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DIDACTICS OF TECHNOLOGY IN PEDAGOGICAL PRACTICE AS A CONTRIBUTION TO RURAL EDUCATION IN BASIC PRIMARY SCHOOL

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Abstract

This analysis focuses on how the teaching of technology impacts educational practice, acting as a resource to improve the learning process in rural areas of primary education. With a qualitative descriptive approach, the tactics used by teachers to include technological tools in their classes are investigated, recognizing their contribution to the advancement of digital, cognitive and social skills in students. The findings demonstrate that the implementation of active teaching methods, supported by technology, fosters motivation, effective learning and involvement of children in educational contexts with limited infrastructure. Similarly, the importance of offering continuous training for teachers that stimulates the reflective and adapted use of technologies, aligning with the realities of the rural environment, is highlighted. The research concludes that technology teaching is essential to close educational gaps and improve the quality of learning in rural areas.

Keywords: Technology Didactics; Unitary classroom; Pedagogical Practice; training proposal; Emerging technologies.

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1. Introduction

In recent years, the integration of technology into education has become essential to revolutionize learning, especially in rural areas where digital, social, and cultural inequalities are most noticeable. The teaching of technology emerges as a key tool to enrich educational methodologies and facilitate relevant learning that adjusts to the needs of students in basic primary education. This approach not only favors access to knowledge, but also promotes equity in education and social inclusion, indispensable elements for the development of more sustainable and participatory rural communities.

Teachers in rural areas face a variety of challenges related to resource scarcity, weak connectivity, and a lack of specific training in the use of technologies in the classroom. However, the creative and adapted use of these tools can make teaching more dynamic, stimulate curiosity and reinforce the development of cognitive, communicative and social skills in children. Therefore, the teaching of technology becomes a

crucial element for innovation in education, by promoting active methodologies that link learning with daily life and the circumstances of the rural environment.

This paper focuses on examining how technology teaching affects the pedagogical work of teachers in rural areas, highlighting their role in creating more relevant learning experiences tailored to their context. It seeks to understand how educators incorporate technological tools into their daily routine and how they influence the integral formation of students. It is also intended to identify the experiences, obstacles and opportunities that emerge in the teaching-learning process in basic primary education in rural areas.

The research is valuable both socially and educationally, as it helps to understand the teaching processes influenced by technology in contexts that have historically been lagging behind in digital terms. Its impact is manifested in the possibility of guiding educational policies that are more inclusive, as well as teacher training programs and pedagogical approaches that are adapted to the particularities of the rural environment. In addition, it provides evidence on the importance of technology as a tool for community development and strengthening human potential from the first levels of basic education.

With a qualitative and descriptive approach, this study invites us to consider the need for a transformative pedagogical practice that bridges the gap between the technological and the human, as well as between educational theory and practice. From this perspective, the teaching of technology is established as an option to improve the quality of education, promote equity and promote learning that favors the integral development of students in rural areas.

2. Purposes

2.1 General Purposes

To analyze the incorporation of Technology Didactics in the teaching processes of pedagogical practice as a contribution to the unitary classroom of the Central Province of Boyacá

To analyze the incorporation of Technology Didactics in the teaching processes of pedagogical practice as a contribution to education in the unitary classroom of the Central Province of Boyacá.

2.2 Specific purposes

- To characterize how the didactics of Technology is developed in the pedagogical practice of the unitary classroom
- To establish the relationship between the didactics of Technology and pedagogical practice in the unitary classroom, analyzing the strategies, resources, methodologies and evaluation used by teachers in the area of Technology and Computer Science.
- To determine the criteria for a training proposal that favours the teaching of the area of Technology in the unitary classroom

3. Theoretical Framework

3.1 The didactics of technology as pedagogical mediation

Technology-related didactics is an area of study that connects learning with the conscious and deliberate use of technological tools to facilitate deep learning. From this perspective, technology is not seen only as a group of devices or digital resources, but as a tool that modifies the interactions between teachers, students and knowledge.

Researchers such as Sancho-Gil (2018) and Area Moreira (2020) state that the integration of technology in the classroom should focus on the active construction of knowledge, promoting independence, creativity and the ability to solve problems in students. Thus, technological didactics implies a change in the role of the teacher, who goes from being a mere transmitter of information to becoming a facilitator who creates learning experiences using digital resources and real contexts.

Therefore, technology-mediated pedagogical practice is not limited only to the functional use of digital tools, but is in a process of didactic innovation that increases the motivation and active involvement of the

student. Teachers in rural environments, by implementing technological strategies that adapt to their situation, help to reduce educational inequalities and promote contextualized learning.

3.2 Rural education and challenges in technological integration

Education in rural areas faces structural problems that directly impact the quality of the teaching process, such as the lack of technological infrastructure, low connectivity, limited teacher training in ICT and the geographical dispersion of educational communities. However, the gradual incorporation of technology offers an opportunity to overcome these obstacles and reform education.

Several studies (López & Chaparro, 2019; Torres, 2021) emphasize that rural schools can be transformed into spaces of innovation if an inclusive and adapted digital culture is cultivated. This requires recognizing the sociocultural characteristics of the environment and adjusting pedagogical strategies to local realities. Technology-mediated education in rural areas does not seek to replicate urban models, but rather to develop relevant proposals that address the specificities of the territory, the community, and the available resources.

In this framework, technological didactics allows educators to create flexible pedagogical practices that unite local and global knowledge, strengthening the cultural identity and sense of belonging of rural students.

3.3 Pedagogical practice as a space for educational innovation

Pedagogical practice is the basis that connects educational theory with action in the classroom. According to Zabalza (2017), teaching practice is developed as a reflective process in which the educator examines, plans, executes, and evaluates his or her teaching methods. In this context, the integration of technology provides new opportunities to reconsider pedagogical practice, diversify methodologies and strengthen the relationship between teaching and learning.

The use of digital tools in primary education facilitates more active teaching, creates experiences that involve several senses and stimulates critical thinking. From this point of view, the pedagogical approach accompanied by technology is transformed into an area of educational innovation that supports the complete development of the student and the constant improvement of the educational process.

In this way, the teaching of technology in rural environments is established as a link between equality in education and excellence in learning, promoting the active participation of students and reinforcing the role of the teacher as an agent of change.

4. Methodology

This section presents the elements that will account for what is being researched based on the paradigm, research method, type of research, research design, categorization, data collection techniques, data analysis and ethical considerations, which will allow us to know the phenomenon that is being studied and the categories of study that emerge in the research process. (Miles et al., 2014) define a category as anything that can change the quality, values, quantity and/or dimension of any quantitative or qualitative characteristic according to the exploration and analysis of data that is desired to be carried out. Likewise, it must have the development of a theoretical framework that involves theoretical, conceptual and contextual foundations to support the study.

4.1 Paradigm and Research Method

The paradigm assumed for this research is the pragmatic-interpretative one, which was considered by philosophical currents as instrumentalist in 1870. According to (Morgan, 2007), this paradigm is based on the methodology and connection that epistemology has over the method. In the same vein, (Arias, 2023) highlights the following cases:

- It assumes an Ontological position, which means that it starts from singular realities (it depends on the reality of each subject) and mixed realities.

- It assumes an epistemological assumption, that is, it accepts subjective and objective views of reality.
- It assumes a methodological assumption, that is, it takes a methodological design that best suits to solve a research problem.
- He considers that if in an investigation the problem has practical implications then it is important.
- The method must help solve the research problem in order for the study to be relevant.
- The results obtained in the research must be useful.
- It must have a practical, utilitarian and common sense value.

On the other hand, the study adopted an interpretative approach, in which (Martínez, 2013) affirms that it has epistemological bases in the constructionism of Seymour Papert, which considers that the subjects [...] "they do not discover knowledge, but construct it" (p.5). Therefore, the subject learns from interaction with the social, physical and cultural world in which he or she finds himself.

In this way, it is possible to interpret in the study carried out, how teachers are carrying out their pedagogical practices and what the experiences or experiences have been like during the teaching of Education in Technology. With the information collected, systematized and analyzed, it is expected to contribute to new contributions in the field of Technology Didactics in basic primary education.

The above indicates that the study is qualitative and is developed under the postulates of (Báez & De Tudela, 2007), since this type of research generates descriptive data from the experiences lived by the subjects. In this way, the researcher considers the context and the population as the object of study from a holistic dimension. Within the framework of the study, it seeks to understand the reality of how Technology Education is being taught from a didactic perspective. With these findings, it is intended to build a conceptual framework that contributes to future research in the field of Technology Didactics.

When referring to qualitative study, it is important to conceive it from the social realities and objectivity in the field of education, as postulated by hermeneutics. (Fuster, 2018) highlights that hermeneutics "comes from the Greek verb hermeneuein, which means to interpret" (p.205). In addition, in the educational field, hermeneutics seeks to analyze pedagogical elements where the teacher is concerned about the events that happen in the classroom and, in this way, improve pedagogical practice. Likewise, the author considers that the phenomenological study complements the hermeneutic by providing an alternative action of understanding and interpretation in pedagogical reflection.

For this reason, this thesis seeks to identify the needs and interests of teachers through a survey with open questions about the design of didactic material that they would like to have to strengthen the teaching of Technology Education at the basic primary level of the central province of Boyacá.

Phases of the hermeneutical phenomenological method (FH)

For this approach to educational research, (Fuster, 2018) proposes to develop the FH method in three phases from Van Manen's perspective:

Phase 1. Preliminary stage or clarification of assumptions: corresponds to the preconceptions, hypotheses and assumptions that are probably involved in the research. Likewise, he conceives the theoretical framework as a fundamental guide to the study.

Phase 2. Collecting lived experience: corresponds to the collection of data from the lived experience in different sources (stories, protocols, interviews, observations, description of a document, among others).

Phase 3. Reflect on the lived experience- structural stage: seeks to understand and reflect on the meaning of something that can be easily complicated.

This research considered the aforementioned phases to analyze the study phenomenon from a theoretical review in contrast to the experience of the pedagogical practice carried out by teachers who teach Technology Education.

4.2 Type of Research

The development of this research focuses on the qualitative approach and according to (Hernández et al., 2014) it is known as naturalistic, phenomenological and interpretative research and is a kind of "umbrella" in which a variety of conceptions, visions, techniques and non-quantitative studies are included (p.19). It originates from an idea that constitutes a subjective reality approached from human experience. For the qualitative type of research, it is not always necessary to have a fully structured research approach. However, it is important to have an idea and a vision that guides the researcher to a starting point. In any case, it is advisable to consult previous sources to obtain references, even if in the end the study begins from your own bases and without establishing any preconceived beliefs (Hernández, et al., 2014, p. 26)

On the other hand, the work will be approached from a descriptive-analytical study that will have the purpose of understanding the phenomena in relation to the categories that emerge from the study. Within the instrument, questions related to didactic material, infrastructure, technological tools, disciplinary and didactic area of Technology will be designed; which will be grouped into macro categories to understand the experiences, interests and contributions that teachers have in relation to Technology Education and Technology Didactics (R. Hernández et al., 2014).

In this way, the research will seek to describe disciplinary, technological and didactic interests of teachers; the educational context in which their pedagogical practice is developed and how a proposal for didactic material can help strengthen the pedagogical practices of teachers.

4.3 Research Design

According to (Stake, 1998), all research requires an organization of conceptual ideas that guide the collection of information and the design of schemes that facilitate interpretation for other people. On the other hand, (Monje, 2011) considers some methodological aspects that must be taken into account for the design of research, among them are: the objectives that can be focused on describing, explaining or understanding; the formulation of research that guides approaches and methodologies when the question reacts to causes and relationships of meaning; The variables or categories of analysis correspond to a research method, in that sense the categories conceive measurement of data and statistical treatments while the categories describe social processes and facts.

For this thesis, the non-experimental research design was selected since (Monje, 2011) states that it consists of collecting data passively without making interventions. On the other hand, Hernández, et al., (2014), agree with Monje that this type of study does not involve the manipulation of variables or the application of controlled treatments. Therefore, it focuses on the deep and detailed understanding of phenomena as they are presented in their natural context, without attempting to establish causal relationships.

Thus, this qualitative study will focus on understanding the phenomena studied from their natural conditions and the impact that the creation and implementation of didactic materials will have through the development of pedagogical practices carried out by teachers in primary school from the teaching of the T&I area. In addition, it will seek to interpret the perceptions, experiences and realities of teachers through a survey validated by experts and the performance of content analysis.

4.4 Population, Sample and Sampling / Study Units and Research Subjects

The research was developed in a rural educational context, where teaching faces challenges related to limited access to technological resources, connectivity and teacher training. In this scenario, primary school teachers were considered as the main units of study, since they are the agents that articulate pedagogical practice with technological mediation within the classroom.

In coherence with the qualitative approach, the study does not seek to generalize the results to a broad population, but to deepen the understanding of the experiences and perceptions of teachers who use technology-mediated teaching strategies. For this reason, the selection of participants was carried out intentionally or for convenience, choosing those subjects that met relevant characteristics for the phenomenon investigated:

- Work as teachers in rural institutions of basic primary education.

- Have implemented or be implementing didactic strategies with technological support.
- Be willing to share their experiences and pedagogical reflections.

The number of participants was determined based on the principle of theoretical saturation, that is, subjects continued to be incorporated until the information collected began to show recurrence in the emerging categories. This criterion guaranteed the depth of the analysis and the interpretative richness of the results.

The qualitative sampling allowed us to capture the diversity of experiences of rural teachers, considering variables such as the institutional context, professional career, degree of access to technology and the teaching strategies used. Thus, the sample was configured as a set of representative cases of the phenomenon, rather than as a statistical proportion.

With respect to the sample, a non-probabilistic sampling was used for convenience. According to Izcara (2007) and Monje (2011), this type of sampling is distinguished by its scientific rigor, which lies in the definition of the methodological design that allows responding to the purposes of the research, and not necessarily in the selection of the sample. Such rigour implies the existence of justified criteria in relation to the objectives pursued.

The sample was made up of volunteers, that is, lucid, reflective people willing to provide information to the researcher.

In the diagnosis stage, it was planned to apply a survey to 59 teachers from schools under the unitary classroom modality in the Central province of Boyacá; however, 33 teachers from eight municipalities participated voluntarily.

Based on the answers obtained, the need to design a training proposal was identified. Subsequently, in the product validation stage, two educational institutions that met the eligibility criteria were selected: the Environmental Technical Educational Institution of Sotepanelas, in the municipality of Motavita, and the Integrated Educational Institution of Cómbita.

For the evaluation of the relevance, applicability and impact of the proposal, 10 teachers who worked under the unitary classroom model collaborated. This decision was made due to limitations of economic resources, time and operational conditions, as well as for the purpose of carrying out controlled piloting.

4.4.1 Population and/or Description of the Research Scenario

The study was carried out in rural educational institutions belonging to areas with diverse geographical and socioeconomic characteristics, which allowed us to understand the impact of the context on technology-mediated pedagogical practice. These educational spaces are characterized by limited infrastructure, intermittent connectivity, and a strong link between the school and the community, factors that directly influence the dynamics of the educational process.

The teachers who participated in the study work with multigrade groups, where the heterogeneity of the student body requires flexible and creative pedagogical strategies. In this sense, the incorporation of technological tools – although restricted by the availability of resources – has generated opportunities for didactic innovation and strengthening student motivation.

The research scenario is also characterized by its cultural and social value, since the rural school plays a fundamental role as a community meeting center and a space for comprehensive training. Therefore, the description of the environment is not limited to the physical or institutional, but incorporates the human and relational dimension that configures the educational process.

The choice of this context responds to the purpose of making visible the realities and potentialities of rural education, recognizing that the didactics of technology can act as a transformative axis that contributes to closing educational gaps and building a more equitable and relevant education.

5. Analysis and interpretation of the results or findings

In this section, the findings found from the purposes that were defined for the development of this doctoral thesis are recorded. Likewise, documentary analysis techniques, information collection through questionnaires and interviews were applied. The techniques used allowed us to collect sufficient information to define the study categories.

5.1 Data Analysis Techniques or Findings

According to (Paz, 2018), there are a variety of documents with similar information that must be analyzed. Therefore, for the analysis of information, inference and interpretation processes were used from the categories established in the study. Although it was an intuitive method, the objectivity of clear procedures prevailed. Therefore, the documents were analyzed in their entirety, not isolated sections, assessing the discursive structure of the texts.

The method used was constant comparison (CCM), according to (Osses et al., 2006) this method allows the data collected to have no mathematical interactions. It is important to note that the data analysis techniques were under the phenomenological design, since (Salgado, 2007) assures that these designs allow the collection of subjective and individual experiences of the participants. In addition, it answers the question of what is the essence of the experience lived either individually or in a group in a community with respect to a phenomenon? Therefore, the inquiry of this design focused on the experience of the participants. Figure 10 presents the phases of the foundation of this methodological design:

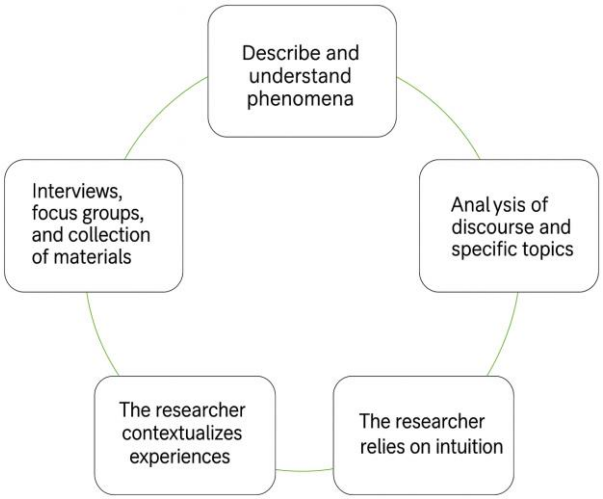


Figure 1. Fundamentals of phenomenology

Note. Adapted from Qualitative Research: Designs, Evaluation of Methodological Rigor and Challenges (Salgado, 2007)

Taking into account the above premises, a first survey was implemented in which information was collected from the experiences lived by the teachers. Likewise, to expand the information obtained, an interview with experts was carried out and complemented with the analysis of documents.

Regarding the processing of qualitative data, programs such as Atlas.ti, NVivo and MAXQDA were used, which facilitated the description, interpretation and generation of theories. As part of the process, categories and subcategories of the study were identified, among them, Didactics of Technology,

pedagogical practice in the unitary classroom and training proposal, didactic material, didactic strategy, emerging technologies, among others.

In addition, concepts were coded through semantic networks, diagrams and explanatory graphics that would allow responding to the purposes by recognizing valuable answers given by the teachers who guide the area of Technology and Computer Science in the unitary classroom and the contributions made by the three experts in the focus group. Likewise, groups of codes were made and the content was elaborated from the explanation of each of them, taking into account the voices and expressions given by the participants in the research. This allowed us to generate categories that enriched the contextualized findings.

5.2 Data Processing (quantitative) and/or Triangulation Process of Findings (qualitative)

For the data triangulation process, Taylor & Bogdan, 2002 suggest data processing based on three moments, as shown in the following illustration

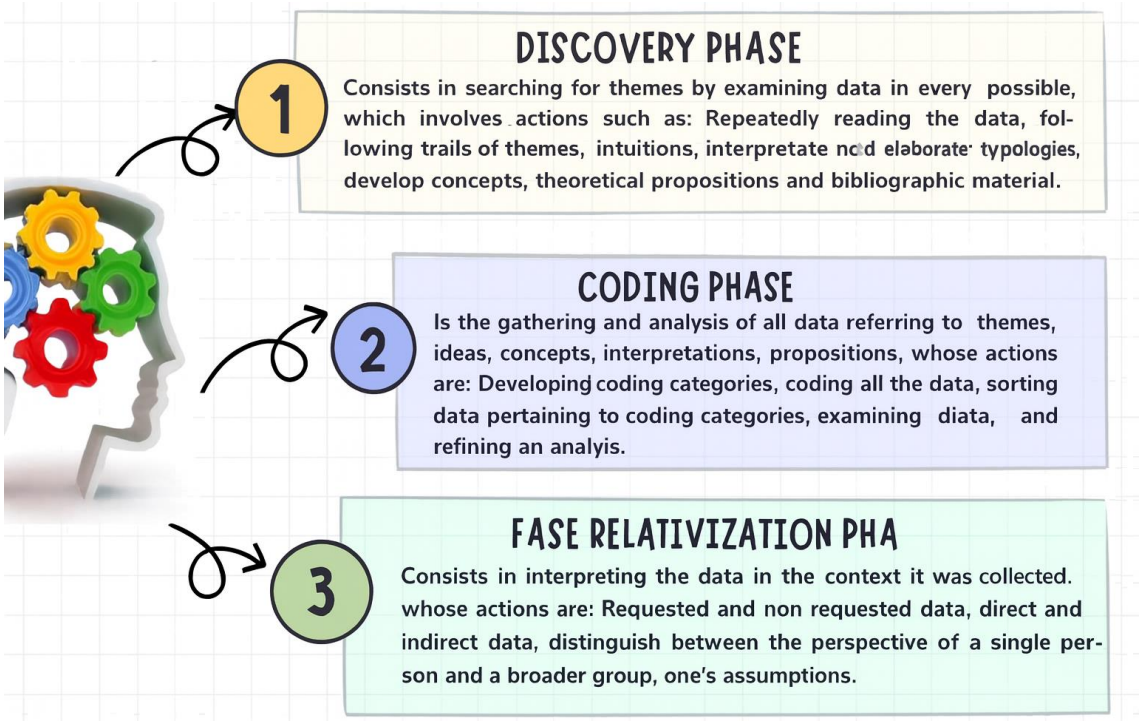
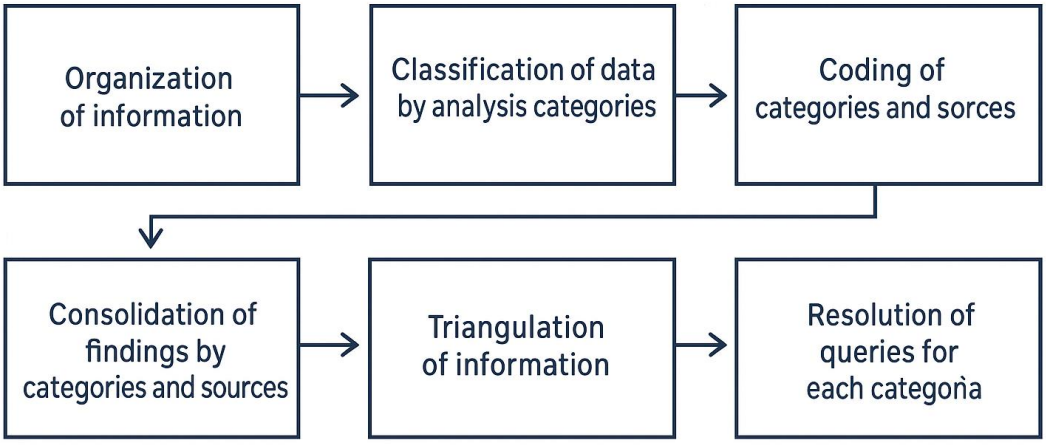


Figure 2. Datea processing

Note. Adapted from Introduction to Qualitative Research Methods (Taylor & Bogdan, 2002)

In this regard (Huberman & Miles, 2000) propose three sub-processes linked to the phases proposed by Taylor and Bogdan, among them are: a-) the reduction of data that are oriented to the elaboration of a conceptual framework, define questions, select the instruments for data collection and the participants; b-) the presentation of data, allow a reflective look at the researcher through presentations such as structured summaries, diagrams, sketches, networks, among others; and finally, c-) the elaboration of conclusions, in this section tactics are used that allow extracting comparisons, making contrasts to the pointing out of patterns, themes, triangulation, searches for negative cases, among others.

On the other hand, (Amezcua & Gálvez, 2002) assure that data triangulation is the best process for analyzing data, since, triangulating, it allows different strategies to be used to study a problem, among them are: different subjects can answer the same questions, different researchers can make an analysis, different theories are used to explain the same phenomenon.



Source: Own elaboration based on Stringer (2007) and Hernández et al. (2014).

Figure 1. General process and interpretation of findings

According to the previous contextual framework, this process was carried out to respond to the three specific purposes from the initial application of a survey to elementary school teachers who guide the T & I area in the Central Province of Boyacá and who were under the unitary classroom modality. For data collection, a survey was designed that consisted of the following subcategories: Infrastructure, area plan, didactic material, technological thinking, technology didactics, T&I didactic strategies, emerging didactic strategies, pedagogical practice, inclusive education. The different findings are presented below:

Didactics of technology from the unitary classroom

From the perspective of (Merchán & Leguizamón, 2022), Technology didactics refers to the set of strategies, pedagogical processes, and models designed to develop different types of thinking, such as technological, critical, creative, systemic, computational in students. In addition, it involves learning experiences through problem solving, artifact construction, critical reflection on technology and social use through active and collaborative scenarios. However, for teachers who guide the area of T&I in a unitary classroom in the central province of Boyacá, in the category of Technology Didactics, it was found, which refers to an educational approach, a set of principles, methods, strategies and pedagogical resources that have the purpose of teaching the fundamentals, applications and tools of education in Technology. The DT must include active methodologies, innovative and didactic strategies such as project-based learning, gamification, problem solving, the use of digital platforms, simulators and technical skills.

Likewise, the DT in the framework of the teaching of topics in Technology and Computer Science must have practical methods that encourage autonomous and collaborative work in children, as well as promote contextualized technological solutions. Not only active methodologies should be encouraged, but also emerging technologies such as programming, robotics, artificial intelligence, among others. As for the dynamic and creative resources and tools that should be used, there are: virtual learning objects, virtual learning environments, virtual learning environments and simulators, tutorials, as represented in the following illustration

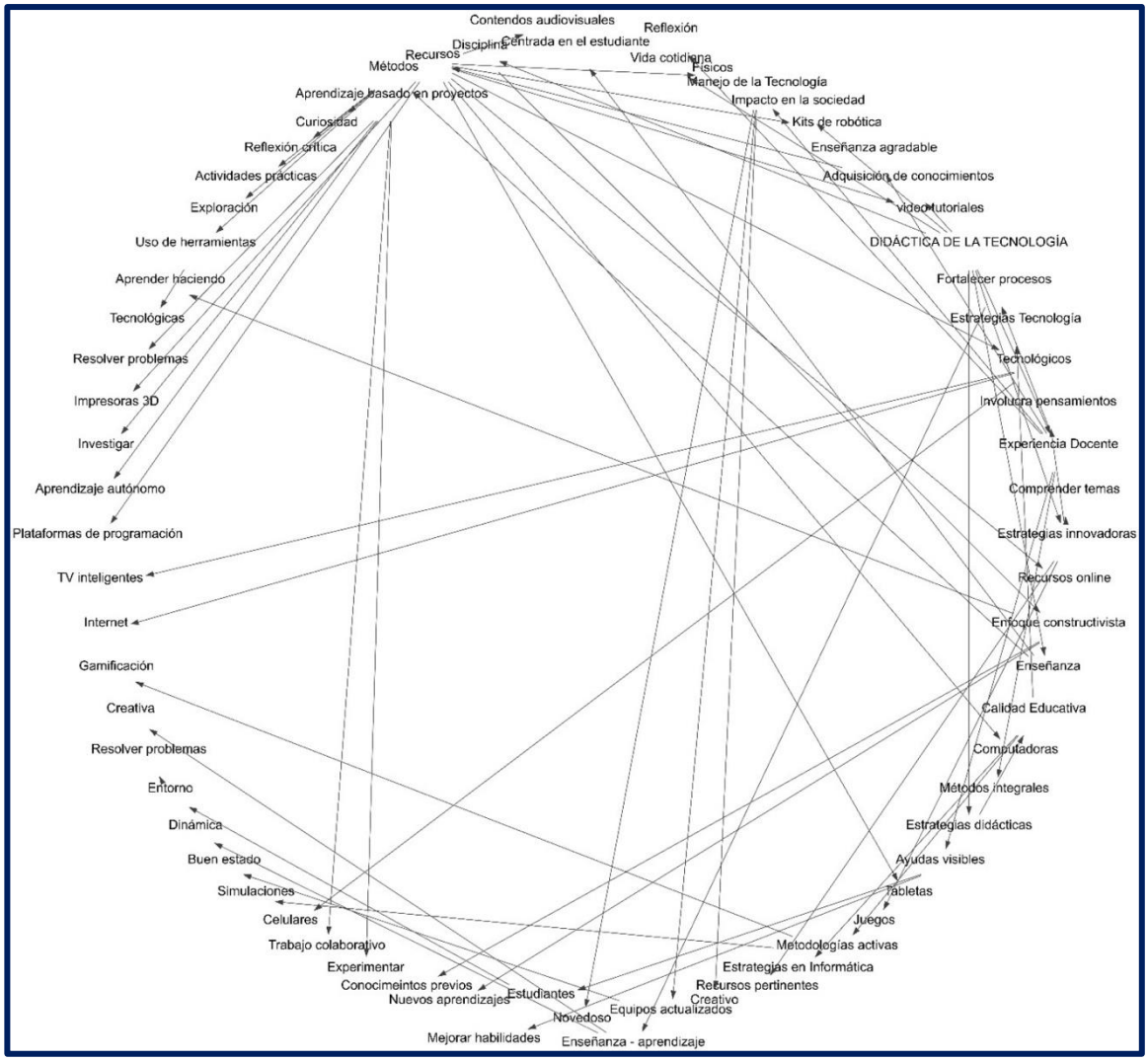


Figure 3. Category Technology Didactics from the Unitary Classroom. In original language: Spanish.

Note. Contributions to the Didactics of Technology from the Teaching Experience in a Unitary Classroom of the Central Province of Boyacá (2025)

Continuing with the development of the category of DT, (Merchán et al., 2019) agrees with teachers that orienting the area of Technology and Computer Science in a unitary classroom must have educational experiences supported by active methodologies, emerging technologies, project work and the use of different virtual platforms for learning. On the contrary, (Orta, 2018) considers that technology education continues to be a didactic challenge in what and how to teach the area, therefore, it requires appropriate didactic strategies, learning sequences and real experiences.

It is important to note that DT in the unitary classroom in the Central Province of Boyacá reflects a clear connection with constructivist learning, since (Verde, 2016) it ensures that students are not passive recipients but protagonists of their knowledge, which makes them have a deep acquisition of what they have learned. However, (Piaget, 1952) considers that the constructivist approach in the unitary classroom model is valuable since it seeks that children are guided to enhance technological skills adapted to their learning rhythms.

These approaches are supported by the focus group interview with experts. In the first place, Dr. Claudia Betancur considers that teaching Technology and Computer Science in elementary school should focus on the development of computational thinking, basic digital literacy, basic programming and artificial intelligence from the development of critical thinking, in addition to integrating creativity and digital ethics.

Betancur's contribution complements what was found in the fieldwork, where it was identified that teachers in their pedagogical practice recognize the importance of teaching students technology education in a reflective and sustainable way.

From the position of Dr. Silvina Orta, the didactics of Technology must contemplate three dimensions in teaching, which are: technological means understood as artifacts, systems, machines and tools, technological processes and social construction. Likewise, he considers that Technology Education cannot be taught only as a tool but as a cultural construction with comprehensive teacher training.

In the same vein, Dr. Luis Bayardo Sanabria expands the interview by indicating that a teacher who guides the area of T & I must have resources, workshops or laboratories that do not limit the teaching of the area. This coincides with what was expressed by the teachers, who pointed out the need for the national government to invest in technological infrastructure such as modern computers, tablets with good storage capacity and internet access.

As for all the interviewees, they agree that the Didactics of Technology does not depend only on the effort made by the teachers who teach the area of T&I, but requires a commitment on the part of the educational institutions to meet the needs of the area. However, Dr. Silvina Orta recommends that, if schools have resources or teaching materials, they should be put at the service of students, not stored and appropriated by teachers.

Didactics of technology and pedagogical practice: strategies, resources, methodologies and evaluation

In the next section, Technology didactics can be understood as a set of strategies, resources, methods and pedagogical approaches used in order to teach education in Technology or in the case of Colombia, the area of Technology and Informatics. According to the participating teachers from the central province of Boyacá, DT is not limited only to the use of software or technological devices, but seeks to bring students closer in a creative, active and contextualized way, to the development of thinking skills, problem solving and the relevant use of technology. Likewise, pedagogical practice in a unitary classroom context has been characterized by having several grades in the same classroom and the attention given to students is simultaneously. This type of scenario is mostly lacking in technological resources, therefore, it requires teachers to have a high capacity to innovate their way of teaching.

The teachers who guide the area of T&I in unitary classrooms agree that their pedagogical practice (PP) must be intervened by the availability of physical and technological resources, such as computers, tablets, smart TVs and cell phones, which are in good condition. Likewise, these practices must be focused on "learning by doing" and supported by different didactic strategies such as gamification, visual resources, simulators, project-based learning, a platform for teaching programming, active methodologies, among others. This view coincides with (Domínguez, 2021) who proposes technological mediation from the maker culture that allows pedagogical practices to be transformed and creative processes to be integrated and thought out in the context and even in rural schools.

A recurring response from teachers was the need for more technological resources, continuous qualification, and institutional support, which coincides with (Benavente, 2021), who in his research on the CODI program stated that digital competencies improve teachers' skills, especially in content creation. This is intertwined with what is expressed by teachers in rural contexts, who recognize the valuable impetus of ICT in pedagogical work, but at the same time, manifest the difficulties it has in terms of infrastructure and connectivity

Regarding the strategies used by teachers in rural areas, it was evident that these are defined by the context and resources available to the educational institution. They also stated that they use visual aids (images, diagrams and videos), exhibitions, games, dynamics, manual activities, manipulatives and basic tools. However, in order to innovate their pedagogical practices, teachers consider that it is important to have activities that encourage active methodologies, to assemble and disassemble games such as legos, to promote more interaction with videos,

to contrast with objects, to project transversal activities, to promote the use of educational platforms, to have greater availability of learning guides, research is encouraged, the use of emerging technologies is included in the curriculum, practices are continuously developed on the computer, among others, as evidenced in Figure 4

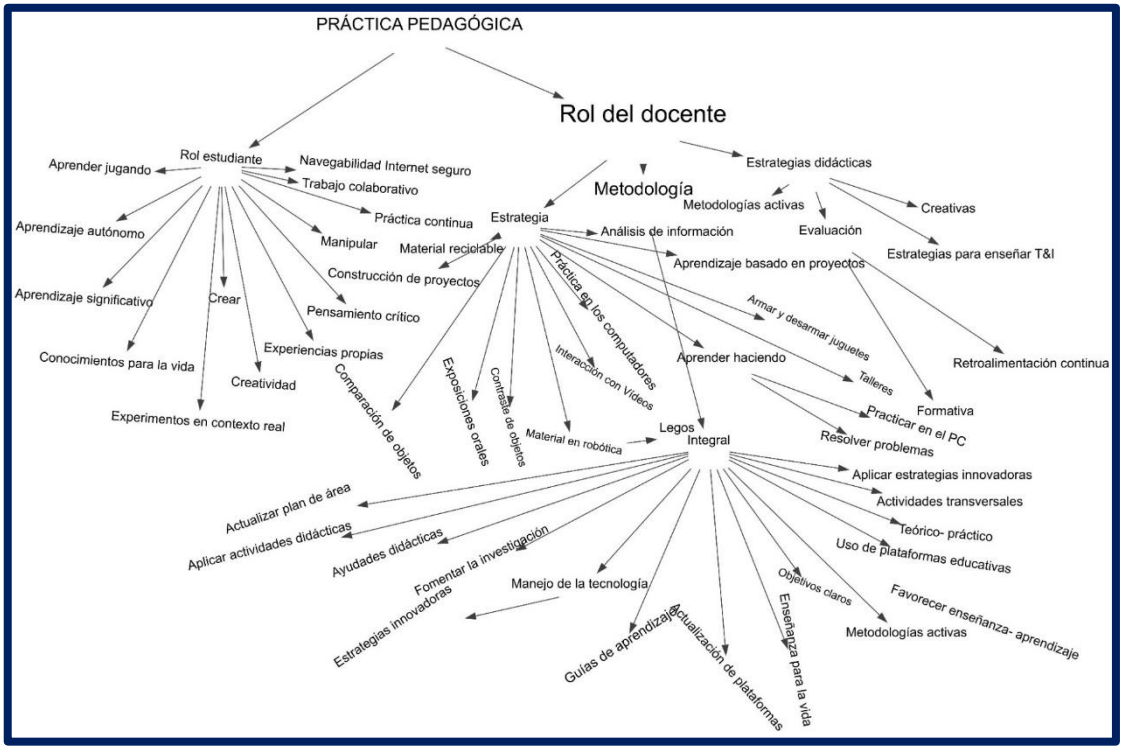


Figure 4. Didactics of technology and pedagogical practice: strategies, resources, methodologies and evaluation. In original language: Spanish.

Note. Contributions to the Didactics of Technology from the Teaching Experience in a Unitary Classroom of the Central Province of Boyacá (2025)

The contributions obtained by the experts in the focus group coincide with the perceptions of elementary school teachers in the Central Province of Boyacá. In the first place, Dr. Claudia Betancur highlights the importance of articulating the teaching of the T&I area, project-based learning, experiential learning, gamification, design-based learning, the development of critical thinking in the face of the use of technology and reflecting on the human-social impact of technological developments. since they favor interdisciplinarity, contextualized work and innovation.

Secondly, Dr. Luis Sanabria, highlights the importance of designing didactic strategies that promote collaborative learning, observational learning and ubiquitous learning in order to promote problem solving in students and that teaching goes beyond the classroom, taking advantage of the use of technological resources. Finally, Dr. Silvina Orta believes that technology education should promote active strategies that are student-centered and promote cooperative work, strategies that favor the use of simulators, strategies that have to do with the design and redesign of technological artifacts, construction and manufacturing strategies as a bridge to understand technical processes, strategies that dynamize the comparative analysis of processes – artifacts, strategies that develop learning based on experience, collaboration, projects and play; all of the above, with the purpose of consolidating knowledge from constructivism and critical thinking.

The results show that DT and PP are related, especially in rural contexts and in the unitary classroom. DT is not limited to the use of devices, but is configured as a set of pedagogical approaches, strategies, active methodologies that stimulate the development of thinking skills, problem solving and critical

appropriation, therefore, the creativity of the teacher must be present in the creation of didactic material. As for pedagogical practice, it becomes a space that comes to life, is contextualized and transformed, allowing the teaching of the area of Technology and Computer Science to respond to what the MEN requires within the framework of the Curricular Guidelines for the area of Technology and Computer Science in elementary and middle school.

Table 1Triangulation between Theoretical Framework, Methodology, Results and Discussion

Analytical Category	**Theoretical Basis**	**Empirical Evidence (Results)**	**Interpretation / Theoretical Triangulation**	**Methodological or conceptual reference**
Social innovation	Social innovation involves creating new forms of organization and collective action that respond to local needs through creativity and collaboration.	It was identified that communities have a high potential for self-management and collaboration, activated when there are adequate spaces for participation.	Practice confirms that social innovation arises from the interaction between actors seeking collective solutions (Moulaert & Nussbaumer, 2013). Participation transformed citizens from passive recipients to protagonists of change.	Moulaert & Nussbaumer (2013); Mulgan (2010).
Community Engagement	Participatory planning incorporates the community in all phases of the process, from diagnosis to evaluation, ensuring legitimacy and sustainability.	The workshops, focus groups and interviews showed community willingness to collaborate and dialogue, generating spaces of trust.	Evidence confirms that social cohesion is strengthened when people recognize themselves as part of a common project (Albuquerque, 2012). The participatory methodology is validated as a means of empowerment.	Monje (2011); Albuquerque (2012).
Sustainable territorial development	Endogenous territorial development is based on local resources, cultural identity and	Productive micro-projects and the recovery of public spaces strengthened identity and the	The findings show that territorial development does not depend only on investments, but	Albuquerque (2012); Bouchard (2016).

	horizontal governance.	sense of belonging.	also on social and cultural capital, confirming the thesis of sustainability from the community base.	
Social cohesion	Cohesion is built through cooperation, trust and shared identity within a territory.	Participants reported improved communication, collaboration, and pride in their community.	It coincides with the theories of Wenger (1998), who points out that communities of practice generate shared learning. Social cohesion is a direct result of social innovation.	Wenger (1998); Van Manen (2003).
Education and institutional management	Organizational innovation in educational institutions promotes collective learning and participatory curricular updating.	61% of the institutions updated their area plans according to MEN guidelines (2022).	This change reflects an organizational learning process (Bouchard, 2016) and pedagogical leadership based on co-responsibility and collaboration.	Bouchard (2016); MEN (2022).
Phenomenological-hermeneutic approach	It allows us to understand the subjective meanings that the actors give to their experience within the context.	The narratives of teachers and leaders show personal transformation: self-confidence, commitment and a sense of belonging.	The interpretation of experiences, according to Van Manen (2003), converts experience into socially significant knowledge.	Fuster (2018); Van Manen (2003).
Participatory methodology	Qualitative interpretive research seeks to understand reality from the voices of the actors.	Surveys, interviews and focus groups were applied to capture the perception of the participants.	The triangulation of methods and sources increases the validity of the study (Huberman & Miles, 2000).	Hernández et al. (2014); Huberman & Miles (2000).
Educational innovation	Innovation in education requires reflection,	The teachers adapted their practice to local	It confirms the situated learning model proposed	Martínez (2013); Mulgan (2010).

	contextualization and teacher co-responsibility.	realities, developing their own strategies.	by Martínez (2013), where knowledge is created in social practice and is not received vertically.	
Social sustainability	Sustainability implies continuity, autonomy and local ownership of processes.	Achievements are maintained thanks to the inter-institutional network between schools, families and local actors.	Cooperative governance ensures the continuity of social change (Moulaert & Nussbaumer, 2013). It is necessary to formalize these processes in public policies.	Moulaert & Nussbaumer (2013); Mulgan (2010).

6. Discussion

The findings of this research confirm that Technology Didactics (DT) plays a fundamental role in the transformation of educational activities, especially in rural contexts of basic primary education. In line with the main objective of examining how DT is integrated into teaching practice as a contribution to rural education, the findings indicate that this area not only facilitates the incorporation of technological tools, but also promotes innovative processes in teaching, fosters student independence, and encourages teachers to reflect on their educational practice. However, the results also reveal that the adoption of DT faces obstacles related to scarce resources, limited connectivity, and the need for constant training.

With respect to the first specific purpose, which aimed to characterize the evolution of Technology Didactics in the educational practice of the unitary classroom, the findings show that rural teachers value technology as a resource that strengthens learning. However, the use of DT is limited due to material conditions and the lack of clear institutional guidelines to guide its implementation. Despite these barriers, the inventiveness of educators to adjust active methodologies, use the resources available in their environment and create innovative teaching experiences is highlighted, which denotes a remarkable pedagogical resilience.

The findings also indicate that educators see technology not only as a tool, but as an opportunity to renew their educational practices, making them more participatory, meaningful, and connected to the reality of their students. This discovery coincides with the ideas of Sancho-Gil (2018) and Area Moreira (2020), who stress that DT must go beyond technical teaching and become a reflective process that promotes critical thinking and autonomous learning. Therefore, DT is not limited to the use of digital tools, but involves a reconfiguration of the traditional roles of the teacher and the student.

In addition, the results indicate that, in the rural context, technology-mediated pedagogical practice acts as a driver of active learning. The teachers interviewed pointed out that the incorporation of technological resources, even in their most elementary form, stimulates students' curiosity and participation. These findings confirm that DT has a motivating effect and facilitates the connection between school knowledge and the student's daily life, which is essential in communities where the school also plays a social and cultural role.

As for the second specific purpose, which sought to establish the relationship between Technology Didactics and pedagogical practice, a dynamic and complementary interaction was identified. While DT provides the conceptual and methodological foundations, pedagogical practice offers the necessary context to adapt them to the resources, conditions, and characteristics of each educational environment. This relationship demonstrates that DT cannot be understood in isolation, but as an integral part of the training process that guides teaching, curricular planning and learning assessment.

The results show that educators who manage to combine technological didactics with active methodologies, such as project-based learning, teamwork and gamification, have a greater impact on the motivation and performance of their students. This phenomenon is due to the fact that these strategies encourage participation, logical reasoning and creativity, which are fundamental for the advancement of technological skills. In this way, pedagogical activity is transformed into an area of testing and innovation that turns rural classrooms into collaborative and contextualized learning spaces.

However, a continuous conceptual fragmentation between the areas of "Technology" and "Computer Science" was also detected, which causes confusion in the curricula and methodologies used. This reality coincides with the observation of Orta (2018), who indicates that the lack of clarity in differentiating these two areas limits their teaching and weakens the didactic coherence of the curriculum. To close this gap, it is necessary for educational institutions to foster a holistic understanding of technology as a scientific, social and practical knowledge, to prevent their teaching from being limited to instrumental skills or the use of elementary software.

With respect to the third specific purpose, which seeks to establish criteria for a training proposal that improves the teaching of the area, the results provided essential guidelines. Among them, the urgency of strengthening teacher preparation in the pedagogical use of ICTs, the development of teaching materials adapted to the context, and the creation of training programs that integrate the rural reality with the technological advances of the world are highlighted. These guidelines address the challenge of adapting educational innovation to contexts with limited resources, without losing sight of equity, inclusion, and social relevance.

In addition, the educators involved stressed the need to have spaces for pedagogical exchange and collaboration networks among colleagues, where they can share experiences, resources and ingenious solutions to the challenges of technological education. This idea is in line with UNESCO's proposal (2024), which highlights the importance of teamwork and teacher-to-teacher learning as a strategy for continuous professional development and the improvement of educational practices in rural areas.

The analysis of the information allowed us to identify three transversal axes in technology-mediated pedagogical practice: didactic strategies, the transformation of teaching work and the perceived effects on students. These axes demonstrate that technological didactics, when implemented consciously, produces relevant benefits in the motivation, concentration and critical thinking of students. It also promotes more inclusive and participatory learning, where the student is recognized as an active agent in his or her own learning process.

From a critical approach, the findings suggest that Technology Didactics should be considered a cultural and social process, rather than a mere set of techniques. Teachers in rural areas, by integrating technology into their work, not only raise the quality of education, but also promote the appropriation of knowledge, community identity, and the sustainability of learning. Consequently, DT is consolidated as a tool for equity, inclusion and social transformation in the educational field.

On the other hand, the research has relevant implications for educational policy and initial teacher training. The findings suggest the urgency of implementing public policies aimed at improving rural technological infrastructure, ensuring connectivity and guaranteeing the training of teachers in digital and didactic skills. Without these components, the incorporation of technology in the classroom runs the risk of being superficial or uneven, perpetuating existing educational gaps.

Finally, this discussion allows us to affirm that Technology Didactics, when incorporated in a critical, reflexive and contextualized way, becomes a transformative element of rural education. Its application not only modernizes teaching methods, but also strengthens student participation, energizes teaching work and contributes to the fulfillment of the educational purposes of quality, equity and sustainability established by international organizations. In short, DT represents a bridge between pedagogical innovation and educational justice, promoting meaningful learning that responds to the realities and needs of the rural context.

Table 2. Synthesis of articulation between theoretical dimensions and empirical results

Theoretical dimension	Key empirical evidence	Interpretation	Projection or impact
Social innovation	Creation of collaborative networks between teachers and the community.	It confirms that innovation emerges from collective intelligence and not from external intervention.	Basis for replicating participatory learning models.
Community Engagement	Increased attendance at meetings and workshops, improved neighborhood communication.	Participation generates a sense of belonging and co-responsibility.	Strengthening social capital and local governance.
Social cohesion	Improved trust between actors, reduction of local conflicts.	Cohesion arises as a result of joint action and mutual recognition.	Consolidation of the social fabric.
Transformative Education	61% of institutions updated their area plan according to MEN guidelines.	Education becomes a space for organisational innovation.	Increased institutional autonomy and teacher leadership.
Territorial development	Recovery of public spaces and productive microprojects.	Sustainable development is built from local resources.	Integration between social welfare and environmental sustainability.

7. Conclusions

The research confirmed that Technology Didactics (DT) acts as a transformative component in the teaching of basic primary education in rural areas. It offers a methodological approach that combines pedagogical innovation with inclusion and equity in education. In accordance with the general objective of the study, it is concluded that DT should not be seen only as a group of techniques or tools, but as a reflective educational practice that fosters critical thinking, creativity and problem-solving in specific contexts.

First, it was observed that rural teachers have a broad vision of DT, understood as a way to dynamize learning and connect students with relevant experiences that involve their environment, culture, and technology. However, the analysis showed structural limitations, such as lack of connectivity, adequate teaching materials and continuous training, elements that limit the full implementation of innovative strategies. Despite this, educational practice highlights the resilience and commitment of rural educators, who, through creativity, manage to navigate between the conditions of the environment and the demands of today's education.

In relation to the first specific objective, it is concluded that the promotion of DT in educational practice in the unitary classroom implies a change in the traditional roles of the teacher and the student. The teacher serves as a guide, counselor and

facilitator of experiences, while the student takes an active role in the construction of his or her own knowledge. This interaction promotes collaborative and autonomous learning that, despite facing material shortages, is based on the ethical and professional commitment of teachers in rural areas.

With respect to the second specific objective, it was determined that there is a reciprocal interaction between DT and educational practice. The former guides the design of methodological strategies, while the latter provides the experience and context necessary to give meaning to those strategies. This relationship supports that DT is developed from reflective practice and is strengthened through the exchange between theory, experience and the educational community.

With regard to the third specific objective, criteria were identified that guide an appropriate training proposal: the continuous updating of teachers, the integration of active methodologies (such as gamification, project-based learning and maker culture), and the creation of teaching materials adjusted to the rural reality. These criteria not only meet the needs of teachers and students, but also encourage the creation of inclusive and sustainable learning environments.

In general, it was shown that technological mediation in rural contexts favors the development of twenty-first century competencies, such as problem solving, systems thinking, and digital literacy, in accordance with the UNESCO (2024) and ISTE (2017) guidelines. The inclusion of these competencies in the rural classroom marks a step towards a more equitable and relevant education, where technology becomes a tool to improve educational quality and not an objective in itself.

Likewise, the study revealed that Technology Didactics is configured as an area of social construction where innovation, culture and ethics meet. Teaching in this field should foster a critical understanding of how technology impacts society, as well as respect for diversity and responsibility towards sustainability. In this context, it is reaffirmed that Technology Didactics has a humanizing potential that goes beyond the technical and supports the integral development of rural communities.

Another important conclusion concerns the role of educational institutions and public policies. Research indicates that individual teachers' efforts should be complemented by institutional strategies that ensure access to resources, infrastructure, and continuing education. Collaboration between the school, the community and the State is essential to establish a pedagogical practice that fits the challenges of digital education.

Likewise, the findings suggest that promoting Technology Didactics in rural education requires an interdisciplinary perspective that includes social sciences, pedagogy and technology. This combination helps to create meaningful learning adapted to the context, capable of addressing local problems and facing innovation at a global level.

In addition, the study shows that the Escuela Nueva pedagogical model continues to be a relevant reference for education in rural environments, as it favours active learning, collaboration and attention to diversity in learning rhythms and styles. The integration of Technology Didactics in this model revitalizes its principles and adapts them to the challenges of the digital age.

Finally, it is concluded that Technology Didactics, when understood as an active, reflexive and contextualized practice, has the capacity to transform rural education. Its conscious use not only improves teaching and learning processes, but also reinforces the professional identity of the teacher, promotes equity and helps reduce technological gaps between urban and rural areas.

In summary, the research presents a renewed perspective on technological education in rural contexts, underlining the importance of reconsidering teacher training, updating curricula and encouraging the creation of pedagogical environments where technology is used as an instrument to promote social justice, educational inclusion and the formation of responsible digital citizenship.

Bibliographic references

1. Amador, S. P. (2021). *Use of ICT and teaching performance, Santiago de Cao, 2020* [Doctoral thesis, César Vallejo University]. https://repositorio.ucv.edu.pe/bitstream/handle/20.500.12692/56549/Amador_MSP-SD.pdf?sequence=1&isAllowed=y

2. Area, M. (2019). *Didactic materials and technological mediations*. University of La Laguna.

3. Ávila, J. (2017). *Contributions to the quality of rural education in Colombia, Brazil and Mexico: significant pedagogical experiences*. Pedagogical and Technological University of Colombia.

4. Basabe, L. (2021). *Education and technology: challenges of teaching practice in rural contexts*. National University of La Plata.

5. Benavente, A. (2021). *Digital teaching skills and educational content creation: evaluation of the CODI programme*. University of Chile.

6. Busso, M., García, J., & Ortega, D. (2017). *Competencies for the 21st century: critical, reflective and systemic thinking*. Ibero-American Journal of Education, 73(1), 45–60.

7. Colbert, V., & Gaviria, C. (2017). *The New School in Latin America: lessons learned and current challenges*. UNESCO.

8. Cuadros, J. (2015). *The new school in Colombia: history and projection of the multigrade model*. Ministry of National Education.

9. Domínguez, J. (2021). *Maker culture as pedagogical mediation in rural technological education*. Revista Educación y Pedagogía, 33(85), 155–168.

10. Hernández, R. (2024). *The didactics of technology and the reflective practice of the rural teacher*. UPTC Publishing.

11. Hernández, R., Fernández, C., & Baptista, P. (2014). *Research Methodology* (6th ed.). McGraw-Hill.

12. Law 115. (1994). *General Education Law*. Congress of the Republic of Colombia. https://www.mineducacion.gov.co/1621/articles-85906_archivo_pdf.pdf

13. Luján, M., & Salas, F. (2009). *Theoretical approaches and definitions of educational technology in the twentieth century*. *Journal of Education*, 9(2), 1–29. https://www.redalyc.org/articulo.oa?id=44713058004

14. Martínez, V. (2013). *Research paradigms: multimedia manual for the development of research works*. University of Sonora.

15. Mejía, L. G. (2013). *The didactic guide: basic practice in the teaching-learning process and in knowledge management*. *Master in Learning Technologies*, 18, 66–73.

16. MEN. (2017). *Resolution 18583 of 2017*. District Legal Secretariat of Bogotá. https://www.alcaldiabogota.gov.co/sisjur/normas/Norma1.jsp?i=71384

17. MEN. (2022). *Didactic guidelines for the teaching and learning of Technology and Informatics*. Ministry of National Education. https://www.colombiaaprende.edu.co/sites/default/files/files_public/2022-11/Orientaciones_Curricures_Tecnologia.pdf

18. Merchán, B. (2018). *Guidelines for the use of didactic strategies in the development of technological thinking*. UPTC Publishing.

19. Merchán, C. A., & Leguizamón, M. (2022). *Technological thinking through educational robotics in basic education*. UPTC Publishing.

20. Merchán, C. A., et al. (2019). *Active methodologies and emerging technologies in the teaching of Technology and Computer Science*. UPTC Publishing.

21. Monje, C. A. (2011). *Quantitative and qualitative research methodology: a practical guide*. Universidad Surcolombiana.

22. Orta, S. (2018). *Technology education in Argentina: didactic challenges and cultural construction*. National University of Córdoba.

23. International Labor Organization [ILO]. (2017). *World Report on Education and Decent Work*. Geneva: ILO.

24. Piaget, J. (1952). *The construction of the real in the child*. Fondo de Cultura Económica.

25. Poveda, D., Roberto, D., & Otálora, B. (2017). *Didactics of Technology and Informatics for basic education through projects*. *Traces and Faces of Knowledge*, 2, 34–41. https://repositorio.uptc.edu.co/server/api/core/bitstreams/dd90207d-3712-4215-8282-88d41b4854c2/content

26. Quintanilla, M. (2005). *Technology: A Philosophical Approach and Other Essays on the Philosophy of Technology*. Fondo de Cultura Económica.

27. Romero, G. (2009). *The use of didactic strategies in class*. *Digital Journal Innovation and Educational Experiences*, 23. https://archivos.csif.es/archivos/andalucia/ensenanza/revistas/csicsif/revista/pdf/Numero_23/GUSTAVO_ADOLFO_ROMERO_BAREA02.pdf

28. Roselló, M. R. (2005). *General Didactics vs. Specific Didactics: A Round Trip*. *Educació i Cultura*, 18, 133–142.

29. Saavedra, C. E. (2020). *Disciplinary integration of ICT in the training of educators for the area of Technology and Informatics at the UPTC (1994–2015)* [Doctoral thesis, Pedagogical and Technological University of Colombia].

30. Salas, F. (2002). *Epistemology, education and educational technology*. *Revista Educación*, 26(1), 9–18. https://revistas.ucr.ac.cr/index.php/educacion/article/view/2873/2793

31. Salazar, J. (2023). *Didactic Journey: A Theoretical-Practical Approach in Educational Processes*. *Dialogus*, 11, 134–146. https://doi.org/10.37594/dialogus.v1i11.817

32. Salgado, A. C. (2007). *Qualitative research: designs, evaluation of methodological rigor and challenges*. *Journal of Psychology of the University of San Martín de Porres*, 13, 71–78.

33. Sanabria, L. B. (2020). *Teaching practice and technological resources: implications for meaningful learning*. National Pedagogical University.

34. Serrano, J. M., & Pons, R. M. (2011). *Constructivism today: constructivist approaches in education*. *Electronic Journal of Educational Research*, 13(1), 1–27.

35. Trisca, A. (2008). *Technology Education: Fundamentals, Methods, and Strategies*. National University of Córdoba.

36. UNESCO. (2024). *Education and technology for sustainable development: guidelines for teachers in the twenty-first century*. Paris: UNESCO.

37. Verde, D. (2016). *Constructivist learning in rural schools: theory and practice*. National Autonomous University of Mexico.