularly in intermediate cities where physical and human resources are lower compared to large cities. It is important to emphasize that it is not just pertinent to design these types of programs, but also to ensure that teachers can implement them. This requires institutional support from education departments and school administrations so that teachers have the space and time to lead these initiatives.

It is also important to note that many of these cities are located in strategic regions for environmental protection, such as Florencia, Caquetá, located in the Colombian Amazon. In this territory, there is a need to develop increased awareness of environmental issues because it's where most of the world's biodiversity is concentrated, as well as containing the forests and jungles that mitigate the effects of climate change. This is another reason why EE training programs for teachers should be implemented in these intermediate cities.

In this context, teachers require normative knowledge and contextualized teaching strategies to successfully incorporate EE into their regular classroom instruction. The authors recommend participation in collaborative networks such as the global environmental education partnership (GEEP, 2024) and the UNESCO (2023) associated schools network (ASPnet), which offer international collaboration frameworks, as well as engagement with local networks such as the educational innovation and quality hubs that facilitate the exchange of EE experiences and best practices. This will allow teachers to have a greater impact on learning while achieving lower dropout rates in school settings.

EE in schools cannot depend entirely on the willingness of teachers. It needs to form part of the entire educational system so that all teachers have the tools, knowledge and support they need to educate environmentally responsible and committed citizens and support a socially sustainable citizenship.

This research offers a perspective from an intermediate-sized city in the Colombian Amazon Region where there is a convergence of structural limitations and territorial potential for EE. This perspective allows us to understand how the KAP of teachers are configured in environments with limited access to resources but significant ecological and sociocultural wealth. The study provides empirical evidence for the design of contextualized training programs that recognize the specific nature of intermediate-sized cities and promote sustainable strategies for educational transformation at the local level.

One limitation of this study is its small sample size. However, the findings allow us to identify relevant trends and establish a diagnostic basis for the design of contextualized training programs. Future research could expand the sample and explore comparisons between different types of cities and regions.

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