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Original article

Pedagogical practices in multigrade classrooms: a comparative qualitative study

Prácticas pedagógicas en aulas multigrado: estudio cualitativo comparativo

Práticas pedagógicas em salas de aula multisseriadas: um estudo qualitativo comparativo

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ABSTRACT

Multigrade, single-teacher schools constitute a significant modality within the Ecuadorian rural education system and face persistent structural limitations related to infrastructure, connectivity, and teaching resources. The objective of this study was to comparatively analyze the teaching strategies implemented in four single-teacher schools in the Pedro Carbo canton, Guayas province. A qualitative, descriptive, and exploratory study was conducted, employing a multiple-case design. Four teachers and 87 students participated. The research methods used were non-participant observation, semi-structured interviews, focus groups, and thematic analysis supported by

comparative matrices. The results showed the simultaneous management of three to six grades, the use of flexible routines, the application of differentiated activities with recycled materials, and the implementation of immediate formative feedback. Technological integration was limited due to connectivity restrictions and the availability of devices. In the schools with greater community participation, micro- pedagogical projects linked to the local environment emerged. The evidence obtained shows that multigrade teaching relies on teacher creativity, community resilience, and shared family responsibility. It is concluded that these practices require differentiated educational policies that recognize the specific needs of rural areas and reduce gaps in resources and access to technology.

Keywords: multigrade teaching; rural education; educational equity; one-teacher schools; pedagogical strategies.

RESUMEN

Las escuelas unidocentes multigrado constituyen una modalidad significativa dentro del sistema educativo rural ecuatoriano y enfrentan limitaciones estructurales persistentes relacionadas con infraestructura, conectividad y recursos didácticos. El objetivo del estudio fue analizar comparativamente las estrategias de enseñanza implementadas en cuatro escuelas unidocentes del cantón Pedro Carbo, provincia del Guayas. Se desarrolló una investigación cualitativa de carácter descriptivo y exploratorio, con diseño de casos múltiples instrumentales. Participaron cuatro docentes y 87 estudiantes. Los métodos de investigación empleados fueron la observación no participante, las entrevistas semiestructuradas, los grupos focales y el análisis temático apoyado en matrices comparativas. Los resultados evidenciaron la gestión simultánea de tres a seis grados, el uso de rutinas flexibles, la aplicación de actividades diferenciadas con materiales reciclados y la implementación de retroalimentación formativa inmediata. La integración tecnológica fue limitada debido a restricciones de conectividad y disponibilidad de dispositivos. En las instituciones con mayor participación comunitaria emergieron microproyectos pedagógicos vinculados al entorno local. Las evidencias obtenidas muestran que la docencia multigrado se sostiene en la creatividad docente, la resiliencia comunitaria y la corresponsabilidad familiar. Se concluye que estas prácticas requieren políticas educativas diferenciadas que reconozcan la especificidad rural y reduzcan las brechas en recursos y acceso tecnológico.

Palabras clave: docencia multigrado; educación rural; equidad educativa; escuelas unidocentes; estrategias pedagógicas.

RESUMO

Escolas multisseriadas com um único professor constituem uma modalidade significativa dentro do sistema educacional rural equatoriano e enfrentam limitações estruturais persistentes relacionadas à infraestrutura, conectividade e recursos didáticos. O objetivo deste estudo foi analisar comparativamente as estratégias de ensino implementadas em quatro escolas com um único professor no cantão de Pedro Carbo, província de Guayas. Foi realizado um estudo qualitativo descritivo e exploratório, empregando um delineamento de casos múltiplos. Quatro professores e 87 alunos participaram. Os métodos de pesquisa utilizados foram observação não participante, entrevistas semiestruturadas, grupos focais e análise temática apoiada por matrizes comparativas. Os resultados mostraram a gestão simultânea de três a seis séries, o uso de rotinas flexíveis, a aplicação de atividades diferenciadas com materiais reciclados e a implementação de feedback formativo imediato. A integração tecnológica foi limitada devido às restrições de conectividade e à disponibilidade de dispositivos. Nas escolas com maior participação da comunidade, emergiram projetos micropedagógicos vinculados ao ambiente local. As evidências obtidas mostram que o ensino multisseriado depende da criatividade do professor, da resiliência da comunidade e da responsabilidade familiar compartilhada. Conclui-se que essas práticas exigem políticas educacionais diferenciadas que reconheçam as necessidades específicas das áreas rurais e reduzam as lacunas de recursos e acesso à tecnologia.

Palavras-chave: ensino multisseriado; educação rural; equidade educacional; escolas com um único professor; estratégias pedagógicas.

INTRODUCTION

In Latin America, and particularly in Ecuador, single-teacher and multi-grade schools have historically been a response to the educational needs of sparsely populated rural areas, characterized by low population density, infrastructure limitations, and reduced connectivity. According to the UNAE Observatory (Herrera *et al.*, 2024), more than 45% of the country's educational institutions are

single-teacher, two-teacher, or smaller multi-teacher schools, highlighting their structural importance within the national system. Despite this significance, they are often evaluated using parameters designed for urban, graded contexts, which reinforces a historical disadvantage and obscures their unique pedagogical characteristics (Arias *et al.*, 2024).

In the province of Guayas, this reality is also evident. Table 1 presents official data from the Ministry of Education of Ecuador (Open Data, 2025), which shows that the number of one-teacher schools has remained stable over the last five years, consistently exceeding 350 and serving approximately 7,000 students annually. This confirms that one-teacher teaching is not a marginal phenomenon, but rather a current practice in the coastal region, with direct implications for equity and educational quality.

Table 1. Single-teacher schools in the province of Guayas (2020-2025)

Academic year	Total number of institutions	Female teachers	Male teachers	Total number of students
2024–2025	354	250	104	6,785
2023–2024	359	244	115	7.183
2022–2023	354	233	121	7,559
2021–2022	360	234	126	7.721
2020–2021	356	237	119	7,464

Source: Open data, Ministry of Education, 2025

This statistical overview allows us to place the analysis of four one-room schools in the Pedro Carbo canton within a broader context. These are not isolated cases, but rather representative examples of the conditions faced by a significant portion of rural children in Guayas province and, by extension, in rural Ecuador. Recent research confirms that these areas continue to experience persistent inequalities in infrastructure, connectivity, access to technological resources, and graduation rates—gaps that intensified during and after the pandemic.

The COVID-19 crisis exacerbated these limitations. In rural communities, the lack of connectivity and devices forced the use of alternative means such as phone calls or printed guides, while in urban areas the use of digital platforms increased. Other studies corroborate that these conditions are not isolated incidents, but rather common structural problems in Ecuador and the region (Padilla, 2024).

Given this situation, it is crucial to understand how rural teachers shape their pedagogical practices in highly vulnerable environments.

One-room schools have historically been conceived more as an administrative solution for serving rural populations with low enrollment than as a pedagogical approach with its own distinct identity. In Ecuador, they maintain a strong presence in the Amazon, the central highlands, and rural coastal areas, where teaching demands high levels of adaptability, creativity, and community integration. The current educational framework for rural one-room schools in Ecuador promotes pedagogical contextualization, teacher autonomy, and community participation as guiding principles for addressing local specificities. However, its implementation faces significant structural limitations, primarily due to the lack of technical support and differentiated policies for rural areas.

The challenges of single-teacher education are not unique to Ecuador. In Latin America, research has shown that multigrade schools in Peru, Bolivia, and Mexico face similar conditions: simultaneous grade levels, infrastructure deficiencies, and limited access to technology (Portilla et al., 2025). Likewise, recent studies warn that Latin American single-teacher schools are in a constant state of tension between quality and equity, requiring sustainable pedagogical innovations to guarantee meaningful learning (Pavo *et al.*, 2024).

From a pedagogical perspective, recent literature presents arguments both for and against multigrade classrooms. Among the positive contributions, their potential to foster inclusive methodologies, collaborative learning, and curricular contextualization stands out. Parfitt *et al.* (2025) propose a theoretical framework that conceives of multigrade classrooms as spaces for developing a "pedagogical core" focused on personalization, cooperation, and the integration of content with the environment. Along the same lines, Ares-Ferreirós *et al.* (2025) maintain that internal heterogeneity can become a resource for stimulating peer tutoring and student autonomy, while Minaz *et al.* (2024) emphasize the need for specific teaching competencies that allow for differentiated planning and monitoring of individual progress.

Likewise, Naparan and Alinsug (2021) warn that the lack of initial and ongoing training in multigrade teaching forces many teachers to improvise, limiting the pedagogical potential of these schools. The scarcity of resources, coupled with poor connectivity and the absence of adapted materials, constitutes another factor that negatively affects the educational experience (Ares-Ferreirós *et al.*, 2025).

The COVID-19 pandemic exacerbated these inequalities. Reports from international organizations reveal that millions of rural students were excluded from digital education due to a lack of connectivity, devices, and institutional support (UNESCO Office Santiago & UNICEF, 2022). In Ecuador, evidence shows that multigrade teaching was sustained primarily by the resilience of teachers and families, rather than by public policy support (Padilla, 2024). In this context, research confirms that "the single-teacher approach positively influences meaningful learning when it manages to implement flexible and contextualized strategies" (Velásquez *et al.*, 2025, p. 2312).

From a broader perspective, educational equity must be analyzed in terms of the actual capabilities that students can develop, which resonates particularly in rural settings where structural limitations restrict the full exercise of the right to education. Thus, the pedagogical debate surrounding one-room schools oscillates between their innovative potential and their structural and technological limitations, demanding differentiated policies, specific teacher training, and sustained resources that allow their educational value to be realized without them becoming a second-rate alternative (Boné-Andrade, 2023).

The relevance of this research lies in highlighting a reality frequently overlooked in public policy: single-teacher rural education. Although these institutions represent a significant percentage of the national education system, with a strong presence in the province of Guayas, they are often excluded from differentiated evaluation processes, specialized teacher training programs, and priority resource allocation.

By documenting situated pedagogical practices, this research seeks to understand how multigrade teaching is organized and developed in rural contexts marked by structural limitations and challenges intensified during the pandemic. The study aims to generate evidence that contributes to the design of differentiated educational policies and the development of a critical perspective on the role of rural teachers in promoting equity and quality in education.

This study aims to comparatively analyze the teaching strategies implemented by teachers in four one-room schools in the Pedro Carbo canton, focusing on classroom organization, teaching strategies, assessment and feedback methods, and the use of material, technological, and community resources. Additionally, it seeks to describe classroom organization, examine assessment methods, and explore the role of families in the educational process.

MATERIALS AND METHODS

Methodological approach and study design

The research is framed within a qualitative approach, with a descriptive and exploratory character, which allowed for an examination of pedagogical practices from the perspective of the actors themselves and within their everyday environment. A multiple case study design, of an instrumental and comparative nature, was chosen, considering that this strategy facilitated not only the documentation of particular experiences, but also the establishment of parallels and contrasts among four multi-grade, single-teacher schools in the Pedro Carbo canton, in the Guayas province (Ecuador).

Categories of analysis

The central variable of the study was defined as teaching strategies in rural multigrade classrooms. From this, five analytical dimensions were constructed (classroom organization, pedagogical methods, evaluation and feedback, didactic and technological resources, and socio-educational environment), each operationalized in specific indicators shown in table 2. These categories guided both the development of the instruments and the subsequent systematization of the information.

Table 2. Categories of analysis of teaching strategies in multigrade-rural classrooms

Dimension	Indicators
Classroom organization	Time management; routines; groupings; simultaneous degrees.
Pedagogical methods	Differentiated activities; use of concrete materials; peer tutoring; autonomous learning.
Evaluation and feedback	Training modalities; shared criteria; positive reinforcement; individual support.
Educational and technological resources	Availability; creativity in adaptation; innovation with basic ICT.
Socio-educational environment	Material conditions; socio-emotional climate; participation of families and community.

Source: Own elaboration

This operationalization guided the construction of the observation guides, interviews, and focus groups.

Participants and context

The sample consisted of four single-teacher schools, each responsible for their own institution: EEB (Escuela de Educación Básica, in Spanish) 2 de Julio (14 students), EEB Antonio José de Sucre (38 students), EEB Ciudad de Pedro Carbo (12 students), and EEB 24 de Mayo (23 students). Selection was purposive (Alonso, 2023) and based on three criteria: simultaneous instruction of multiple grade levels under a single-teacher model, location in rural areas with limited infrastructure and connectivity, and the willingness of the schools and communities to participate in the study. Additionally, where possible, families and students participated in focus groups.

The four centers are located in rural areas of Pedro Carbo characterized by their population dispersion, precarious infrastructure, limited access to technological resources and strong dependence on community participation, conditions that make them representative scenarios of multigrade rural education in Ecuador.

Instruments and techniques for obtaining information

To gather information, various qualitative techniques were used. Non-participant direct observations of full school days were conducted at each school, recorded on structured guides according to the dimensions of analysis. Semi-structured interviews were also carried out with teachers, organized into five thematic blocks (classroom organization, pedagogical methods, assessment, resources, and community engagement). Additionally, focus groups with families and students were conducted at two schools to understand perceptions of the learning climate and shared educational responsibility. Finally, field notes and systematization matrices were used to ensure the traceability and coherence of the data.

Fieldwork and instrument validation

The fieldwork was conducted between April and July 2025. Two days of full-class observations were carried out at each school. The semi-structured interviews lasted approximately 45 minutes and were audio-recorded with the participants' permission. The focus groups, held at two of the schools, lasted

around 60 minutes and provided complementary insights into the educational experience and family involvement.

The instruments were designed considering the current pedagogical guidelines for rural one-teacher schools in Ecuador, as well as recent contributions from the specialized literature on multigrade education. Before their application, they were submitted to expert review, who evaluated the clarity, relevance, and coherence of the items. Subsequently, linguistic and contextual adjustments were made to adapt them to the local context.

The study was conducted in accordance with ethical principles of social research. Informed consent was obtained from the teachers and legal guardians of the students, as well as assent from the participating minors. Voluntariness, confidentiality, anonymity, and strictly academic use of the information were guaranteed at all times. The testimonies cited in this study correspond to textual fragments of interviews and focus groups, anonymized and reproduced with the express authorization of the participants

Data analysis

The analysis followed the thematic analysis technique, which included several phases: data familiarization, initial coding, grouping into categories according to the defined dimensions, triangulation of sources (teachers, families, students) and techniques (observation, interviews, and focus groups), and interpretation in light of the adopted theoretical framework. To facilitate comparison between cases, cross-sectional analytical matrices were developed, which allowed for the identification of common patterns, divergences, and particularities related to enrollment, historical trajectory, connectivity, and community participation.

The rigor of the process was ensured through various strategies: credibility through triangulation, transferability thanks to dense descriptions of the context, and confirmability through the traceability of analytical decisions. These actions strengthened the validity of the study and ensured that the findings accurately reflected the complexity of multigrade teaching in rural areas.

The study adhered to the ethical principles of educational research and current data protection regulations. Informed consent was obtained from the participants and the legal representatives of the minors.

RESULTS

Classroom organization

In all four institutions, teachers simultaneously managed between three and six grade levels. Routines varied according to teaching experience and the level of community involvement. Rotation strategies, learning centers, and school assemblies were observed, as one teacher explained: "Here, the older children help the younger ones with reading because "Here the big kids help the little ones with reading, because I can't take care of them all at the same time" (Teacher, EEB 2 de Julio). Another teacher noted that "when the group is very mixed, the important thing is to maintain a routine that provides security; we all start together, and then each grade works with its own materials" (Teacher, EEB Antonio José de Sucre).

Table 3. Classroom organization in the one-teacher schools of Pedro Carbo

School	No. of grades served	Grouping strategies	Main routines	Notable observation
2 de Julio	3	Rotation by level	Begin with collective reading	Use of work corners
Antonio José de Sucre	6	Affinity groups	Schedule segmented by area	Greater dispersion during recreation
Ciudad de Pedro Carbo	4	Learning corners	Fixed sequence (mathematics–language–science)	Take advantage of peer mentoring
24 de Mayo	5	Flexible combination	Daily assembly routine	High community participation

Source: Own elaboration

The comparative analysis of table 3 shows that the EEB 24 de Mayo incorporates greater flexibility and community participation in classroom organization, while in Antonio José de Sucre, the breadth of grades served creates additional difficulties in maintaining stable routines.

Pedagogical methods

Methodologically, a predominance of level-differentiated activities, supported by the use of concrete materials, was observed. "The children like it when we work with seeds or things from their surroundings; they learn with what's close at hand" (Teacher, Pedro Carbo City Elementary School). From a family perspective, one mother noted: "When we plant together, the children better understand what they read and calculate; they feel part of the learning process" (Mother, 24 de Mayo Elementary School). As shown in figure 1, peer tutoring and independent learning appeared less frequently.

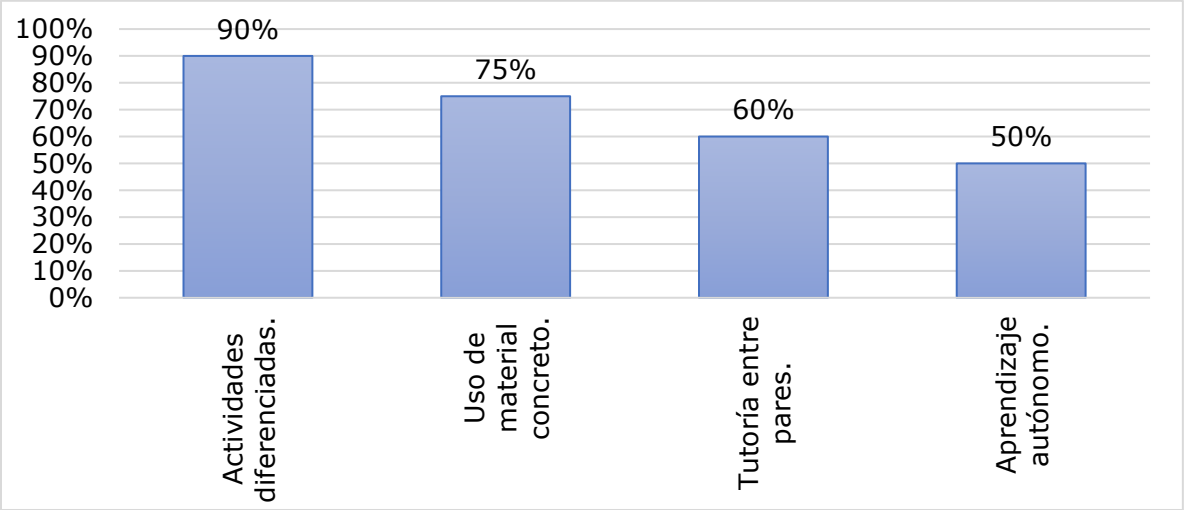

Figure 1. Relative frequency of observed pedagogical methods
Source: Own elaboration

The use of differentiated activities was common across all schools, confirming that it is the most widely used strategy for sustaining instruction in multi-grade classrooms. However, specific experiences made a difference: at the Pedro Carbo City Basic Education School, the teacher created recycled math and reading workbooks, which allowed for continuity despite the lack of books; and at the 24 de Mayo Basic Education School, community micro-projects (gardens, recycling workshops) were implemented that connected the curriculum to the local area. As one mother expressed: "When we plant together, the children understand better what they read and do calculations *" (participating family, 24 de* Mayo Basic Education School).

Evaluation and feedback

The assessment practices were characterized as formative, immediate, and continuous, based on notebook review, oral questions, and direct feedback. "I know they are learning when they explain things out loud or when they correct another classmate; I don't need to wait for a test to know" (teacher, Antonio José de Sucre Elementary School). One student commented: "We like it when the teacher tells us what we did well before correcting us; that way we don't feel bad" (student, focus group, 2 de Julio Elementary School). As shown in table 4, an emphasis on immediate feedback was evident as the predominant strategy.

Although traditional methods prevailed in most institutions, the 24 de Mayo school stood out by introducing adapted rubrics and shared feedback with families, which represented a step towards more participatory practices. One teacher expressed it clearly: "I know they are learning when they explain things out loud to me, I don't need to wait for an exam" (teacher, EEB Antonio José de Sucre).

Table 4. Evaluation and feedback strategies

School	Evaluation techniques	Feedback
2 de Julio	Notebook review, differentiated tasks	Individual oral comments
Antonio José de Sucre	Oral questions, short tests	Collective positive reinforcement
Ciudad de Pedro Carbo	Written activities, household chores	Constant individual monitoring
24 de Mayo	Microprojects, adapted rubrics	Feedback shared with families

Source: Own elaboration

Educational and technological resources

The use of teaching resources was heavily influenced by the teachers' creativity. Recycled and handcrafted materials were common in all schools, while Information and Communication Technologies (ICTs) were limited to the teacher's personal cell phone.

The schools shared a pattern of intensive use of recycled materials (cardboard, bottle caps, seeds, painted stones). The lack of connectivity reinforced the digital divide compared to urban schools. One testimony illustrates this: "We don't have internet here; I get what I teach from my own cell phone." (Teacher, EEB Ciudad de Pedro Carbo).

As shown in figure 2, the use of teaching resources in the one-room schools of Pedro Carbo was characterized by a high reliance on recycled materials, traditional blackboards, and notebooks (100%). To a lesser extent, printed guides and handcrafted materials made by the teachers themselves were used (75%). Technological resources—mainly cell phones, television, or radio—as well as official textbooks and materials from the natural environment, reached only 50%.

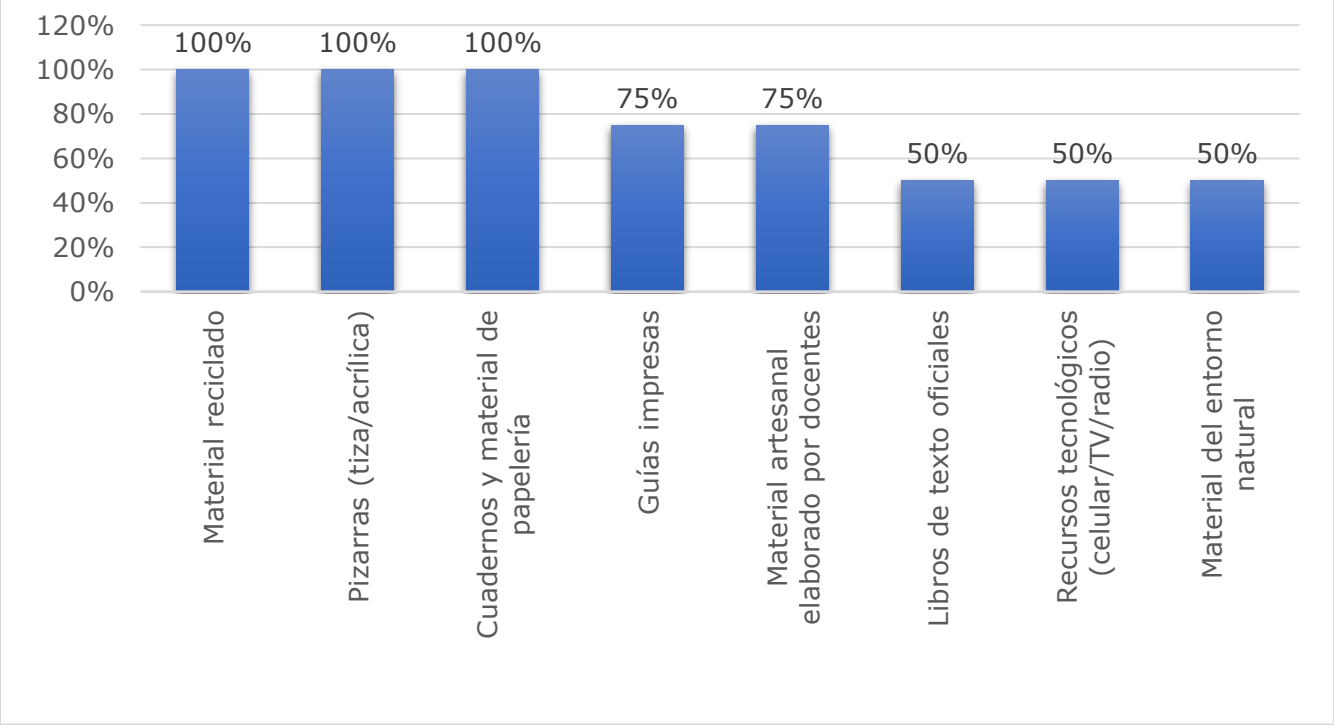

Figure 2. Resources used in the observed schools

Source: Own elaboration

Socio-educational environment and community participation

Table 5 shows that the socio-emotional climate in the four schools was mostly positive, based on cooperative and respectful relationships, although conditioned by the precariousness of the

infrastructure (small classrooms, incomplete furniture, deteriorated bathrooms). Community participation varied significantly: while at EEB 24 de Mayo families assumed active co-responsibility in projects, in other institutions collaboration was limited to occasional support or meetings. "At school, we all know each other; if there is a problem, we solve it between parents and the teacher, without waiting for the district" (Parent, EEB 24 de Mayo). Another parent added: "Sometimes we bring wood or paint to fix the classroom, because we want the children to be in a decent place" (Parent, EEB Antonio José de Sucre).

Table 5. Socio-educational environment and community participation

School	Material conditions	Socio-emotional climate	Community participation
2 de Julio	Classroom in good condition, no connectivity	Teacher-student respect	Occasional (school events)
Antonio José de Sucre	Fair infrastructure, incomplete furnishings	Moderate cooperation	Low, limited to meetings
Ciudad de Pedro Carbo	Small classroom, run-down bathrooms	Weak emotional regulation	One-off support (recycled material)
24 de Mayo	Basic infrastructure, frequent community contribution	Strong emotional bond	High co-responsibility in projects

Source: Own elaboration

Teacher, family, and student perceptions

Interviews with teachers confirmed that managing multiple grade levels simultaneously and the lack of official materials are the main challenges. Even so, they highlighted the role of personal creativity and community support as key elements of sustainability.

Families emphasized the close emotional bond they felt with teachers, although they acknowledged that agricultural work and a lack of internet access limited their ability to provide support at home. Students, for their part, expressed enjoyment of hands-on activities and community projects, but noted the difficulty of concentrating in classrooms shared with multiple grade levels and their desire for access to educational technologies.

Comparative Synthesis

Table 6 summarizes the differences and similarities between the four schools, showing that the variation in classroom organization, the use of pedagogical methods, evaluation practices and community participation depends largely on teacher initiative and the degree of family co-responsibility.

Table 6. Comparison of strategies in the four one-teacher schools of Pedro Carbo

Dimension	2 de Julio	Antonio José de Sucre	Ciudad de Pedro Carbo	24 de Mayo
Classroom organization	Rotations, collective reading	Daily routines, occasional tutoring	Learning corners	Weekly meetings with families
Pedagogical methods	Differentiated activities	Basic concrete material	Recycled booklets	Community micro-projects
Evaluation/Feedback	Oral questions	Notebook review	Immediate feedback	Shared feedback
Resources	Recycled material	Printed guides	Teacher's cell phone	Handmade and cell phone materials
Community participation	Occasional support	Low participation	Moderate	High, shared responsibility

Source: Own elaboration

Overall, the results show that, despite structural insecurity, the one-room schools in Pedro Carbo demonstrate resilient practices that combine creativity, community support, and organizational flexibility. However, inequalities in resources and connectivity continue to create substantial differences compared to urban schools, highlighting the need for differentiated policies for rural areas.

DISCUSSION

Based on the findings, it is possible to critically examine these experiences within the existing national and international literature, highlighting both relevant pedagogical contributions and persistent structural tensions. The results not only confirm the potential of multigrade classrooms to develop flexible, contextualized, and cooperative learning dynamics, but also underscore limitations associated with teacher overload, resource scarcity, and the rural digital divide. This duality between innovative capacity and structural fragility creates a complex scenario that poses substantial challenges for building effective educational equity in rural contexts.

First, the results show that classroom organization in one-teacher schools relies on flexible routines (rotations by grade level, learning corners, and group assemblies) that allow for a degree of continuity and order in a setting where a single teacher attends to between three and six grades simultaneously. This finding aligns with Ares-Ferreirós (2025), who emphasizes the importance of flexibility in managing space and time in multi-grade contexts. In Pedro Carbo, teachers depend heavily on their ability to improvise and on community support. This situation highlights the lack of differentiated policies for rural areas in Ecuador and reinforces the need to move beyond the view of the one-teacher school as a temporary or residual solution. This practical and collaborative approach is reflected in statements such as that of a teacher who noted: "Creativity is the only tool we have when books are lacking" (teacher, Pedro Carbo City Elementary School), which coincides with Velásquez *et al.* (2025) on teacher resilience in rural contexts.

Regarding pedagogical methods, a clear predominance of grade-level differentiated activities, supported by the use of concrete materials, was identified, while peer tutoring and autonomous learning appeared more sporadically. These practices coincide with those proposed by Velásquez *et al.* (2025), who emphasize that the effectiveness of multigrade teaching depends largely on teachers' ability to adapt content and generate situated learning experiences. A particularly illustrative example was the 24 de Mayo School, where community micro-projects were implemented that linked curriculum and local context, in line with critical pedagogy. From a comparative perspective, Parfitt *et al.* (2025) point out that multigrade classrooms can become privileged settings for cooperation and autonomy when teachers manage to consolidate their own "pedagogical core." However, the findings also reveal that such innovations depend, in most cases, on the individual initiative of the teachers. This agency confirms what Minaz *et al.* (2024) warned about, who argue that multigrade

teaching demands specific professional skills that, in many contexts, are still not part of initial training or continuing education.

Regarding assessment, it was observed that the practices are carried out with a strong formative and continuous focus. Notebook reviews, oral questions, immediate comments, and direct feedback were the most frequent strategies, allowing for close monitoring of the learning process. These methods align with the pedagogical principles promoted in the national educational framework for single-teacher schools, which emphasize constant feedback as a strategy for monitoring learning. However, the absence of standardized instruments specifically designed for multigrade classrooms was evident. This limitation restricts the possibility of generating nationally comparable information and, consequently, contributes to keeping the achievements and needs of rural students invisible.

Regarding teaching and technological resources, the results show a strong reliance on recycled and handcrafted materials, which became the basis of daily pedagogical practice. The use of technology, on the other hand, was almost entirely limited to teachers' mobile phones, used primarily to communicate with families or display brief content. This scenario aligns with Guapulema 's findings. *et al.* (2024), who point to the digital divide as one of the most persistent obstacles to educational equity in Latin America. However, the problem goes beyond access to devices or connectivity. Jiménez-Rogel and Campoverde-Moscol (2024) warn that rural education faces structural inequalities that affect student retention, performance, and educational prospects.

The COVID-19 pandemic only exacerbated these inequalities, leaving rural students at a clear disadvantage compared to their urban peers (UNESCO Office Santiago & UNICEF, 2022). In this context, while teachers' creativity helped to partially mitigate the lack of materials, the absence of connectivity and adequate devices limits the development of digital skills and contributes to the perpetuation of existing social inequities.

Community participation emerged as a decisive element in school life. At the 24 de Mayo Basic Education School, shared family responsibility enabled pedagogical innovations such as micro-projects linked to the local area and spaces for shared feedback, in line with Hernández and Álvarez's (2024) observations on the key role of families in the sustainability of rural education. In contrast, in the other institutions, collaboration was limited to sporadic meetings or occasional contributions, demonstrating that the school - community relationship is not homogeneous and depends largely on local social and economic dynamics.

From a comparative perspective, the results highlight the structural tension that runs through single-teacher schools: their innovative potential versus the precariousness of their conditions. On the one hand, it is confirmed that, with teacher creativity and community co-responsibility, multi-grade classrooms can become settings for cooperative, contextualized, and flexible learning (Ares-Ferreirós *et al.*, 2025; Parfitt *et al.*, 2025). At the same time, limitations persist due to excessive workload, lack of specialized training, and scarcity of resources, which coincides with the warnings of Naparan and Alinsug. (2021). In this sense, the research reaffirms that multigrade teaching cannot rely solely on individual resilience, but requires differentiated public policies that recognize its specificity and strengthen its working conditions.

This study offers recent empirical evidence on the pedagogical strategies teachers implement in rural one-teacher classrooms in Ecuador, an area still relatively unexplored in the regional literature. It also highlights community co-responsibility as a key factor for both pedagogical innovation and the sustainability of practices in multigrade contexts. Finally, it provides concrete elements for the formulation of differentiated policies that recognize the specific characteristics of these schools and prevent them from continuing to be treated as secondary structures within the national education system.

Because this is a qualitative and exploratory study based on a small number of cases, the results cannot be extrapolated to all single-teacher schools in the country. Furthermore, the lack of standardized instruments for measuring achievement in multigrade contexts limits the possibility of systematic comparisons. Finally, the absence of longitudinal data restricts the analysis of medium- and long-term effects, especially regarding the impact of pedagogical strategies on student learning.

Several future lines of work emerge from these limitations. First, moving towards mixed and longitudinal studies that integrate academic achievement indicators with deeper qualitative analyses. Second, developing comparative research with countries in the region that already have specific policies for multigrade classrooms, such as Peru and Colombia, which would allow for the identification of transferable practices. Third, designing and validating assessment instruments adapted to the reality of single-teacher schools, providing reliable and comparable data. Finally, exploring in greater detail the possibilities of digital innovation in rural contexts with low connectivity, prioritizing sustainable and viable technological alternatives.

The research confirms that multigrade teaching in Ecuador rests on three fundamental pillars: teacher creativity, organizational flexibility, and community co-responsibility. However, it also highlights structural limitations (lack of specific training, scarcity of resources, and unequal access to technology) that restrict its pedagogical potential. Recognizing single-teacher schools as legitimate spaces for educational innovation and social cohesion requires moving beyond the view that they are merely an emergency administrative solution. Differentiated policies are needed to strengthen teacher training, provide relevant resources, and guarantee equitable conditions for rural students. Only in this way will it be possible to transform the resilience that currently sustains these schools into a path toward education with true social justice. As one teacher summarized: "Although we are few and have little, here we all teach and learn together" (teacher, EEB 24 de Mayo).

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Conflict of interest

Authors declare no conflict of interests.

Authors' contribution

The authors participated in the design and writing of the article, in the search and analysis of the information contained in the consulted bibliography.