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Evaluation of Teachers' Digital Competencies in Colombia: A Qualitative Approach to the Integration of ICT in Education

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Abstract

This qualitative study explores Information and Communication Technology (ICT) competencies among teachers in Colombia, based on the guidelines set by the Ministry of National Education. It investigates how these skills are perceived and applied in the current educational context, highlighting their importance for the professional development of educators. Using an interpretive approach, semi-structured interviews were conducted with 53 teachers from various educational levels, intentionally selected for their participation in ICT training programs. ATLAS.ti was used to code and categorize the data, enabling a detailed analysis. The findings reveal that these skills, including basic competencies and digital content creation, are essential for effectively integrating technologies into pedagogical practices. Educators recognize the importance of information management, digital communication and collaboration, as well as innovation in teaching. However, they face challenges such as the digital divide and the need for ongoing training. The research underscores the alignment of emerging competencies with those established by the Ministry of National Education, emphasizing the importance of a comprehensive approach to teacher training. It concludes that strengthening these skills is crucial to improving educational practices and preparing students for the challenges of the 21st century.

Keywords: *Digital Competence, ICT, Teacher Training, Educational Innovation, Digital Divide.*

Introduction

In the last decade, Information and Communication Technologies (ICT) have revolutionised global education, transforming access to and interaction with knowledge. These digital tools have introduced new dynamics into educational environments, offering unprecedented opportunities to personalise teaching, foster collaboration, and develop essential competencies for the 21st century (Voogt et al., 2013). In this context, teachers' ability to effectively integrate ICT into their pedagogical practices is crucial to ensuring that students are prepared for a constantly evolving digital world (Mishra & Koehler, 2006; UNESCO, 2019).

The role of ICT in education goes beyond merely incorporating digital tools; it involves a paradigmatic shift in teaching methods. ICT enables teachers to create interactive learning environments, facilitating access to global resources and promoting critical and creative skills (Selwyn, 2011). However, many face challenges in using these technologies effectively. A lack of adequate training, limited access to resources, and resistance to pedagogical change are common obstacles hindering their full integration into the educational setting (Ertmer et al., 2012).

Developing ICT competencies among teachers is essential to overcoming challenges and maximizing the impact of these technologies in education. This involves not only technical skills for managing digital resources but also the ability to strategically integrate them into teaching, adapting pedagogical methods to take advantage of their opportunities (Koehler & Mishra, 2009). Teachers need a continuous professional development approach that allows them to stay up-to-date and respond to the changing demands of the educational environment.

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Despite efforts to integrate ICT into education, significant disparities persist in teachers' understanding and application of these skills. These disparities reflect not only unequal access to technologies but also differences in training and professional development. Previous research has identified considerable variability in teachers' ability to incorporate ICT into their pedagogical practices. This variability is influenced by factors such as ongoing training, access to technological resources, institutional support, and the organizational culture in which educational activities are carried out (Howard et al., 2020; Ertmer and Ottenbreit-Leftwich, 2013).

The literature highlights that while some teachers demonstrate remarkable ability to incorporate advanced technologies into their teaching, many others face significant barriers that prevent effective integration. These barriers range from a lack of basic technological infrastructure to the absence of pedagogical models that effectively integrate ICT with curricular objectives (Ertmer et al., 2012). Additionally, there are marked differences in how teachers perceive the utility of ICT in teaching, which often translates into inconsistent implementation of these tools in the classroom (Koehler & Mishra, 2009).

Unequal access to ICT training is another critical dimension of this gap. Many professional developments programmed do not adequately address teachers' specific needs related to technology, focusing more on technical aspects than on pedagogical strategies for the effective use of ICT (Foulger et al., 2017). This results in a situation where teachers' ability to apply what they have learned to their specific contexts is limited, thereby restricting the transformative potential of ICT in education (Selwyn, 2016).

Despite these difficulties, ICT is recognized as having the potential to enrich the learning environment by making it more interactive, accessible, and relevant to today's students (Voogt et al., 2013). However, to harness this potential, it is crucial to better understand how these ICT competencies are developed in different educational contexts and what factors contribute to their success or failure. This includes exploring the systemic and contextual barriers that teachers face, such as institutional expectations, administrative support, and cultural perceptions of technology in education (Hennessy et al., 2015).

There is an urgent need for research that not only evaluates teachers' ICT competencies but also explores all dimensions and contexts of their integration into pedagogical practice. A more holistic and contextualized approach could provide a stronger foundation for developing effective training programmed and educational policies that promote equitable and effective integration of ICT at all levels of the educational system (Zhao, 2012; Anderson & Dron, 2011).

The need to foster a culture of educational innovation is emphasized, where teachers feel empowered to experiment with and apply new technologies in their teaching practices (Jenkins, 2006). By doing so, the study not only contributes to existing knowledge on ICT competencies but also promotes a cultural shift in education that values creativity, collaboration, and continuous learning.

These competencies not only facilitate the effective use of technological resources but also enable teachers to integrate these tools into their pedagogical practices to enhance student learning (Koehler and Mishra, 2009). In the current context, where digitalization and access to information are pillars of the knowledge society, these competencies are essential. However, the effective integration of ICT in education requires a systematic and strategic approach that not only develops competencies but also promotes a cultural shift in education that values innovation and pedagogical experimentation.

This study focuses on teachers' ICT competencies in the Colombian educational context. The Colombian Ministry of National Education has established competencies, promoting their integration as a strategy to improve educational quality and reduce inequalities in access to knowledge, with the aim of integrating these technologies into the educational system and enhancing teachers' professional development, as presented in the document "ICT Competencies for Professional Teacher Development" (Ministry of Education, 2013).

The model seeks to foster educational innovation through five key competencies: technological, pedagogical, communicative, management, and research. These competencies range from the basic use of

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technological tools to advanced application to create innovative learning environments. Each competency is developed at three levels of complexity: exploration, integration, and innovation, allowing teachers to familiarize themselves with, adapt to, and ultimately transform learning through the creative use of ICT.

In the department of Norte de Santander, the need to evaluate and adapt the ICT competencies model of the Ministry of Education to meet local educational needs has been highlighted. This region, located in northern Colombia, has been affected by armed conflict, drug trafficking, and difficult access to marginalized areas, significantly impacting educational quality (Hernández Albarracín, et al., 2022). Effective implementation of these competencies requires a deep understanding of teachers' ICT-related capabilities and needs, making this research relevant to informing future decisions.

The main objective of this study is to explore and gain an in-depth understanding of teachers' ICT competencies, analyzing how they align with the competencies defined by the Colombian Ministry of National Education (2013). This analysis goes beyond the acquisition of technical skills, focusing on how these competencies manifest in daily pedagogical practice.

To achieve this objective, interviews were conducted with teachers using the ICT Competencies model proposed by the ministry as a reference framework. The narratives provided by the teachers offered valuable insights into the interpretation and application of these competencies in their specific educational contexts. Through these narratives, both the opportunities and challenges they face in integrating ICT into their teaching were revealed, allowing for a deeper understanding of competencies from a practical and contextual perspective.

Additionally, teachers' accounts highlight the importance of adapting ICT competencies to local realities and emphasize the need for continuous professional development to strengthen their ability to effectively integrate ICT into their educational practices. By considering teachers' experiences and needs, this study offers a more holistic and nuanced view of ICT competencies, stressing the need for training approaches that are sensitive to the particularities of teachers' educational contexts.

Methodology

Research Design

The present study is grounded in a qualitative design, adopting an interpretative-hermeneutic approach (Gadamer, 1975). This approach allows for an in-depth exploration and understanding of the ICT competencies proposed by the Colombian Ministry of National Education for professional teacher development. Qualitative research was selected due to its ability to capture the perceptions, experiences, and meanings attributed by teachers within the educational context (Denzin & Lincoln, 2018).

Study Context

This study is situated within the Colombian educational context, focusing on teachers' ICT competencies. The research centers on the department of Norte de Santander, a region in northern Colombia that borders Venezuela. This geographical location has influenced the social and educational dynamics of the department, particularly with the massive influx of Venezuelan migrants in recent years, which has added pressure to the local educational system. Norte de Santander has faced significant challenges due to armed conflict, drug trafficking, and difficult access to marginalized areas, all of which considerably impact educational quality (Hernández Albarracín, et al., 2022). These conditions have created a complex educational context where the implementation of ICT competencies requires specific adaptations to meet local needs.

Participants

Participants were selected using purposive sampling (Patton, 2002), aiming to include only teachers from various educational levels who have participated in ICT training programmed and apply these competencies

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in their daily practice. Data collection continued until saturation was reached, following the theoretical saturation approach described by Glaser and Strauss (1967), where the inclusion of new participants did not contribute novel information or significant additional themes, thus confirming the study's comprehensiveness and depth (Guest, Bunce, & Johnson, 2006). Ultimately, a total of 53 teachers were selected, ensuring diversity in experience, educational level, and geographic location, to thoroughly explore ICT usage.

Data Collection Instruments and Procedure

Semi-structured Interviews

In-depth semi-structured interviews were conducted to obtain detailed data on ICT competencies, allowing for flexible exploration that adapts to participants' responses (Kvale, 1996). An interview guide was designed based on the study's objectives and literature, covering technological, pedagogical, communicative, management, and research competencies (Brinkmann & Kvale, 2015). Open-ended questions encouraged deep discussion, enabling teachers to freely express their experiences and perceptions regarding ICT competencies and their integration into teaching (Patton, 2002). The interviews, lasting 60 to 90 minutes, were conducted in a neutral setting to facilitate a trusting environment (Brinkmann & Kvale, 2015). They were recorded with informed consent and supplemented with field notes. Verbatim transcriptions included pauses and emphasis, ensuring the fidelity and authenticity of the data (Davidson, 2009).

Data Analysis

Coding

Data analysis was conducted using a systematic approach based on Grounded Theory by Glaser and Strauss (1967), following three stages of coding to ensure the validity and consistency of the results.

Open Coding: A detailed reading of the transcripts was performed to identify emerging concepts and themes, generating initial codes focused on ICT competencies and teachers' experiences with technology (Strauss & Corbin, 1990).

Axial Coding: The categories from open coding were related to build a more detailed structure, grouping codes into categories and subcategories to understand interactions within the educational context (Charmaz, 2006; Corbin & Strauss, 2015).

Selective Coding: The categorical structure was refined to develop theoretical models explaining how the categories contribute to the development of ICT competencies, validating these theories through data review and comparison with existing literature (Glaser, 1978; Strauss & Corbin, 1990; Charmaz, 2006).

Triangulation

Triangulation is a technique used to ensure the validity and consistency of the results by comparing different sources (Flick, 2004; Denzin, 1978). In this study, several forms of triangulation were applied:

Data Triangulation: Multiple sources, such as interviews and documents from the Ministry of National Education, were compared to verify the consistency of the findings and detect common patterns and differences (Patton, 1999).

Investigator Triangulation: Several researchers reviewed the data to reduce bias and ensure balanced interpretation, thereby improving the study's reliability.

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Theoretical Triangulation: Different theoretical perspectives were used to interpret the data, comparing the results with previous research and theories to validate and contextualize the findings, ensuring they are not dependent on a single theoretical perspective (Denzin, 1978).

Validation of Results

To ensure the reliability and validity of the results, several rigorous and systematic strategies fundamental to qualitative research were implemented. These strategies focused on peer review and data triangulation, all designed to strengthen the credibility and trustworthiness of the study's findings.

Peer Review: Peer review is essential for validating qualitative data, allowing external researchers to evaluate the consistency and plausibility of the findings (Lincoln & Guba, 1985). In this study, experts in ICT and education, with experience in qualitative methodologies, were selected to ensure an objective evaluation. Preliminary findings, including codes and emerging theories, were analyzed alongside detailed documents and interview transcripts. Reviewers assessed the coherence and relevance of the results, ensuring they were well-founded. Feedback received was incorporated to adjust codes and categories, clarifying any ambiguities, thereby ensuring that the conclusions were accurate and faithfully reflected the data collected.

Results

The findings of the study were organized into themes identified through the coding process. Table 1 summarizes these categories along with their corresponding items, codes, dimensions, and subcategories, showing how teachers perceive and develop their ICT competencies.

Table 1. Dimensions, Subcategories, and Categories Related to ICT Competencies

	Category	Dimensions	Subcategory	Category
1	Access to Technological Resources	Basic ICT Competencies	Competencias y capacidades digitales	Teachers' Conceptions of ICT Teaching Competencies
2	Ability to Use Technological Tools			
3	Knowledge of Technological Tools			
4	Knowledge of Software			
5	Knowledge of ICT			
6	Use of Software			
7	Use of Audiovisual Resources			
8	Use of Technological Devices			
9	Management of ICT Tools			
10	Management of Interactive Resources			
11	Creativity	Digital Competence for Content Creation		
12	ADDIE Model			
13	Skill and Ability to Create			
14	Creation of Multimedia Content			
15	Digital Educational Resources (DER)			

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16	ICT-Supported Learning Resources			
17	Software Development			
18	Access to Information	Information Management Competence		
19	Source of Information			
20	Information Search			
21	Ability to Synthesise and Organise Information			
22	Critical Evaluation of Information			
23	Information and Communication Technologies (ICT)			
24	Information and Communication Technology for Learning (ICTL)			
25	Collaboration			
26	Assertive Communication	Competences for Communication and Collaboration		
27	Interaction Channels			
28	Communication Platforms			
29	Communication through ICT			
30	Social Networks			
31	Support and Communication Networks			
32	Synchronous Communication			
33	Asynchronous Communication			
34	Cognitive Interaction			
35	Types of Activities			
36	Design and Planning of Activities			
37	Integration of ICT in Pedagogical Strategy	Pedagogical Management Competencies		
38	Through ICT			
39	Interaction with ICT			
40	Research with ICT			
41	ICT-Based Learning Environment			
42	Asynchronous Teaching			
43	Participation in Activities			
44	Access to Different Research			

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45	Information Search Skills			
46	Research with ICT			
47	Ability to Synthesise and Organise Information	Research and Innovation Competencies		
48	Innovation			
49	Technological Trends			
50	Technological Tools for Research			
51	Artificial Intelligence			
52	Digital Pedagogy			
53	Category			
54	Access to Technological Resources			
55	Ability to Use Technological Tools			
56	Knowledge of Technological Tools			

The following section provides a structured overview of the competencies necessary for teachers to effectively integrate ICT into the educational field. At the center of this framework are the "ICT Teaching Competencies," which serve as the core from which various skills unfold under the "Digital Competences and Capabilities" framework. These include basic ICT skills, digital content creation, information management, digital communication and collaboration, pedagogical management, and the capacity for research and innovation. Each category reflects a key aspect of the digital competence that teachers must develop to meet the challenges of modern education, ensuring a comprehensive approach that fosters adaptation and innovation in technology-enhanced teaching (See Fig. 1).

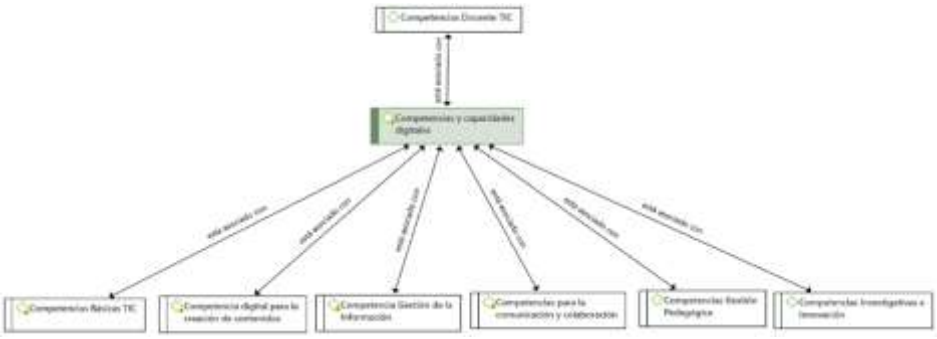

Figure 1. ICT Competencies Framework for Teacher Development

Figure 1 on ICT competencies visually illustrate the skills necessary for teachers to integrate ICT into their teaching. It highlights the 'ICT Teaching Competencies' as the core, from which subcategories under 'Digital Competences and Capabilities' emerge, such as basic skills, content creation, information management, communication and collaboration, pedagogical management, and research and innovation. This visual structure aids in understanding how these competencies interconnect, contributing to professional development in a digital environment.

Digital Competences and Capabilities

The subcategory of "Digital Competences and Capabilities" is divided into two key components: "Basic ICT Competencies" and "Digital Competence for Content Creation." Basic ICT Competencies encompass

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the fundamental skills that teachers must possess to effectively use digital technologies in their daily activities, ensuring their familiarity with the technological tools and platforms necessary to facilitate classroom learning. Digital Competence for Content Creation focuses on the ability to develop and produce relevant and engaging digital content, promoting interactive and dynamic learning. These skills enable the effective integration of ICT into education, preparing teachers to innovate and adapt their methods to current digital demands.

The study shows how teachers integrate ICT into their pedagogical practices through interviews and observations, identifying significant patterns in the classroom. Both strengths and challenges in the use of educational technologies are revealed, providing a comprehensive view of educational transformation through ICT. The detailed results of each area are presented below, illustrated with concrete examples and teachers' narratives.

Basic ICT Competencies

Basic ICT Competencies intertwine with Pedagogical Application, Confidence and Self-assessment, and Continuous Updating, forming a comprehensive framework to enhance the use of technologies in education.

Pedagogical Application. The pedagogical application of ICT is reflected in the integration of technological tools into teaching. For example, D3 comments: "I participated in a programmed called Coding for Kids... they taught us how to use a programming tool called MyCrobit to teach programming to students." D85 uses Geogebra to "better set the scene for classes... practising polygons," thus improving the understanding of complex mathematical concepts. Similarly, D62 notes that technological tools are essential in mathematics: "I really like using graphing tools so that they can observe functions and the like." D5 highlights the importance of "sparking the teacher's interest in participating in training... taking full advantage of technological potential in education."

Confidence and Self-assessment. Confidence in using ICT varies among teachers. D1 states: "My proficiency with tools is excellent... my background is in systems engineering." D20 emphasizes: "I believe I have all the competencies because my undergraduate degree is in computer science." D3 notes: "I am competent in exploring and evaluating educational software." D88 compares their level to that of other colleagues: "I consider myself at a high level... compared to many who refuse to use technology."

Continuous Updating. Continuous updating in technological tools is essential to remain relevant in education. D27 mentions their commitment to "updating software." D1 reaffirms their excellent tool proficiency thanks to their systems engineering training, while D20 highlights their high competence in technology due to their academic background. D5 emphasizes the importance of participating in training. Finally, D21 points out that their skills are based on using specific software for educational tasks, and D62 concludes: "I always use technological tools in everything I do in the classroom."

Figure 2 shows the structure of Basic ICT Competencies, highlighting the interrelation between different technological aspects in education. Each node represents a specific skill, and the lines reflect their associations. This representation helps to understand how these competencies are crucial for teachers' professional development and the technological integration in daily teaching. The examples of using technological tools reinforce this structure.

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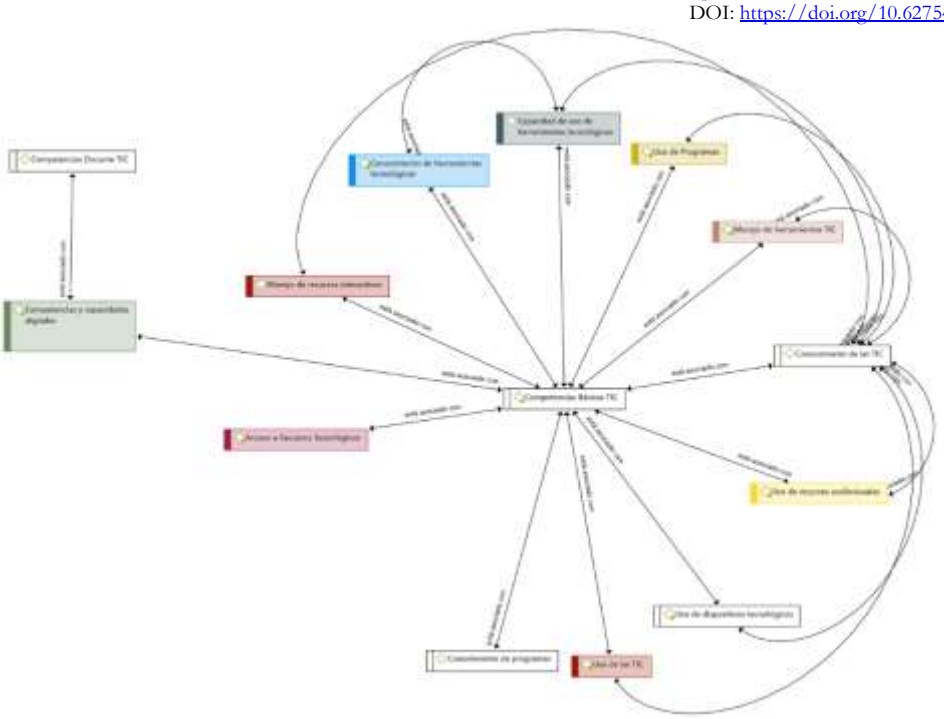

Figure 2. Basic ICT Competencies

Digital Competence for Content Creation

Digital Competence for Content Creation is based on three key dimensions: the integration of pedagogical models, creativity and content development, and the use of digital educational resources and software development**.**

Integration of Pedagogical Models

The integration of pedagogical models, related to Digital Competence for Content Creation (Code 12) and Skill and Ability to Create (Code 13), involves applying educational theories and models that incorporate technology. D49 highlights their "knowledge in applying models with ICT (ADDIE model, Jonassen model, etc.)." D21 uses specific software to enhance learning, stating: "My technological skills and knowledge are based on the use of specific software for educational tasks." D62 mentions that "in mathematical areas, there are many applications that can be used for teaching, obviously, in statistics." This demonstrates how integrating pedagogical models with technology can enhance the understanding of complex concepts.

Creativity and Content Development

Creativity and content development, encompassing codes related to Creativity (Code 11) and Multimedia Content Creation (Code 14), are crucial for enriching educational material. D5 mentions being "open to changes frequently, multimedia creation, digital communication, and dynamism." D21 reaffirms the use of specific educational software. This approach ensures that each section highlights a unique aspect of teachers' contributions without unnecessary redundancies.

Use of Digital Educational Resources and Software Development

The use of Digital Educational Resources (DER) (Code 15) and ICT-Supported Learning Resources (Code 16), along with Software Development (Code 17), are essential for supporting learning through ICT. D85 uses Geogebra to better set the scene for their classes and practice polygons, illustrating the positive impact of these resources on teaching mathematics. D57 mentions the "development and implementation of

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educational material created through various technological means," emphasizing the importance of software development and customized resources to enrich the educational experience. These accounts underline teachers' ability to create and use digital resources that facilitate more interactive and personalized learning.

Figure 3 provides an analysis of how different digital skills and capabilities combine to foster innovation in teaching. The elements in the figure represent key areas such as ingenuity, the use of digital resources, and software development. The connections show how these capabilities integrate to enable teachers to create engaging learning experiences. The use of tools like Geogebra reflects the visualized relationships.

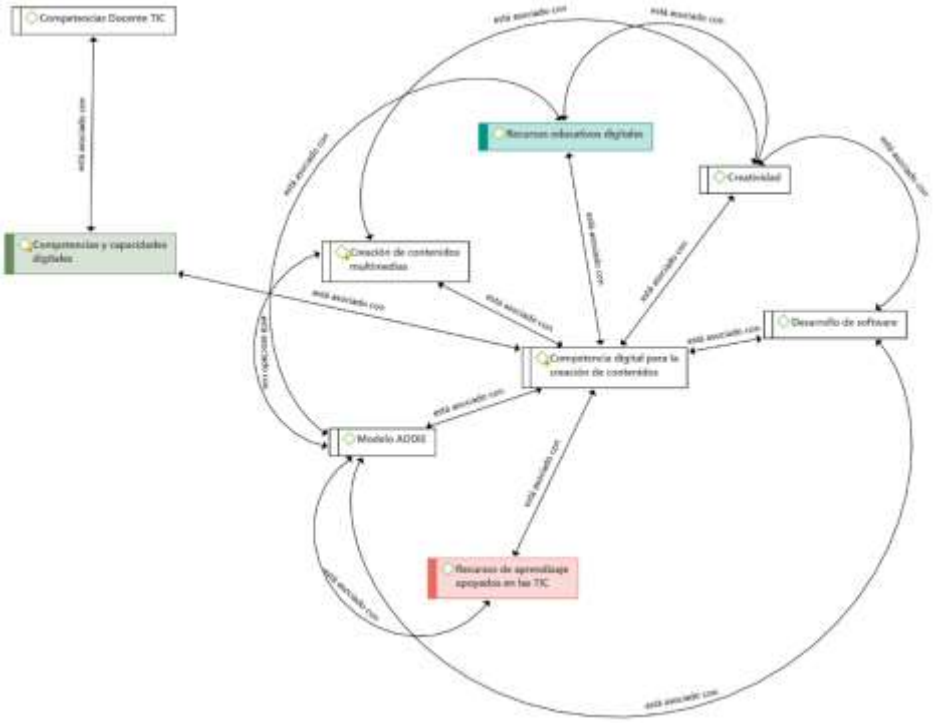

Figure 3. Digital Competence for Content Creation

Pedagogical Management Competencies

Pedagogical Management Competencies involve teachers integrating these tools into teaching and learning processes, recognizing both their advantages and limitations, to foster a holistic education that benefits students and teachers' professional development. According to various studies, ICT can transform education by facilitating new teaching methods, improving access to information, and promoting collaborative and autonomous learning (Voogt et al., 2013; Koehler & Mishra, 2009).

This competency manifests in several key areas. The positive impact of ICT on teaching transforms the educational process, making learning more dynamic, interactive, and accessible for students. The integration of digital technologies into the school curriculum ensures their use across all areas of study, allowing for a more comprehensive approach. Innovative pedagogical strategies incorporate advanced methodologies and gamification, making learning more engaging and relevant. Challenges in implementing ICT, such as the digital divide and the need for continuous teacher training, are important to address. Additionally, activity design enables teachers to create learning environments enriched with digital technologies to enhance teaching and assessment. These interconnected areas highlight how ICT not only facilitates the teaching of complex content but also promotes meaningful participation.

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Positive Impact of ICT

The positive impact of ICT on teaching is reflected in improved motivation, engagement, and student participation. Digital technologies have broken traditional barriers, fostering a stronger connection with educational content. According to D1, "The impact has been positive because, despite the initial fear, students like the computer, the novelty, and the new tasks" (Codes 37, 44). D88 emphasizes: "ICT has a positive impact because we can work creatively, trying to stimulate students with topics they find difficult through didactics, games, and creativity" (Code 46). D64 also highlights: "I think one of the advantages is that the student connects more with what we want to teach; students are totally technological..." (Code 46).

Integration of ICT into the School Curriculum

The integration of ICT into the curriculum involves its cross-cutting incorporation across all areas of study. D7 points out that "ICT is not just an additional tool but a fundamental resource that should permeate all areas of study" (Code 40). Planning activities that promote its effective use is crucial to preparing students for the digital world. D21 mentions: "...when working in the classroom, I usually alternate my lecture methodology with formative and evaluative activities that incorporate the use of technology" (Codes 39, 41).

Innovative Pedagogical Strategies with ICT

Innovative strategies with ICT employ advanced pedagogical models and gamification. D49 describes: "Through a model like Jonassen's, applying virtual chemistry labs and complementing it with a website featuring additional resources (interactive activities, cognitive activities, information, among others)" (Codes 38, 40). D21 shares their experience: "For teaching chemistry in 2021, an online game based on gamification using Harry Potter was integrated to study chemical equilibrium" (Code 43).

Challenges in Implementing ICT

Challenges in implementing ICT include issues such as the digital divide and the need for continuous training to ensure that all teachers can use technologies effectively. D65 mentions: "There are many challenges. Right now, the most difficult one we face is the digital divide, digital inequality" (Code 42). D3 emphasizes: "I think that for me to be successful from a pedagogical standpoint, I have to capture the student's attention because if the student does not pay attention to me, the development of my pedagogical experience will make no sense. What technology does, from my perspective, is that it helps teachers to capture students' attention more effectively" (Code 45).

Design and Planning of Activities

Designing and planning activities involve creating learning environments that effectively incorporate technologies to facilitate and enhance the educational process. D36 comments: "Teachers now use digital tools such as slide presentations, educational videos, online resources, and educational apps to improve teaching and learning. ICT has facilitated the evaluation and feedback process" (Code 39). During the pandemic, D4 notes: "In the pandemic, I think it was where more use was made of digital educational resources. For example: using Google Classroom, which is a virtual learning environment that we used with students virtually during the pandemic" (Code 44).

Figure 4 on Pedagogical Management Competencies highlights the integration of information and communication technologies (ICT) into teaching processes, emphasizing their importance in educational transformation. This approach requires teachers to be able to incorporate digital tools into their pedagogical practices to enhance learning, adapt to students' needs, and foster an inclusive educational environment. By combining various competencies, such as activity design and planning, along with access to educational resource banks, collaborative and personalized learning is promoted. Additionally, critical aspects such as incorporating advanced pedagogical models, developing creative content, and using educational software are addressed, all of which are essential to preparing students for the challenges of the 21st century. Thus,

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pedagogical management competencies aim not only to optimize the educational process but also to tackle challenges like the digital divide and continuous teacher training, ensuring that ICT is used effectively and equitably in the current educational context.

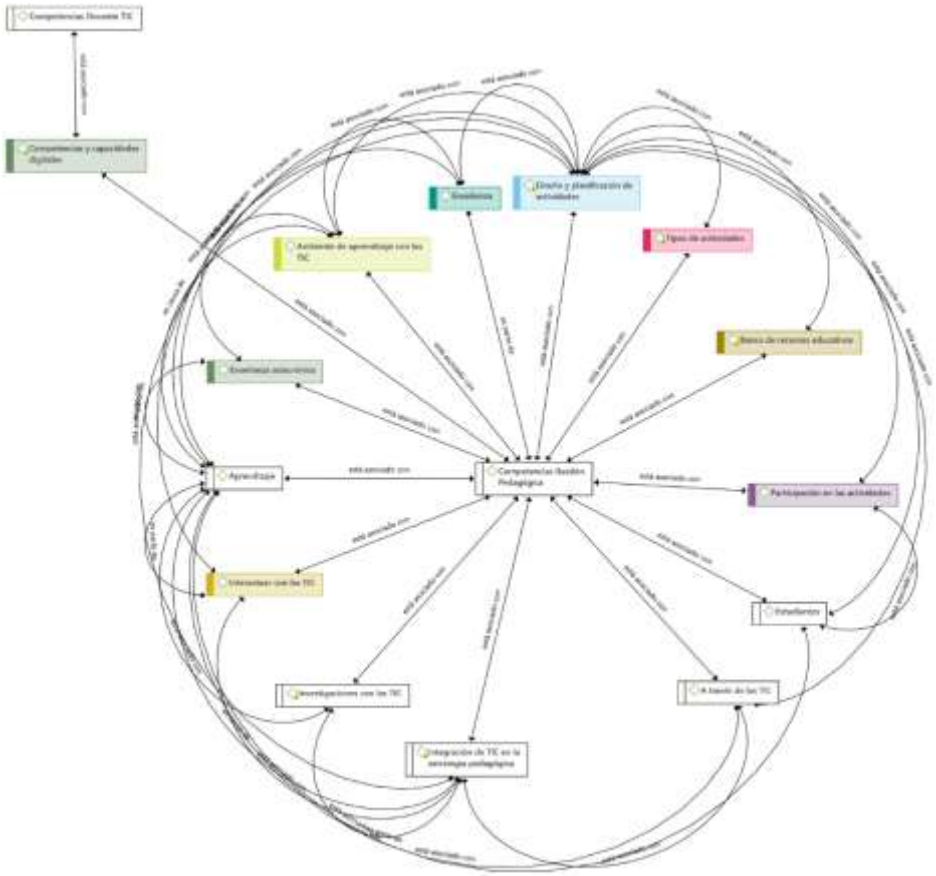

Figure 4. Pedagogical Management Competencies

Competences for Communication and Collaboration

Communication competence in the educational field, defined as teachers' ability to express themselves and interact in virtual and audiovisual spaces, is fundamental for developing an effective and collaborative learning environment. This skill enables fluid and dynamic interaction among teachers, students, and the educational community, both synchronously and asynchronously. This section explores how the use of ICT, through specific platforms like Google Classroom and Zoom, the management of real-time and delayed communication, and collaborative work via forums, strengthens these competencies. It also analyses teachers' self-efficacy in managing these technologies, highlighting their role in educational modernization. Theoretical models such as those by Ferrari (2012) and Redecker et al. (2011) emphasize that strong communication competence enhances the effective use of ICT, promoting a more dynamic and collaborative educational environment.

Use of Specific Platforms

The use of specific digital platforms is crucial for teachers' communication competence, facilitating the organization and constant flow of communication, essential for educational success. Tools like Google Classroom and Zoom allow teachers to maintain effective communication with their students, overcoming traditional barriers and enhancing educational interaction. Teacher D14 mentions: "I have used emails and groups on platforms like Google Classroom to maintain constant communication with my students and their parents" (Codes 30: Communication Platforms and 31: Communication through ICT). During the

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pandemic, the use of these platforms intensified, as D6 highlights: "In the pandemic, I think it was where more use was made of digital educational resources. For example: using Classroom..." (Code 30), emphasizing their vital role in ensuring educational continuity. D15 expands the view: "...use of platforms like Drive, Zoom, Classroom and others," showing their versatility in managing and distributing resources. D19 also highlights: "...the school's platform that allows us to create forums, send messages, notifications and more" (Code 30), illustrating how they facilitate comprehensive communication. D63 emphasizes: "...everything that involves virtuality, video conferencing, and the specific management of the Google tool..." (Codes 30 and 34), highlighting the importance of video conferencing for real-time communication. Finally, D1 comments: "Initially, when this year began, for the Year 11 students, each student has their assigned computer, with an individual session on Windows and an institutional email," highlighting the technological organization necessary for effective communication.

Synchronous vs. Asynchronous Communication

The ability to manage synchronous (real-time) and asynchronous (at different times) communication is fundamental for the flexibility and effectiveness of educational communication, allowing teachers and students to adapt to different schedules and needs. D36 points out: "ICT allows for constant communication with students as it can be done synchronously and asynchronously" (Codes 34 and 35), highlighting the continuous and flexible interaction facilitated by ICT. D21 reinforces this idea: "ICT allows for constant communication with students... It is not limited to a specific time and place" (Codes 34 and 35).

Collaborative Work and Forums

The use of forums and collaborative tools promotes student participation, fostering a cooperative and autonomous learning environment. These tools facilitate interaction among students, allowing them to resolve doubts and work on joint projects. D4 mentions: "Regarding forums... students can interact with each other and resolve their doubts..." (Codes 27 and 31), highlighting how these platforms foster autonomy. D64 adds: "We work by subject areas... encouraging students to consult, research, and learn more" (Codes 27 and 33). D19 mentions: "We have WhatsApp groups, the school's platform that allows us to create forums..." (Codes 27 and 31), illustrating how these tools facilitate communication and collaboration.

Use of Social Media and WhatsApp

Social media and applications like WhatsApp enhance immediate and accessible communication between teachers, students, and parents. These platforms enable quick and direct interaction, facilitating information flow and academic follow-up. D57 comments: "... I have improved my communication with my students thanks to new channels like WhatsApp..." (Codes 32 and 31), highlighting how WhatsApp improves communication and fosters creativity. D45 notes: "Email, WhatsApp, Google Forms, challenges on Educaplay" (Codes 32 and 31), emphasizing the integration of various platforms to facilitate interaction. D36 highlights: "To improve communication with students, I use WhatsApp to form groups with parents..." (Codes 32 and 31), illustrating how WhatsApp is used to keep parents informed and strengthen collaboration between school and home.

Self-Efficacy and Continuous Improvement

Teachers' self-efficacy in using ICT is crucial for the continuous improvement of their communication competencies. This self-efficacy manifests in teachers' ability to seek strategies and solutions independently, even without formal training. D36 mentions: "My level of competence is basic because, despite not having had training, I have sought strategies..." (Codes 26 and 36), illustrating self-efficacy in improving communication. D64 highlights: “Yes, I believe that ICT has helped improve communication in the sense of how the child expresses themselves...” (Codes 26 and 28), highlighting the improvement in students' verbal expression thanks to ICT. D81 adds: “...the pedagogical practice has improved a lot because one has

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the ability to prepare through technology..." (Codes 26 and 36), emphasizing how technology facilitates preparation and improves communication with students.

Figure 5 on Competences for Communication and Collaboration highlights the fundamental role of ICT in transforming the educational environment into one that is more dynamic and inclusive. Teachers' ability to use digital tools, communicate effectively both in real-time and asynchronously, and foster collaborative work through digital platforms is crucial for developing strong communication skills. These competencies not only facilitate constant and effective interaction but also promote student autonomy and improve interaction among all participants in the educational process. Additionally, teachers' confidence in their use of ICT is essential for ensuring continuous improvement in educational practice, addressing the challenges of modernization, and ensuring that all students benefit from a more connected and accessible education. Figure 5 reflects these interconnections and underscores the importance of integrating these skills into educators' professional development to elevate the quality of learning and teaching in the digital age.

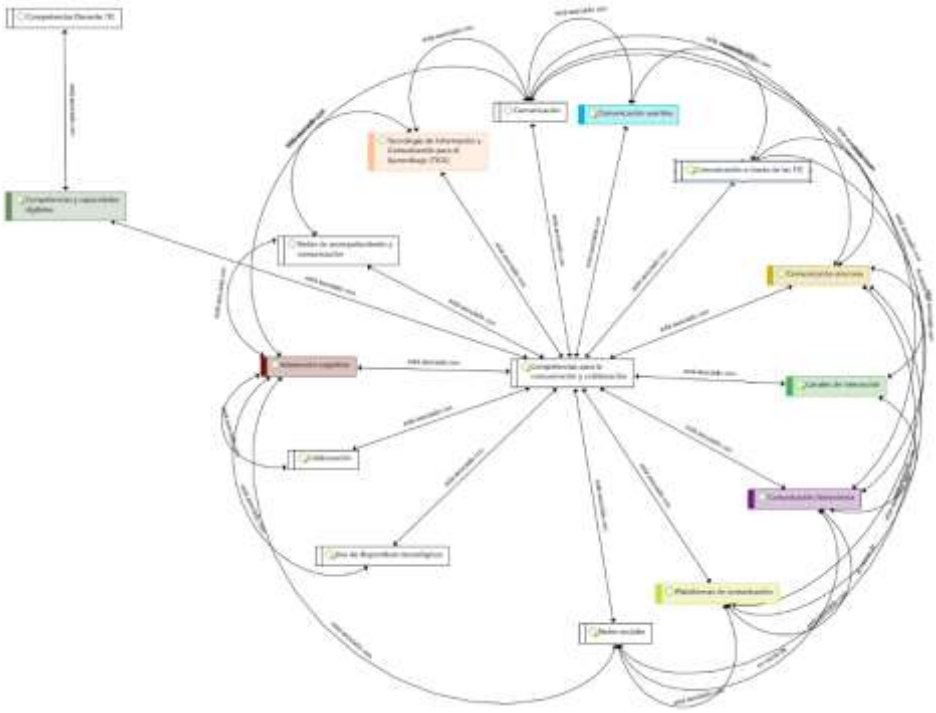

Figure 5. Competences for Communication and Collaboration

Information Management Competence

Effective educational management involves modulating the factors of the educational process through planning, organizing, evaluating, and decision-making. "Information Management Competence" is essential for educators to efficiently handle critical data at each stage. Eisenberg et al. (2000) highlight that searching, evaluating, and using information is vital for setting clear, evidence-based objectives. Marchionini (1997) emphasizes the systematic organization of information to optimize resources during implementation. According to Kuhlthau (2004), information management is crucial for evaluating performance and adjusting educational strategies. Davenport and Prusak (1998) indicate that institutions that manage their information well are better adapted to change, which is key to making informed decisions.

Management of Technological Resources

The management of technological resources is fundamental in the educational field, as it involves planning, organizing, administering, and evaluating educational processes systematically. According to the Education Sector Plan, this approach improves school efficiency and makes education more participatory, presenting

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students with alternative ways to engage in classes. A clear example of this competence is seen in the account of teacher D88, who mentions: "I have organized this computer lab in the best possible way, where each student has their own computer connected to the internet." This statement demonstrates advanced competence in organizing technological resources. Efficient management of these resources is crucial for maximizing learning and student participation, as related to Codes 24: Information and Communication Technologies (ICT) and 19: Access to Information. Another teacher, D7, expands on this perspective by explaining: "Each student has their own computer connected to the internet, with their Windows session, and I've maintained it in terms of software and hardware." This demonstrates detailed skill in configuring and maintaining technological equipment. The literature highlights that well-maintained technological infrastructure is fundamental for modern education. Codes 22: Ability to Synthesise and Organise Information and 24: Information and Communication Technologies (ICT) are relevant here.

Implementation of ICT in Pedagogical Planning

The implementation of information and communication technologies (ICT) in pedagogical planning is crucial for adapting to new educational realities and improving the effectiveness of the teaching-learning process. The pandemic has accelerated this need, transforming how pedagogical activities are planned and executed. Teacher D22 notes: "Planning is done digitally. After the pandemic, the use of ICT in education is a necessity." This statement underscores the importance of digitalization in post-pandemic education, highlighting Codes 24: Information and Communication Technologies (ICT) and 25: Information and Communication Technology for Learning (ICTL). Teacher D2 comments: "The application of ICT in my pedagogical planning has been progressive, allowing spaces for reflection and debate on learning." The progressive integration of ICT facilitates more interactive and meaningful learning. Codes 24: Information and Communication Technologies (ICT) and 22: Ability to Synthesize and Organize Information apply here.

Handling Digital Tools for Communication and Collaboration

Handling digital tools is a key competence for educational management, facilitating both administrative management and effective communication with students. These tools allow teachers to organize and share information efficiently. Teacher D36 mentions: "I use tools to manage grades, upload photos, and update student documentation on the platform." This statement underscores the versatility in using various digital tools. Codes 19: Access to Information and 24: Information and Communication Technologies (ICT) are pertinent here.

Teacher D1 expands on this perspective by explaining: "My skills lie in managing ICT tools, from computer support to their application in the educational environment." Codes 24: Information and Communication Technologies (ICT) and 20: Source of Information highlight how ICT serves as a centralized source of information and technical support.

Challenges in ICT Management

Managing ICT in the educational field presents various challenges, especially in digital communication and the effective integration of technologies into teaching. These challenges include the need to improve training and digital culture. An example of these challenges is seen in teacher D19's statement: "We had a difficulty with the poor management of communication in ICTs..." This highlights the challenges in managing digital communication. Codes 23: Critical Evaluation of Information and 24: Information and Communication Technologies (ICT) are relevant here. Teacher D20 comments on the challenges related to limited technological infrastructure: "I have to make the most of the resources because we don't have enough here at the institution." This statement highlights how inadequate technological resources can hinder efficient management. Codes 19: Access to Information and 24: Information and Communication Technologies (ICT) indicate how limited resources can negatively impact information access and educational quality. Teacher D12 also highlights the challenges in organizing educational activities with limited resources: "I organize my activities according to the tools available, sharing data for information

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access." This statement reflects the need to adapt to technological limitations. Codes 22: Ability to Synthesize and Organize Information and 19: Access to Information apply here.

Information Management Competence in the educational field is essential for teachers to efficiently handle the vast flow of data and resources available in the digital age. This competence encompasses key skills such as the ability to search for, evaluate, and use information critically and ethically, as well as the ability to integrate information and communication technologies (ICT) into pedagogical practices. Figure 6 illustrates the various dimensions and components of this competence, highlighting the interconnection between the ability to synthesize and organize information, critical evaluation, and access to reliable information sources. Additionally, the importance of information and communication technology for learning (ICTL) to facilitate information management in educational environments is emphasized. The visual representation helps to understand how these competences interrelate to support a dynamic learning environment based on accurate information, enabling teachers to improve their pedagogical practices and foster more effective learning among their students.

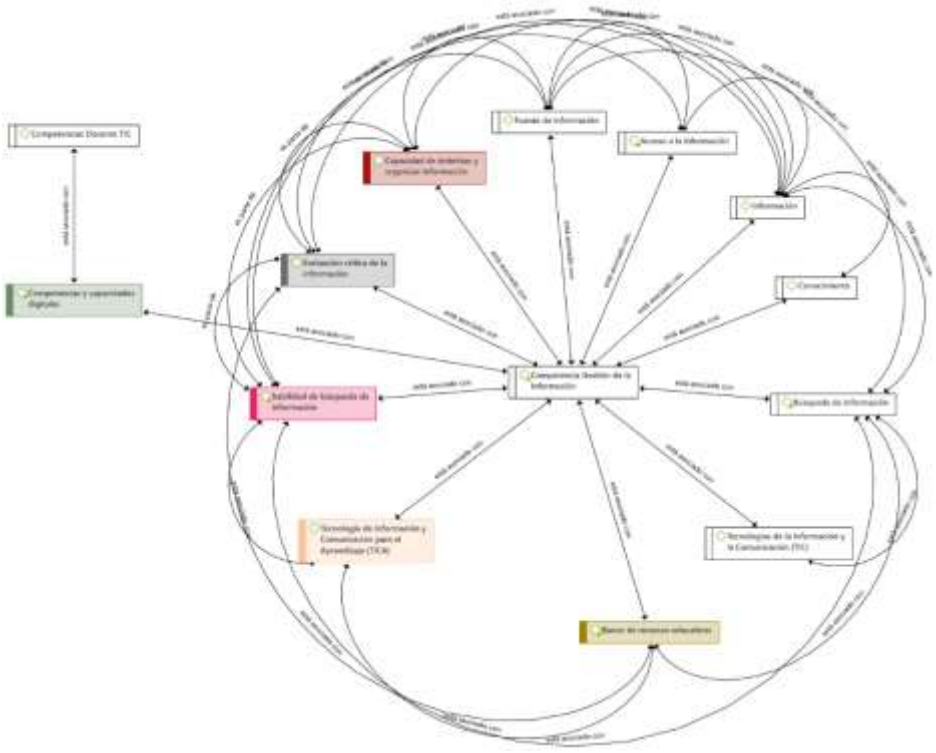

Figure 6. Information Management Competence

Research and Innovation Competencies

Research competence is defined as the ability to use Information and Communication Technologies (ICT) to transform existing knowledge and generate new insights. In today's educational context, this competence is crucial due to the increasing availability of digital resources and the need to prepare students and teachers to face the challenges of the 21st century. ICT has transformed research competence by providing advanced tools for data collection, analysis, and dissemination, thus facilitating more rigorous and collaborative research.

Use of ICT for Data Collection and Analysis

The effective use of Information and Communication Technologies (ICT) is essential for data collection and analysis in education, allowing teachers to transform existing knowledge and generate new insights. ICT facilitates the systematization, organization, and communication of information, thereby improving

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the quality of research outcomes. Teacher D6 illustrates this competence by stating: "I have conducted research projects where Google forms were used to collect information. Articles have been published in digital journals." (Codes 49: Research with ICT and 50: Ability to Synthesize and Organize Information). This account highlights the use of digital forms for efficient data collection and the ability to publish results. Teacher D3 explains: "The use of simulators in the classroom promotes variational thinking. We use ICT to collect data and communicate results in a master's programmed in digital technologies." (Codes 48: Information Search Skills and 54: Technological Tools for Research). This account shows how simulators are integrated into the classroom to promote critical thinking and how ICT is used for analyzing and communicating results. Teacher D88 emphasizes the use of ICT in information management within a doctoral thesis, mentioning: "In my doctoral thesis, ICT supports the organization and effective management of information to achieve research objectives." (Codes 50: Ability to Synthesize and Organize Information and 55: Artificial Intelligence). This account underscores the efficient management of data as crucial for achieving research goals. Finally, teacher D22 highlights: "Research in the context of ICT allows teachers to improve the quality of their teaching, personalize learning, and use feedback more effectively." (Codes 53: Technological Trends and 56: Digital Pedagogy). Here, it is emphasized how ICT enhances teaching and learning through access to resources and effective feedback.

Development of Research Projects

The development of research projects is a key dimension of research competence in education, involving planning and leadership to advance knowledge and improve pedagogical practices. Teachers' accounts illustrate how this competence manifests in their daily practice. Teacher D5 mentions: "I have been categorized as an associate researcher since 2017 and develop research on pedagogy and curriculum development." (Codes 51: Critical Evaluation of Information and 56: Digital Pedagogy). This account highlights leadership in research focused on pedagogy and curriculum. Teacher D88 explains: "I have been an associate researcher since 2017, participating in research groups on pedagogy and curriculum development." (Codes 48: Information Search Skills and 52: Innovation). This account emphasizes collaboration in research groups and a focus on educational improvement. Teacher D2 adds: "My research project strengthens logical-mathematical thinking through ICT in the teaching and learning of mathematics." (Codes 49: Research with ICT and 53: Technological Trends). This account demonstrates the application of ICT to improve students' mathematical thinking.

Information Management and Communication of Results

Information management and communication of results are essential in educational research competence. These competencies involve organizing, analyzing, and effectively communicating information using ICT. Teacher D88 mentions: "ICT supports the organization and management of information in my doctoral thesis." (Codes 50: Ability to Synthesize and Organize Information and 55: Artificial Intelligence). This account underscores the importance of ICT for handling large volumes of data. Teacher D6 adds: "In research, problems are more easily identified, which is crucial for focusing efforts." (Codes 51: Critical Evaluation of Information and 56: Digital Pedagogy). This account highlights how research competencies allow for effective problem identification. Teacher D22 emphasizes: "ICT allows teachers to communicate results effectively, keeping up with the latest trends." (Codes 53: Technological Trends and 56: Digital Pedagogy). Here, the importance of clear communication of results is highlighted. Teacher D21 highlights: "The impact of gamification on scientific competencies was researched using Kahoot and Unity." (Codes 49: Research with ICT and 56: Digital Pedagogy). This account demonstrates the use of evaluation and feedback tools to communicate results.

Training and Supporting Other Teachers

Training and supporting other teachers are fundamental to developing research competencies, fostering a culture of collaboration and continuous learning.

Teacher D5 highlights: "I am a trainer of trainers and support teachers in developing digital competencies in the educational field." (Codes 52: Innovation and 56: Digital Pedagogy). This account emphasizes the

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importance of training other teachers to integrate ICT into teaching. Teacher D22 states: "Research in the context of ICT allows teachers to improve the quality of their teaching, personalize learning, and use feedback more effectively." (Codes 53: Technological Trends and 56: Digital Pedagogy). This account underscores the importance of staying up to date with technological trends to improve education. The attached image illustrates "Research and Innovation Competencies," highlighting how ICT facilitates the integration of technological tools for research, information management, and communication of results. Figure 7 reflects the interrelation between different skills and knowledge needed to advance educational research and foster pedagogical innovation, helping teachers adapt to the demands of the 21st century and improve their educational practices.

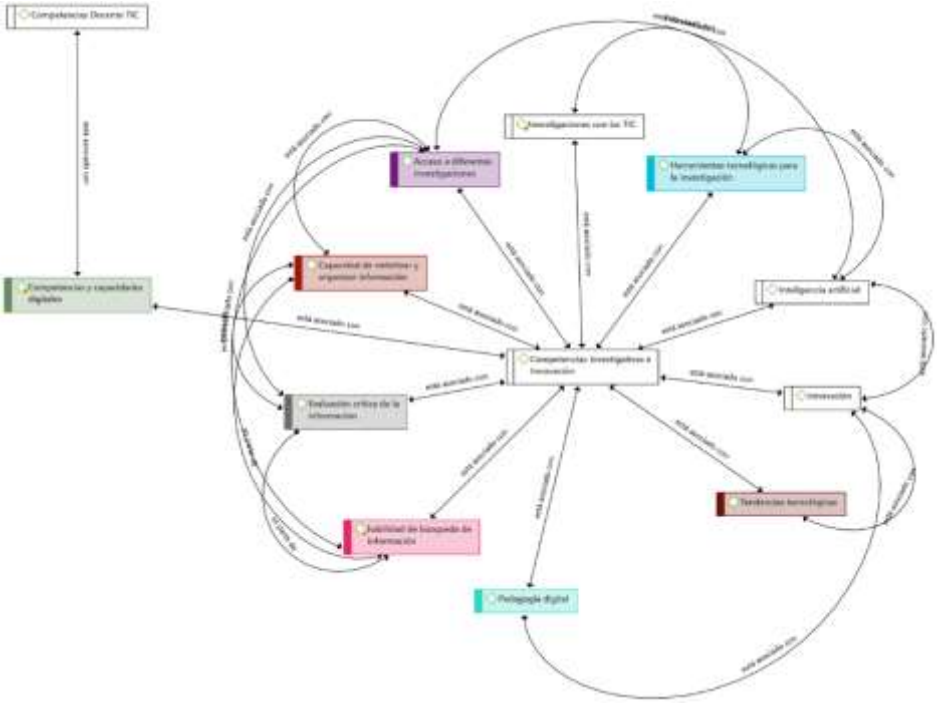

Figura 7. Competencias Investigativas e Innovación

Discussión

ICT Teaching Competencies

ICT teaching competencies are fundamental in modern education because they enable teachers not only to use technologies but also to integrate them effectively in the classroom to enhance learning and teaching. According to Mishra & Koehler (2006), these competencies involve a set of skills necessary to combine digital tools with pedagogical strategies. These competencies are divided into two main categories: Basic ICT Competencies and Digital Competence for Content Creation.

According to UNESCO (2019), Basic ICT Competencies refer to the essential skills for the effective use of digital technologies in daily activities, while Digital Competence for Content Creation, as defined by the European Commission (2006), encompasses the ability to develop and produce digital content useful for creating teaching materials. These concepts are expanded by the DigComp 2.0 framework (Vuorikari et al., 2016), which provides a conceptual model for strengthening these competencies in the educational context, helping teachers face contemporary challenges.

The OECD (2016) report emphasizes the need to innovate education using digital technologies and the development of 21st-century skills, complementing the DigComp 2.0 approach and aligning with UNESCO's ICT Competency Framework for Teachers (2019). This framework provides a structured guide

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on how teachers can effectively integrate ICT into teaching, emphasizing participatory and collaborative learning.

Additionally, Jenkins et al., (2009) highlights the importance of fostering a participatory learning environment, which is crucial for developing an innovative educational culture. ICT teaching competencies are essential to equip educators with the capabilities needed to face the challenges of the contemporary educational environment, ensuring they are prepared to facilitate effective and meaningful learning.

Basic ICT Competencies

The evaluation of previous studies highlights that, although many teachers have a solid foundation in technological competencies, the pedagogical application varies significantly. This variability, according to Ertmer et al. (2012), is influenced by confidence, self-assessment, continuous training, access to resources, and institutional support, as also noted by Howard et al. (2020). This underscores the importance of educational policies that not only provide access to advanced technologies but also offer professional development programmed focused on continuous updating and technological adaptation.

Continuous updating is essential to maintain educational relevance. The TPACK framework by Koehler & Mishra (2009) emphasizes the need to update technological and pedagogical competencies for effective teaching. These findings on the need for continuous updating align with the recommendations of Foulger et al. (2017), who highlight the importance of adaptive professional development programmed.

Digital Competence for Content Creation

The integration of pedagogical models with technology, such as the ADDIE model discussed by Mayer (2009), can improve instructional design. However, there is a need for continuous training to ensure that all teachers reach this level of competence, as suggested by studies by Jonassen (2006).

Creativity and content development are crucial for creating dynamic and engaging learning environments, according to Mishra & Koehler (2006). The use of digital educational resources and software development is essential to support learning. Programmed that promote the use of digital platforms enable interactive teaching that enhances conceptual understanding, as supported by Hegedus and Penuel (2008). Additionally, the development and implementation of educational material created through various technological means are key to enriching the educational experience. Teachers who develop personalized educational material improve the educational experience, fostering greater motivation and student engagement, as indicated by Resnick (2017).

Pedagogical Management Competencies

The literature review reveals that, although many teachers have a solid foundation in integrating ICT into the school curriculum, there are significant challenges in its effective and equitable implementation. The variability in the ability to design and plan pedagogical activities with ICT highlights the need for personalized and continuous training. This is related to Pedagogical Management Competencies, which involve teachers' ability to effectively manage technological resources in the educational context. According to Ertmer and Ottenbreit-Leftwich (2013), teachers require specific support to integrate ICT effectively into their pedagogical practices, which is essential for developing pedagogical strategies that optimize the use of technologies and improve educational outcomes.

The literature underscores the positive impact of ICT on teaching, which is crucial in modern education. Research such as that by Higgins, et al., (2012) finds that digital technologies can significantly improve academic performance when properly integrated into teaching. It is also highlighted that digital technologies can facilitate innovative and playful teaching methods, increasing student interest and engagement, according to Kozma (2003).

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The integration of ICT into the school curriculum is essential for preparing students for a digital world. This aligns with UNESCO's (2019) recommendations on the need to integrate ICT across all disciplines to develop 21st-century skills. Voogt & Roblin (2012) emphasize the importance of equitable and effective implementation, suggesting the need for continuous training for all teachers.

Innovative pedagogical strategies that use ICT have a significant impact on the effectiveness of the teaching-learning process. These practices reflect the ideas of Jonassen (2006) and Gee (2005), who argue that learning through interactive technologies and gamification can be more relevant and engaging for students.

The challenges in implementing ICT are significant and multifaceted. Selwyn (2011) discusses how the digital divide persists in various educational contexts, affecting equity in access to and use of technologies. Biesta (2010) suggests that ICT can enhance student attention and engagement, although continuous training is needed to maximize its effectiveness.

The design and planning of activities that incorporate ICT are fundamental to improving the quality of the educational process. This coincides with the recommendations of Laurillard (2012) on the importance of integrating technologies in a structured way to enrich teaching.

Competences for Communication and Collaboration

The literature review reveals a solid foundation in communication competence and the use of ICT, although there is variability in its pedagogical application. According to Ertmer et al. (2012), this variability is influenced by factors such as confidence, self-assessment, continuous training, access to resources, and institutional support. This underscores the importance of educational policies that offer professional development programmed focused on continuous updating and technological adaptation. UNESCO (2019) and the Chilean Ministry of Education (2013) have emphasized the need to integrate communication competencies into educational programmed to strengthen digital teaching.

The literature supports the idea that ICT can overcome barriers and foster a more connected and efficient educational environment, especially in remote teaching contexts, as emphasized by Howard et al. (2021). The OECD (2016) also notes that the effective use of ICT can transform teaching by improving communication and collaboration among all educational actors.

The ability to manage synchronous and asynchronous communication is crucial for educational flexibility and effectiveness. Hrastinski (2008) points out that the combination of both types of communication improves student participation and satisfaction, creating a more flexible and accessible learning environment. UNESCO (2019) suggests that the ability to alternate between both types of communication is vital to prepare students for a digital world.

The use of forums and collaboration tools fosters student participation and autonomy, creating a collaborative learning environment. Wenger et al. (2002) and Alawawdeh & Kowalski (2015) argue that virtual communities of practice, such as forums, are essential for collaborative learning, allowing students to share knowledge and solve problems together. The Framework for 21st Century Learning (P21, 2009) highlights the importance of developing collaborative skills through digital platforms.

Social media and applications like WhatsApp enhance immediate and accessible communication between teachers, students, and parents. Greenhow et al. (2009) and Fan et al. (2023) affirm that social media can increase student participation and engagement by facilitating a more informal and direct flow of communication. The American Association of School Librarians (AASL, 2018) has identified the use of social media as a key tool for developing communication competencies in educational settings.

Teachers' self-efficacy in using ICT is fundamental for the continuous improvement of their communication competencies. Bandura (1997) and Klassen & Tze (2014) highlight that self-efficacy is a

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key factor for motivation and personal success, essential for teachers' professional development. Vygotsky (1978) also emphasizes the importance of language as a mediating tool in learning, and Coyle et al., (2010) underline the relevance of digital language as a mediating tool in learning.

Information Management Competence

The literature analysis shows that, although there is a solid foundation in Information Management Competence, there are challenges in its effective implementation. The effective integration of ICT in education is influenced by confidence, self-assessment, continuous training, access to resources, and institutional support, according to Ertmer and Ottenbreit-Leftwich (2013). This underscores the importance of educational policies that offer professional development programmed focused on continuous updating and technological adaptation. Yong Zhao (2012) emphasizes the need to prepare students to be creative and entrepreneurial learners in a global educational environment, which requires teachers to be well-equipped to manage information effectively. The DigComp 2.0 framework (Vuorikari et al., 2016) also highlights information management as a key competence in digital education.

Studies highlight that effective organization of technological resources facilitates an optimal learning environment. Livingstone (2012) argues that ICT can be powerful tools for overcoming educational barriers, especially in remote teaching contexts, by providing continuous access to information and facilitating a more connected learning environment. The OECD (2016) also supports the idea that ICT improves educational management by optimizing resource use.

Digital planning has become essential in post-pandemic education. Selwyn (2016) suggests that digitalization in education is crucial to face the new realities and demands of the 21st century, allowing for faster adaptation to changes in the educational environment. Jenkins (2006) also highlights the importance of digital literacy to promote a participatory culture in education.

The progressive integration of ICT into pedagogical planning allows for spaces of reflection and debate. Mike Sharples et al. (2010) highlights that mobile and digital technologies can transform learning by making it more accessible and flexible, thus fostering continuous and adaptable interaction between teachers and students. The Framework for 21st Century Learning (P21, 2009) underscores the importance of integrating technologies into the educational process to develop 21st-century competencies.

Handling digital tools is crucial for administrative management and communication with students. Allison Littlejohn and Margaryan (2014) emphasize that digital tools can enhance professional learning by facilitating access to resources and fostering peer collaboration. Enlaces (2011) highlights teacher professional development using ICT to improve educational practices.

ICT management in the educational field presents challenges, especially in digital communication and technological infrastructure. Anderson (2008) suggests that technical and pedagogical challenges must be addressed simultaneously to ensure successful ICT implementation in education.

Research and Innovation Competencies

The literature analysis reveals a solid foundation in research competence and the use of Information and Communication Technologies (ICT), although challenges remain in their effective implementation. The variability in the use of these tools underscores the need for continuous and personalized training for teachers, which is essential for fostering innovation in educational practices (Tondeur et al., 2016; Hennessy et al., 2015). References to the Framework for 21st Century Learning (P21, 2009) and DigComp 2.0 (Vuorikari et al., 2016) reinforce the importance of integrating digital competencies into education to promote innovation and critical thinking.

ICT facilitates data collection and analysis, reflecting the ability to synthesize and organize information (Aktaruzzaman et al., 2011; Littlejohn & Margaryan, 2014). Jenkins (2006) also highlights how the use of technologies can facilitate a participatory and collaborative culture in the research process.

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Leadership in research projects is crucial for research competence. This reflects the importance of critical evaluation of information and pedagogical innovation (Hennessy et al., 2015; Selwyn, 2016). UNESCO (2019) emphasizes the need to promote research and innovation in educational practices using ICT.

Continuous training and support for other teachers are essential to strengthening digital competencies. The Chilean Ministry of Education (2013) highlights the importance of continuous teacher training in the use of ICT to improve educational practices.

ICT is fundamental for effective information management and communication. The OECD (2016) highlights ICT's ability to improve information management and communication of results in the educational field.

Despite the benefits, teachers face significant challenges in implementing ICT, such as inadequate training and infrastructure issues. This underscores the need for strategies that combine continuous technical and pedagogical training to close these gaps and ensure the effective and creative use of ICT (Tondeur et al., 2016; Hennessy et al., 2015; Sharples et al., 2010). Anderson (2008) suggests that addressing both technical and pedagogical challenges simultaneously is essential for the successful implementation of ICT in education.

Comparison between Teachers' Conceptions and ICT Competencies of the Colombian Ministry of National Education

The qualitative thematic content analysis reveals a significant alignment between the emerging competencies identified, such as "ICT Teaching Competencies," "Digital Competences and Capabilities," "Basic ICT Competencies," and "Digital Competence for Content Creation," with the competencies established by the Colombian Ministry of National Education. These encompass essential capabilities for effectively integrating ICT into educational processes, reflecting teachers' conceptions of the importance of ICT in education. According to Anderson & Dron (2011), the evolution of distance education pedagogy underscores the need to integrate technologies to enhance teaching and learning.

Other emerging competencies, such as information management, communication and collaboration, pedagogical management, and research and innovation, also find parallels in the ministerial definitions. For example, the ministry's "Management Competence" is reflected in information management capabilities, while "Research Competence" aligns with research and innovation. This analysis highlights a comprehensive and coherent approach to teacher training, encompassing various aspects of ICT use to enrich teaching and foster educational innovation (Livingstone & Sefton-Green, 2016).

The comparison between the emerging competencies from the thematic analysis and those established by the Colombian Ministry of National Education, as shown in Table 2, confirms the coherence between both.

Table 2. Comparative Analysis: Teachers' Conceptions and ICT Competencies of the Colombian Ministry of National Education

ICT Competence of the Colombian Ministry of National Education		**Category: Teachers' Conceptions of ICT Teaching Competencies**	
		Dimension	Subcategory

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ICT Competencies	A set of capabilities necessary to effectively integrate ICT into teaching and learning processes (Ministry of National Education, 2013).	**ICT Teaching Competencies**	A set of skills necessary to effectively integrate ICT into education, combining digital tools with pedagogical strategies (Mishra & Koehler, 2006; INTEF, 2017; UNESCO, 2019).	**Competencias y Capacidades Digitales**	Development of capacities necessary to integrate ICT into educational processes (UNESCO, 2019; DigCompEdu, 2017; INTEF, 2017).
Technological Competence	The ability to select and use a variety of technological tools appropriately, responsibly, and efficiently (Ministry of National Education, 2013).	**Basic ICT Competencies**	Essential skills for the effective use of digital technologies in daily activities (UNESCO, 2019).		
		Digital Competence for Content Creation	The ability to develop and produce digital content useful for creating teaching materials (European Commission, 2006; ISTE Standards, 2017).		
Pedagogical Competence	The ability to use ICT to strengthen teaching and learning processes, recognizing the scope and limitations of its incorporation (Ministry of National Education, 2013).	**Pedagogical Management Competencies**	Skills to apply and manage ICT in educational contexts to enhance teaching and learning (Ministry of Education of Chile, 2013; INTEF, 2017; UNESCO, 2019).		
Communicative Competence	The ability to express oneself, establish contact, and interact in virtual and	**Competences for Communication and Collaboration**	Skills to communicate and collaborate effectively in digital environments (Partnership for 21st Century Learning (P21), 2009; Enlaces, 2011; DigCompEdu, 2017).		

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	audiovisual spaces through various media and languages (Ministry of National Education, 2013).		
Management Competence	The ability to use ICT in the effective planning, organization, administration, and evaluation of educational processes (Ministry of National Education, 2013).	**Information Management Competence**	The ability to manage, organize, and evaluate information using digital tools (AASL Standards Framework for Learners, 2018).
Research Competence	The ability to use ICT for the transformation of knowledge and the generation of new insights (Ministry of National Education, 2013).	**Research and Innovation Competencies**	The ability to use ICT for research and innovation in the educational field (Ministry of Education of Chile, 2013; OECD, 2016; INTEF, 2017).

The comparison between the emerging ICT competencies and those established by the Colombian Ministry of National Education reveals a remarkable alignment in terms of the effective integration of ICT in the educational field. According to Mishra & Koehler (2006), Technological Pedagogical Content Knowledge (TPACK) is fundamental for teachers to combine digital tools with pedagogical strategies, a concept reflected in the "ICT Teaching Competencies." UNESCO (2019) also emphasizes the importance of developing digital competences and capabilities that enable teachers to effectively integrate ICT into educational processes. Additionally, the European Commission (2006) underscores the need for digital competence in content creation, emphasizing the ability to develop and produce digital teaching materials. These competencies not only enrich teaching but also promote educational innovation.

In terms of pedagogical management, Puentedura (2006) highlights the SAMR model as a framework for applying and managing ICT in educational contexts, thereby improving the teaching-learning process. Communicative competence, as noted by Jenkins (2009), is essential for teachers to express themselves and collaborate in digital environments, establishing effective communication. Regarding information management, Vuorikari et al. (2016) emphasize the teachers' ability to manage, organize, and evaluate information using digital tools, a crucial skill for educational planning and administration. Finally, research competence, as proposed by the OECD (2016), is vital for teachers to use ICT in transforming knowledge

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and generating new insights, supporting a comprehensive and coherent approach to teacher training to meet the challenges of the 21st century.

Additionally, the Partnership for 21st Century Learning (P21, 2009) establishes a framework for 21st-century learning that supports the integration of ICT in education. The American Association of School Librarians (AASL, 2018) provides standards for the management and use of information in school libraries, which is applicable in education. The Ministry of Education of Chile (2013), through the Framework for Good Teaching (MBE) and the ICT Competencies for Professional Teacher Development (Enlaces, 2011), offers examples of how to integrate ICT into teacher training, highlighting the importance of effective pedagogy that incorporates technological tools.

Conclusiones

This qualitative study has enabled the identification and in-depth understanding of teachers' ICT competencies, based on an interpretative-hermeneutic approach. The findings highlight that teachers possess a solid foundation in basic technological competencies but face significant challenges in the pedagogical application of ICT. Variability was observed in teachers' ability to effectively integrate technologies into the classroom, influenced by factors such as continuous training, confidence, and access to technological resources. Teachers who have participated in training programmed demonstrate greater proficiency and application of ICT in their pedagogical practices, which aligns with the competencies established by the Colombian Ministry of National Education.

The results of this study have both practical and theoretical implications. Practically, they suggest the need to design professional development programmed that focus on continuous updating and personalized training for teachers to improve the integration of ICT in teaching. Theoretically, this study contributes to the existing knowledge on digital competencies in the educational field, offering a more nuanced understanding of how these competencies can be effectively developed and applied. The findings also highlight the importance of educational policies that support equitable access to technologies and promote a culture of pedagogical innovation.

The study presents several limitations, including the limited geographical diversity of participants, which could affect the generalization of the results. Additionally, the qualitative approach, while providing deep understanding, does not allow for the quantification of findings. Furthermore, teachers' perceptions may be influenced by personal and contextual biases.

Future research could explore the effectiveness of specific ICT training programmed, as well as the impact of educational policies on the development of digital competencies. It would also be valuable to investigate how teachers' experiences vary across different educational and cultural contexts. A quantitative approach could complement the qualitative findings and provide a more comprehensive view of the state of ICT competencies in education.

This study reaffirms the need to strengthen teachers' ICT competencies through a comprehensive approach that considers both continuous professional development and access to technological resources. Teachers' ability to effectively integrate ICT into their pedagogical practices is essential to meet the challenges of the 21st century and ensure a quality education that prepares students for an ever-evolving digital environment.

The findings and conclusions presented here underscore the importance of ICT competencies in modern education, highlighting key areas for development and improvement. By emphasizing the need for continuous training and equitable access to technologies, a clear guide is provided for future educational initiatives

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