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Educational Technology and Meaningful Learning: The Impact of Infopedagogical Resources on Teacher Training

Tecnología educativa y aprendizaje significativo: impacto de los recursos infopedagógicos en la capacitación docente

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Abstract

The continuous technological advancement transforms the way we interact, learn, and work. In the educational sphere, it generates the need for ongoing training for teachers in the use of methodologies, software, and educational tools with the aim of integrating technology into the teaching-learning process, adopting an Infopedagogical approach. In this context, the focus of this study is the analysis of the existing connection between teacher training and the creation of meaningful knowledge in students; hence, the challenge is taken to conceptualize, identify, and implement a training program with the collaboration of 67 educators from "Nuestra Señora de Pompeya" Educational Unit, centered on the implementation of a training program exclusively designed for this group of professionals, based on their training demands and framed comprehensively in five relevant technological tools. The dynamic interaction of teachers allowed assessing the usefulness and ease of use of technology in the educational context and understanding that ongoing training for educators become an essential element to address the demands of technological advances and strengthen daily pedagogical practice adapted to various educational contexts.

Keywords: training, teaching, meaningful learning, infopedagogy, pedagogical practice

Resumen

En el ámbito educativo, el continuo avance tecnológico transforma la manera en la que estudiantes interactúan, aprenden y trabajan. Esto genera la necesidad de formación continua en los docentes sobre el manejo de metodologías, software y herramientas educativas, con el objetivo de integrar la tecnología en el proceso de enseñanza-aprendizaje, adoptando un enfoque Infopedagógico. El centro de atención de este estudio fue el análisis de la conexión existente entre la formación del personal docente y la creación de conocimientos significativos en los educandos. Por ello, se asumió el reto de conceptualizar, identificar y ejecutar un programa de capacitación con la colaboración de 67 educadores de la Unidad Educativa "Nuestra Señora de Pompeya" centralizado en la implementación de un programa de capacitación diseñado exclusivamente para este grupo de profesionales, basado en sus demandas formativas y enmarcado de manera integral en cinco herramientas tecnológicas de relevancia. La interacción dinámica de los docentes permitió evaluar la utilidad-facilidad de uso de la tecnología en el ámbito educativo y comprender que la formación continua de los educadores se convierte en un elemento esencial para hacer frente a las exigencias de los avances tecnológicos y fortalecer la práctica pedagógica diaria adaptada a diversos contextos educativos.

Palabras clave: capacitación, enseñanza, aprendizaje significativo, infopedagogía, práctica pedagógica

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Introduction

To work as educators, individuals must develop specific pedagogical competencies. However, in today's world, beyond this set of skills and knowledge, it is essential for teachers to stay updated and trained in the use of the latest technological tools. Recognizing the urgent need for educators to remain up to date is crucial to addressing the ever-changing demands of technological advancements.

This process of continuous updating not only involves keeping up with the latest technologies but also adapting and strengthening teaching strategies and methodologies across various educational contexts. The agility and willingness to incorporate new tools and pedagogical approaches are crucial for tackling contemporary challenges in education (García et al., 2022).

Teacher training plays a fundamental role in personal responsibility for acquiring new knowledge, improving skills, and fulfilling aspirations with a transformative and self-transformative impact on social reality (Nieva & Martínez, 2016). In the educational field, the exchange of knowledge acquired during professional training is necessary but not sufficient. Constant updating and exploration of new and original pedagogical tools and resources are equally important. These practices not only directly impact students' academic satisfaction but are also closely linked to innovative teaching approaches. Inclán (2021) asserted that teacher training, as a public and educational policy, should focus on preparing educators to acquire the necessary knowledge, attitudes, and skills to effectively carry out their work in the classroom and the school community.

The COVID-19 viral outbreak in 2020 significantly impacted many areas, including education. It drastically changed the way educational actors interacted, the teaching-learning process, and the overall learning environment. In response to the health emergency, governments mandated the continuation of classes through virtual learning models, creating uncertainty and insecurity among teachers accustomed to face-to-face instruction (Rodríguez, 2021). Díaz (cited in González, 2021) stated that the pandemic exposed the lack of teachers' readiness for digital instruction, with only 2% of them being adequately prepared. Given this reality, teacher training became crucial during the COVID-19 era to help educators overcome the new challenges that emerged in the educational sector.

According to a survey conducted by UNICEF, UNESCO, and the World Bank on teacher training processes and professional support, training efforts focused on the use of technology in education (including infopedagogical resources) and the development of ICT-related competencies. The survey results revealed a significant gap between middle-low-income and high-income countries, with high-income nations providing 71% of support compared to just 10% in middle-low-income countries (UNESCO, 2021).

Another UNESCO-led study revealed that, globally, 81% of primary school teachers and 78% of secondary school educators barely met the minimum requirements to deliver quality education. This finding highlights that many educators are not adequately prepared to face the challenges of virtual education. The situation in Latin America and the Caribbean is even more concerning, as 83% of primary school teachers and 84% of secondary school teachers lack essential tools to

tackle the challenges brought by pandemic-era education (UNESCO, 2020). UNESCO emphasized that, to prevent an educational crisis, governments, NGOs, and various educational institutions were compelled to invest in teacher training to enhance their competencies.

In response to this challenge, Ecuador's Ministry of Education restructured the national curriculum and implemented digital platforms to support teacher training and help educators navigate the demands of remote education. The ministry launched a training initiative that encouraged teachers to unlearn and relearn in order to sustain and support education, aligning with Objective 2 of Ecuador's COVID-19 Humanitarian Response Plan. This plan outlined several strategies to support distance learning, including:

- Online platforms enabling teachers and students to access learning materials, educational resources, and real-time communication tools.
- Tele-education through real-time communication tools such as phone calls and video conferencing to facilitate teacher-student interaction.
- Radio-based education for students lacking access to digital platforms or technological resources.
- Innovative teaching practices incorporating phones, social media, and digital platforms to adapt to the new educational landscape.
- Curriculum adaptation to ensure students develop relevant skills within the remote education context (UNICEF, 2020).

As part of the COVID-19 Humanitarian Response Plan, Ecuador's Ministry of Education launched a nationwide online teacher training program in 2020, offering a variety of courses aimed at preparing educators for the challenges of virtual teaching (Ministry of Education, 2021). However, according to the *Mecapacito* platform, of all the available courses, only one addressed topics related to the use of Information and Communication Technologies (ICT).

Data from *Mecapacito* revealed that in 2020, a total of 2,927 educators in the province of Pastaza received training. However, only a small group of 230 high school teachers benefited from the emergency program implemented by the Ministry of Education (2020). This limited number of trained teachers highlighted the urgent need to establish a specific training program focused on the management and creation of infopedagogical resources (Manotoa, 2022).

Based on the elements discussed in the previous paragraphs, this study will present several scientific foundations to develop a state-of-the-art analysis and propose a training program centered on educators' training needs regarding infopedagogical resources. The goal is to provide teachers with the necessary skills for creating and managing online pedagogical resources, thereby enhancing their ability to develop and conduct virtual academic activities that improve students' knowledge acquisition.

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1.1. ICT in Education

The development of these technologies is due to progress in computer engineering, communications, and human knowledge. They are created and offered to people to facilitate information management and enable its immediate and simultaneous sharing. Technological advancements and telecommunications have generated new job opportunities and contributed to societal progress and well-being (Universidad Latina de Costa Rica, 2019).

Regarding the contribution of technology to society, its impact became particularly evident during the declaration of the health emergency when society at large was forced to adopt telework and conduct various activities online due to confinement.

The rapid spread of COVID-19 led employers and companies to restructure the work environment, adapting and modifying their strategies to face the challenges presented by the health crisis. Telework emerged as an alternative resulting from the global social situation, offering an innovative way to continue educational work. It allowed educators to adapt to the restrictions imposed by the health crisis, facilitating the continuity of distance learning.

Camacho (2021) defined telework as all activities carried out to achieve a specific objective, solve problems, and meet human needs through information and communication technologies (ICT). Its implementation in the educational field confronted teachers with various challenges related to the use of digital platforms, interactive tools, and online resources.

The transition to a new educational paradigm required the acquisition of technological skills and adaptation to virtual environments, making it a demanding process. Despite these challenges, educators demonstrated remarkable resilience in overcoming technological difficulties and worked tirelessly to ensure the effective delivery of educational content.

This strategy to guarantee the constitutional right to education and maintain teaching and learning processes during the pandemic highlighted not only the need for greater support in developing teachers' digital skills but also the importance of recognizing and valuing their dedication amid the complexities of educational telework (Ramírez et al., 2021).

During the pandemic, implementing telework in distance education required the establishment of guidelines to ensure proper practices in labor, social, and technological fields, in compliance with the existing legal framework, aiming for positive outcomes for educational institutions, teachers, and students (Ramírez et al., 2021).

According to Ministerial Agreement AM-MDT-2020-181, Article 4, regarding telework tools, the employer is responsible for providing employees with the necessary equipment, guidelines, and supplies to perform telework. Additionally, the employer must inform workers about the directives for supervising and monitoring their tasks (Ministry of Labor, 2020). During the pandemic, telework in distance education became a necessity, leading to the creation of directives that ensured its proper implementation. These regulations aimed not only to comply with the legal framework but also to ensure that educational institutions, teachers, and students achieved positive results.

1.2. Educational Plan During the COVID-19 Pandemic by the Ministry of Education of Ecuador.

During the health emergency caused by the COVID-19 pandemic, on March 16, 2020, Minister Monserrat Creamer and the Ministry of Education of Ecuador introduced the "Covid-19 Educational Plan," aimed at adapting and strengthening the country's educational system in response to the situation. This plan included pedagogical activities, measures, and strategies designed to ensure the continuity of educational services, support the educational community in preventing COVID-19, and provide emotional support to students and teachers. Additionally, the plan established guidelines for remote work in the educational sector, including the provision of resources and appropriate conditions to fulfill work responsibilities (Bonilla, 2020; Ministry of Education, 2020).

Initially, this process was framed by the transition from in-person classes to virtual environments, as established in AGREEMENT No. MINEDUC-MINEDUC-2020-00014-A, which ordered the nationwide suspension of academic activities. This measure affected public, faith-based, and private educational institutions, as well as early childhood development centers regulated by this government entity, across all schedules and modalities. Likewise, educational staff were required to continue their work through remote modalities in accordance with the regulations issued by the supervisory labor authority for this purpose (Ministry of Education, The implementation of the Educational Plan during the COVID-19 pandemic was structured around four fundamental elements: Prioritized Curriculum, which identified key topics for each educational stage based on the community's needs during the pandemic. Educa Contigo Portal, which provided alternatives and support for students who lacked internet access due to various factors. This included learning materials, educational content, and digital tools delivered through traditional communication channels such as television and radio, with specific schedules for different educational levels. Educational Portal, which offered access to educational materials, review resources, socio-emotional support, and tools to ensure the continuity of educational services during various stages and situations of the health emergency. According to Varguillas and Bravo (2020) and NU. CEPAL - UNESCO (2020), it was essential to have tools that facilitated information acquisition from multiple sources, such as television programs, radio, or written materials. Educational Transformations, which encompassed the structural and pedagogical changes implemented in the country's education system (Ministry of Education, 2020)

The COVID-19 Educational Plan was organized into two main phases: "*We Learn Together at Home*" and "*Together We Learn and Take Care of Each Other*." Each phase had specific conceptual frameworks, execution resources, and operational rules. The first phase, "*We Learn Together at Home,*" focused on providing didactic actions, educational content, and tools to facilitate home-based learning under the supervision of families and tutors. The second phase, "*Together We Learn and Take Care of Each Other,*" expanded education into public and social spaces while emphasizing COVID-19 prevention and psychological support (Ministry of Education, 2020).

1.3. Regulations and Integration of ICT in Educational Spaces.

The technological dimension of Ecuadorian education is regulated. In the third section on Communication and Information, the Constitution of the Republic of Ecuador states that "all

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individuals, individually or collectively, have the right to (…) universal access to information and communication technologies" (Constitution of the Republic of Ecuador, 2008, Art. 16).

Building upon this, it was established that all individuals have the opportunity to use and benefit from information and communication technologies, regardless of their origin, gender, age, geographic location, or any other personal characteristic. This right is considered fundamental to ensuring equal opportunities and access to information and knowledge in today's society. Similarly, it was reiterated that the State will promote diversity and plurality in media, guaranteeing universal access to ICT for all citizens, with a particular focus on individuals and groups who lack access or face limitations in using these technologies (Constitution of the Republic of Ecuador, 2008, Art. 17). The State's responsibility was also emphasized in eliminating digital illiteracy, ensuring that people acquire the necessary access and skills to interact effectively with information and technologies. Additionally, it is the State's duty to incorporate ICT into education and foster the development of skills and knowledge related to these technologies (Constitution of the Republic of Ecuador, 2008, Art. 347).

The Organic Law of Intercultural Education (LOEI) (2016) established interlearning and multi-learning as key principles for decision-making and the development of activities in educational settings. These were considered educational strategies that enhance human capabilities through interaction, collaboration, and group learning in areas such as culture, sports, access to information and technology, communication, and knowledge. Similarly, the Organic Law of Higher Education (LOES) (2016) made the use of digital technologies mandatory and stipulated that resource allocation must also be directed toward acquiring technological infrastructure.

Having a regulatory framework to guide educational practices from a technological perspective is not enough to guarantee educational quality. Although there are clear regulations regarding technology in education, their mere existence does not ensure successful implementation or the full utilization of all available tools. Legislation alone does not replace the existing needs of teachers and the education system to adapt to the new technological reality. For this reason, it is essential to provide teachers with the necessary training in educational technology, adequate technological infrastructure, and a culture that fosters innovation and adaptability to technological advancements.

1.4. Teacher Training in Digital Competencies for Navigating Virtual Environments.

Digital competencies refer to a set of skills, attitudes, and knowledge that guide the effective use of digital technological tools in multiple contexts; they not only involve the use of such tools but also imply the critical understanding of information, online work, critical use of digital tools, and adaptation to different environments (Vargas, 2019).

The European Commission (2007, cited in Salas et al., 2022) established as basic competencies in the fundamental skills of Information and Communication Technologies (ICT) the ability to use computers to access, evaluate, store, create, present, and exchange information, as well as to communicate and participate in online collaboration networks (UNESCO, 2018). For educators to

develop digital competencies, it is essential that they undergo training, stay updated, and share knowledge with their students. Furthermore, they must use the appropriate technological tools to strengthen this process and achieve a paradigm shift. Educators who possess these competencies are prepared to face the challenges of contemporary education in the 21st century.

Technology offers a wide range of resources and tools that are fundamental to teaching; therefore, it is essential to conduct training processes in the proper use of computer tools to foster effective teaching methods. This involves applying pedagogical approaches tailored to needs, but with an innovative focus that maximizes the potential of new technologies (Pinto and Plaza, 2020).

Digital literacy for educators is crucial regarding their mastery of technology and its incorporation into teaching-learning processes. To boost teachers' digital competency and promote innovation in education, the European Framework for Digital Competence of Educators (DigCompEdu) was published in 2017. This framework integrated practices, concepts, and criteria to propose, adapt, guide, and implement policies for teacher training and professional development; it also aimed to determine, evaluate, and improve teachers' digital competencies to include digital technologies meaningfully in pedagogical work, teaching-learning processes, and to awaken or support students' digital competencies (Cabero et al., 2022).

The Ministry of Education and Vocational Training and the educational administrations of autonomous communities (2022) outlined the competency areas of DigCompEdu as follows:

- **Professional Commitment:** the ability to use technology to improve teaching processes and professionally interact within the educational community (Cabero Almenara and Palacios, 2020).
- **Digital Resources:** searching/selecting/creating/modifying/using/sharing/managing digital resources or content responsibly in the educational process (Cabero Almenara and Palacios, 2020).
- **Digital Pedagogy (Teaching-Learning):** the ability to plan/design and implement ICT during various stages of the educational process (Cabero Almenara and Palacios, 2020).
- **Assessment-Feedback:** linking tools and digital strategies for assessment; empowering students, developing student-centered strategies to encourage active participation (Cabero Almenara and Palacios, 2020).
- **Facilitating Digital Competence in Students:** integrating digital skills into the curriculum and educational process, providing adequate follow-up to assess their development (Cabero Almenara and Palacios, 2020).

In line with the described competency areas, the educational system has presented some challenges in the current context in which teachers operate. One way to generate integrated work is to direct teacher training and development towards the development of generic competencies (Andrade et al., 2020). Therefore, it is important in the educational field to have programs tailored to existing needs that improve teachers' performance and their ability to effectively apply their role. The Organic Law of Intercultural Education (2016) established that teachers have the right to free

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access to opportunities for professional development, training, updating, continuous learning, and pedagogical and academic improvement at all levels and modalities, adapted to individual and the National Education System's needs.

1.5. Infopedagogical Resources.

Educational environments rely on digital tools that enable the creation of favorable learning spaces for cognitive skill development. These resources must be systematically managed by educators who, through practical pedagogical methodologies, enrich dynamic and evolving learning environments.

Digital educational resources facilitate the demonstration, observation, and understanding of complex concepts, while Information and Communication Technologies (ICT) provide access to a variety of information to support both collaborative and autonomous student work efficiently (Álvarez Santizo, cited in Manotoa, 2022).

The WHO's declaration of lockdown led to the integration of web resources with pedagogical methods, transforming traditional education paradigms into a Connectivist Paradigm. In this new model, applications and digital tools have been essential for displaying, interacting, evaluating, and sharing knowledge between students and teachers. It is crucial to discern and categorize the vast array of digital material to establish a concept based on its capabilities and utility.

Table 1 presents the most important and popular web resources that have facilitated teachers' work.

Table 1

Infopedagogical Resources.

Tools-Description
Videoconferencing Tools: In a context of simultaneous and bidirectional communication, which takes place synchronously and in real-time over a distance, it is a process of establishing dialogues between two or more people. During the lockdown, the need for interaction led videoconferencing applications to become essential tools (Torres, 2021).
Zoom: Enables instant meetings and group text messaging. Additionally, it provides a unique experience in the simultaneous transmission of multimedia content through sound and image, with the ability to share the screen so users can view it (Casarotto, 2021). Microsoft Teams: This flagship platform from the corporate giant Microsoft brings together many utilities for communication and collaboration; it offers a wide range of tools to simplify videoconferences, meetings, group chats, and calls (Serrano, 2021).
Tools for Presenting Information: These tools allow summarizing curricular topics, transforming them into interactive, stimulating, and attractive lessons that engage students and facilitate their understanding (Pimbo et al., 2023).
Genially: Allows the creation of multimedia content in a simple and interactive way, using pre-designed templates (Hernández, 2018). Its design focuses on the following principles: animation to bring images to life, interactivity to involve the student, and integration with different add-ons for optimal connection with the platform (Allende, 2021). Prezi: Facilitates the creation of innovative and creative multimedia content, presenting it in a visually interactive manner using the "canvas." As the presentation progresses, visual elements, graphics, and sections appear and disappear in a dynamic way (Universidad Nebrija, 2018).
Herramientas para la evaluación del conocimiento: Instruments for measuring retention and comprehension of information; they provide means to reinforce knowledge, strengthen learning, resolve doubts, self-assess, and evaluate mastery of concepts (Pimbo et al., 2023).
Kahoot Platform: A novel environment for creating assessments in a quiz format with a playful approach, presenting information in the form of challenges and competitions. Participants answer from their devices, and during the game, a ranking of participants' positions is displayed. It focuses on engaging each student, turning a monotonous class into an interactive and fun game (UNADE, 2021). Quizziz Platform: Allows the creation of fun online quizzes, using game elements and encouraging healthy competition among students. The platform enables the creation of tools with different types of questions, such as single-choice, multiple-choice, fill-in-the-blank, essays, and surveys. These questions can be customized with images, audio, videos, links, and equations to meet the specific needs of the user (Manotoa, 2022).
Online Forms: Google Forms, among its features, includes creating quizzes, surveys, tests, and exams; it also allows the automation of evaluations and immediate viewing of results. Additionally, it generates reports in tables and charts based on the data collected (Naranjo, 2021).
Tools for Consolidating Learning: Simplifies the management of information, promotes the development, and builds specific concepts related to academic content (Pimbo et al., 2023).
Mural Platform: Offers the possibility of creating a dynamic and collaborative environment for all session participants, where each member can contribute their ideas and viewpoints using a variety of visual and multimedia resources. This favors cooperation in constructing cognitive maps, diagrams, or any other visual representation of the content to be analyzed. The tool also facilitates real-time or delayed collaboration by sharing the board through a web link, allowing students to work at their own pace (Arana, 2021b).

Note: Adapted from Manotoa (2022).

Methodology

The research was conducted at the Fiscomisional Educational Unit "Nuestra Señora de Pompeya," located on Av. Alberto Zambrano and Calle 9 de Octubre in the city of Puyo. This mixed-management institution is under the direction of the "Las Marianitas" Congregation and is co-

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administered by Zone 3 of Educational District 16D01 in the province of Pastaza. It stands out for its long history of shaping individuals with integral Christian values and scientific knowledge.

The study employed an experimental methodology that included a pre-test to establish initial perceptions and design the experiment. The study was applied, evaluated, and verified using the TAM methodology to analyze the relationship between educational resources and trained personnel. A diagnostic assessment was conducted with a random group of 43 teachers before the experiment to collect essential data, followed by an evaluation of 67 teachers after the experiment's implementation. The TAM method was used to understand perceptions and validate the proposed hypothesis.

To begin the experimentation process, data was initially collected through a diagnostic survey to examine the use of infopedagogical resources-tools in teaching practice. Then, the TAM model was used to gather data on the achievements attained after the training experience. The surveys used for the pretest and posttest were statistically validated in advance using Cronbach's Alpha statistic. The research was conducted following the ADDIE framework, which corresponds to the progressive development of the following stages: Analysis, Design, Development, Implementation, and Evaluation, as detailed below:

- Analysis: A diagnostic assessment was conducted to establish the study population's baseline using a pre-test. The findings highlighted the need to develop and implement a virtual training plan for teachers. Five online platforms were identified as relevant to the teaching-learning cycle, as introduced earlier.
- Design: Once the key tools facilitating pedagogical activities in the virtual classroom were identified, the following platforms were selected: Zoom Meetings, Prezi, Mural, Quizziz, and Online Forms. These were categorized and structured by content units, specific topics, essential content, and learning outcomes, according to the needs and available time. The content progressed from basic skills (account creation) to expert-level management of tools for innovative educational processes.
- Development: The virtual environment for experimentation and implementation of the training plan was created through the acquisition of web hosting services and the registration of the domain https://capacitaciondocente.website through the company Namecheap. After installation, the WordPress content management system was implemented, along with the necessary plugins that facilitated the organization and development of the website.
- Within the platform, the list of available courses, detailed information about the instructor, project details, contact information, an internal search engine, and a link to the user panel were included. Upon accessing the user panel, personal data, descriptions of the courses associated with the account, and progress in each of the created contents were displayed.
- Each course presented a structured curriculum in sections accessible to users enrolled in the platform. These sections were divided into: introduction, conceptualization and functionality of the tools, demonstrative examples, and evaluation.

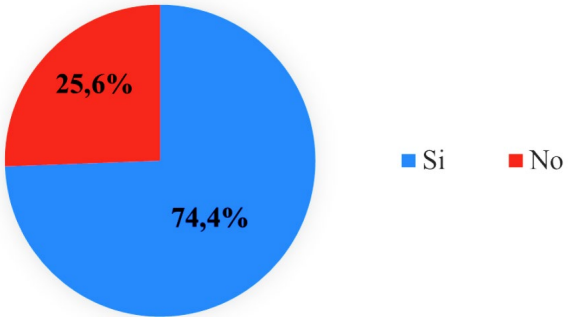
- Implementation: The experimental phase involved 67 educators from the institution under study. The training plan was carried out during the last fifteen days of January 2022 through the virtual platform Zoom, divided into 5 sessions of three hours each, with each session focusing on the topics previously established for each tool.
- Evaluation: The study consisted of an experiment that, at the end, was evaluated through an instrument that collected the opinions of the participants regarding the implemented program. For this purpose, the Technology Acceptance Model (TAM) was used, a tool employed in the computer and technology field to assess and verify results related to the adoption of new innovative applications.

Results

Initially, a pretest with 21 questions was applied to a randomly selected diagnostic group of 43 teachers. In general, the test covered aspects such as knowledge, usage, advantages, and disadvantages of Web 3.0 tools, highlighting the most significant findings, as presented in *Figure 1*.

Figure 1

Knowledge of Infopedagogical Tools



Note: Pretest application

74% of respondents stated that they have knowledge of digital tools. However, possessing knowledge does not guarantee effective use or educational application. It is important to highlight that familiarity with these tools does not always translate into appropriate usage for pedagogical purposes (Manotoa, 2022).

It was interesting to observe that although 74% of respondents feel familiar with digital tools, this confidence does not necessarily result in effective use in educational settings. Simply having knowledge of technology does not ensure its appropriate application to enhance the teaching-learning process. This highlighted the need for continuous training and pedagogical strategies that integrate these tools effectively, ensuring that technology genuinely enhances education.

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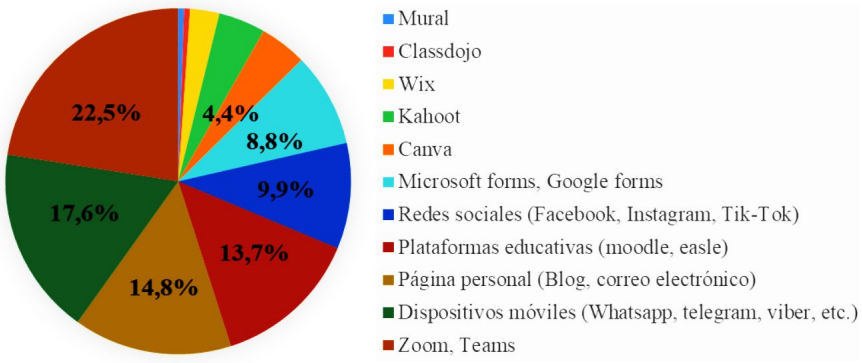
Figure 2

Educational 3.0 Tools Used for Teaching.



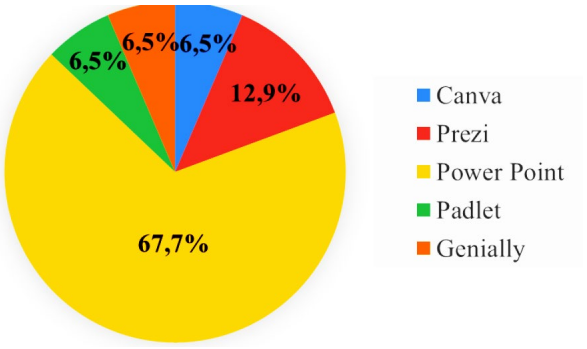
Note: Aplicación de pretest

Additionally, 54.9% indicated that the most frequently used educational 3.0 tools were Zoom, Teams, other mobile applications, and personal websites. This suggests that teachers primarily use technology for communication rather than for creating pedagogical resources, as tools like Prezi, Mural, or Quizziz allow. Furthermore, 55.8% reported that they often use online tools solely as communication channels for teaching, reinforcing the idea that they tend to rely on popular applications that are not necessarily pedagogically oriented and may not be suitable for creating educational materials (Manotoa, 2022).

The preference of 54.9% of teachers for tools like Zoom and Teams revealed a trend toward using technology mainly as a means of communication rather than leveraging its potential for creating pedagogical resources. This indicated that while these platforms are popular and effective for interaction, they are not being used to their full capacity to enrich educational content. It is essential to promote a shift in this mindset, encouraging the use of more pedagogy-oriented tools that facilitate the creation of innovative and effective teaching materials.

Figure 3

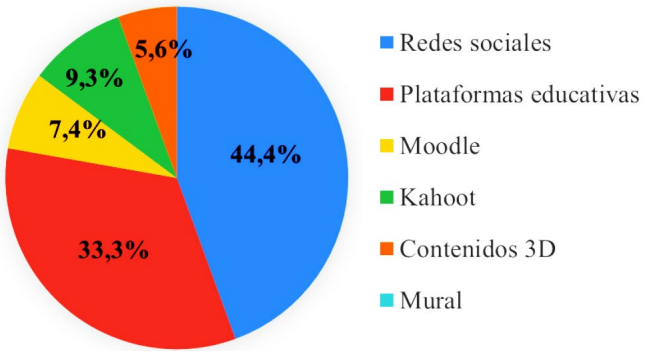
Educational 3.0 Tools Used for Teaching.



Note: Pretest application

Figure 4

Tools for Knowledge Consolidation.



Note: Pretest application

Regarding the tools used to present information, 67.7% stated that they use PowerPoint to display content or information about their subjects. This suggests that the traditional presentation method outweighs the didactic approach of generating interactive content through tools like Prezi or Genially.

Approximately 44.4% of teachers primarily used direct communication tools, such as WhatsApp or Facebook, to reinforce the knowledge imparted. However, this reveals an urgent need to explore and adopt new, more interactive and learning-oriented digital pedagogical tools. Tools like Prezi, Mural, or Quizziz, for example, offer more dynamic and creative functionalities for the development of educational content (Manotoa, 2022).

The analysis revealed a tendency toward using traditional and direct communication tools in the educational field, indicating a preference for conventional methods, possibly due to their familiarity and ease of use. However, this trend also suggests an underutilization of more dynamic and interactive tools such as Prezi or Genially, which could enrich the learning experience and facilitate the creation of educational content.

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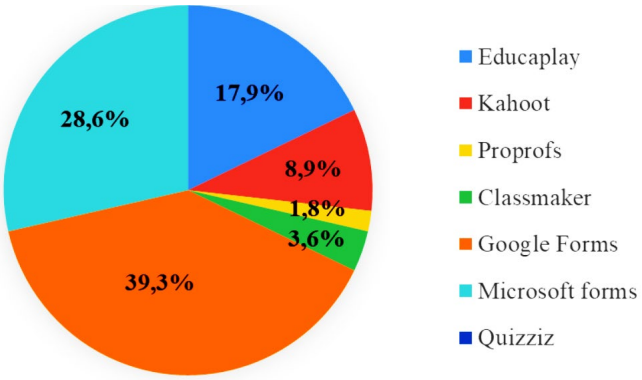
Figure 5

Herramientas para Evaluar los Aprendizajes.



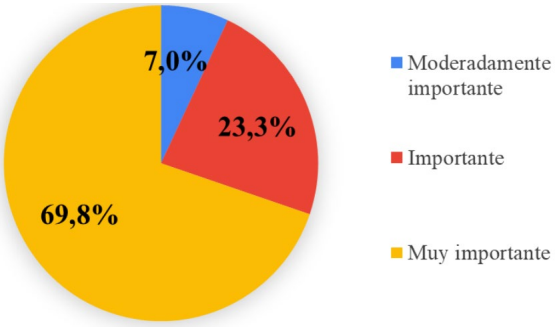
Note: Pretest application

Regarding the tools used for assessment, the study provided a clear view of the preferred evaluation tools, highlighting that 39.3% of respondents rely on online forms. The need to employ digital resources that facilitate more effective feedback was emphasized, mentioning Quizziz as a comprehensive and dynamic platform for assessment. However, it was noted that this tool is relatively unknown among the surveyed population. This suggests an opportunity to promote the use of more advanced and effective tools in the educational assessment process (Manotoa, 2022).

Most teachers in the study used online forms for evaluation, reflecting a preference for relatively basic methods. This trend underscores the need to adopt digital resources that offer more effective feedback. Although platforms like Quizziz stand out for their dynamic and comprehensive functionality for assessment, their limited familiarity among the studied population suggests an opportunity to promote their use. Integrating advanced and efficient tools like Quizziz could significantly enhance the educational assessment process by providing more interactive and detailed feedback.

Figure 6

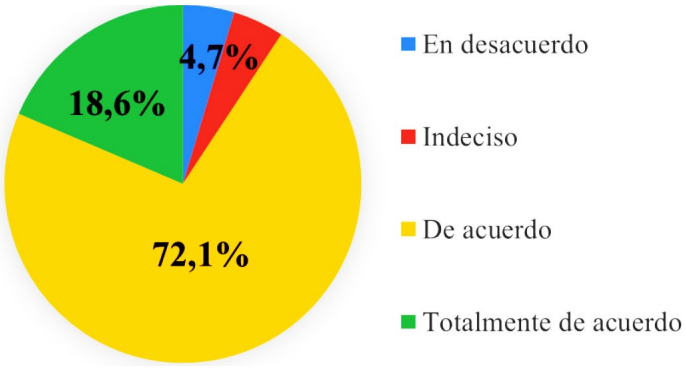
Importance of Using Web 3.0 Tools in Teaching.



Note: Pretest application

Figure 7

Resource Generation Using Web Tools.



Note: Pretest application

In response to the importance of using Web 3.0 tools in teaching, 93.1% recognized the relevance of planning virtual classes by leveraging the advantages of various online platforms and applications. It was mentioned that these tools are fundamental for presenting information, reinforcing knowledge, and evaluating content.

Additionally, 90.7% of the surveyed population considered it essential for teaching materials in virtual classes to be created by teachers themselves to ensure content personalization. The importance of the appropriate use of these resources was highlighted to foster student autonomy and collaboration (Manotoa, 2022).

It is encouraging to see that 93.1% of teachers recognize the importance of planning virtual classes by leveraging the advantages of various Web 3.0 tools. These platforms and online applications are fundamental for effectively presenting information, reinforcing knowledge, and assessing content in a virtual environment. Even more significant is that 90.7% of respondents consider it essential for virtual class materials to be created by teachers, ensuring content personalization and alignment with specific learning objectives. This underscores the importance of teachers mastering the appropriate use of these resources, thereby fostering student autonomy and collaboration in a technology-enhanced learning environment.

3.3. TAM Model Analysis

The Technology Acceptance Model (TAM) was used to draw conclusions from the experiment. This model “evaluates elements such as usefulness, ease of use, attitude, and intention to use new and innovative digital or technological resources” (Manotoa, 2022). A questionnaire was developed consisting of 16 Likert-scale items, as shown in *Table 2*.

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Table 2

Alternatives and Assigned Values.

Alternative	Assigned Value
Strongly Disagree	A
Disagree	B
Neutral	C
Agree	D
Strongly Agree	E

Note: Extracted from Manotoa (2022) and Pimbo et al. (2023)..

Table 3

TAM Model Items

Instrument	
Factor: Perceived Usefulness (PU)	
ID	Statement
UTI1	The use of Web 3.0 tools allows me to complete my work more quickly.
UTI2	The use of Web 3.0 and gamification tools enables me to maintain a more friendly communication with my environment (classmates and teachers).
UTI6	I have felt satisfied when carrying out activities using Web 3.0 or gamification tools.
UTI8	I believe that the use of Web 3.0 digital tools supports learning.
Factor: Perceived Ease of Use (PEU)	
FAC1	Learning to use gamification and technological tools is easy for me.
FAC2	I find it easy to do what I want with the use of technology.
FAC8	I would like to use these types of tools more frequently in virtual classes.

Note: Extracted from Manotoa (2022) and Pimbo et al. (2023).

herramientas Web 3.0 y de gamificación facilita una comunicación más amigable entre los estudiantes y docentes, promoviendo un entorno de aprendizaje colaborativo e interactivo.

Table 4

Perceived Usefulness.

	Frecuencia					Porcentaje					TOTAL	
Alternativas Ítems	A	B	C	D	E	A	B	C	D	E	67	100%
UTI1	0	0	0	14	53	0,0	0,0	0,0	20,9	79,01		
UTI2	0	1	1	34	31	0,0	1,5	1,5	50.7	46,3		
UTI6	0	0	2	38	27	0,0	0,0	3,0	56,7	40,3		

UTI8	0	0	0	28	34	0,0	0,0	0,0	41,8	58,2

Note: TAM Model applied to teachers.

Based on *Table 4*, the results can be interpreted as follows for each item:

- UTI1: It was observed that 79.01% of the participants considered that the use of web 3.0 tools allows them to perform their work more quickly, suggesting a positive perception of the efficiency and usefulness of these tools in their roles as educators. This accelerates the execution of educational tasks in classes, collaborations with colleagues, and the development of lesson plans. According to Suárez et al. (2020), the use of web 3.0 tools provides teachers with greater flexibility and autonomy in their educational work, enabling them to focus on more valuable activities and improve the quality of their work. Additionally, they highlighted that these tools foster collaborative learning and...
- UTI2: con un 50,7% de respuestas afirmativas, se evidenció que el uso de Digital and Gamification Tools for Communication in the Workplace Context are Essential, as they simplify and make the technological educational work environment more enjoyable, indicating the importance of these technologies in improving interaction and collaboration. Zambrano et al. (2020) emphasized the importance of using gamification tools and digital resources to enhance interaction and collaboration in the classroom. These innovative technologies allow teachers to create interactive environments that promote self-regulated learning and student motivation, which in turn improves the quality of learning. Additionally, they facilitate communication and collaboration among students, which is beneficial for the development of social skills and teamwork..
- UTI6: 56.7% of the participants expressed satisfaction when carrying out their work and virtual classes using web resources, reflecting a considerable level of satisfaction with the use of these tools to conduct their tasks and virtual classes. According to Castro and Alanya (2024), the use of digital tools can enhance teachers' job satisfaction because it facilitates classroom management, communication with students, and learning assessment; this is because web tools provide greater flexibility and accessibility, making it easier to manage tasks and virtual classes.
- UTI8: With 58.2%, it was highlighted that participants considered the use of web tools in the virtual classroom environment to provide essential support for acquiring meaningful learning, emphasizing the importance of these technologies in teaching and training. These benefits cannot always be measured quantitatively, but they represent the foundational basis for knowledge development. Alarcón (2021) emphasized that the use of web tools in the teaching-learning process has several key benefits. First, it enhances the learning experience, enabling students to construct their learning more effectively. Moreover, it promotes inclusion and accessibility, as it allows learners to work at their own pace, which can be beneficial for those who need more time or who learn in different way.

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Table 5

Perceived Ease of Use.

	Frecuencia					Porcentaje				TOTAL	
Alternativas Ítems	A	B	C	D	E	A	B	C	D	D	67	100%
FAC1	1	1	5	39	21	1,5	1,5	7,5	58,2	31,3		
FAC2	0	0	2	38	27	0,0	0,0	3,0	56,7	40,3		
FAC8	0	0	3	27	37	0,0	0,0	4,5	40,3	55,2		

Note. TAM Model Applied to Teachers

Based on *Table 5*, the results for each item were interpreted as follows:

- FAC1: The majority of participants (58.2%) agree that learning to use gamification and technological tools is easy for them. This suggests a general perception of ease in using these tools, which can be a positive indicator of familiarity and comfort with technology in this group. This perception is reinforced by the results of Heredia et al. (2020), who concluded that tools like Kahoot, Socrative, and Quizziz are easy to use due to their intuitive interface and easy access. Furthermore, teachers considered gamification a tool that is easy to implement and doesn't require much effort to learn how to use it. This suggests that the ease of use and access to these tools may be a positive indicator of the teachers' familiarity and comfort with technology, as they are willing to learn and use innovative tools to enhance their teaching.
- FAC2: Although 40.3% of participants agreed that they find it easy to do what they want with the use of technology; this figure is lower compared to FAC1. This indicates that there is a diversity of opinions regarding the ease of personalized use of technology, which may reflect varying levels of skill and technological experience among participants. Varona and Engel (2024) stated that digital technologies facilitate personalized learning and pointed out that although they are designed to be intuitive, their effective use varies according to the user's technological experience. Users with higher technological competence make better use of personalized tools, while those with less experience face more difficulties. Perceptions of ease of use and personalization depend on individual skill and experience, leading to diverse opinions about the effectiveness of these technologies in education.
- FAC8: el 55,2% of participants expressed their desire to use these tools more frequently in the virtual classroom. This majority response suggested an interest and positive willingness toward the integration and continued use of these tools in the educational environment, which could enhance innovation and the effectiveness of the educational process. According to Cevallos et al. (2020), the implementation of technological tools in the classroom generates great interest in using them even more in virtual classes, reflecting a positive attitude toward technology in education. This enthusiasm suggests that the ongoing integration of these tools could promote innovative and effective teaching methods, increasing student motivation and engagement. The regular adoption of digital

technologies is linked to higher participation and a proactive approach to learning, transforming the educational environment into a more dynamic and meaningful one.

In summary, the results showed a general tendency toward a positive perception and interest in the use of technological and gamification tools in the educational field, although there are variations regarding the perceived ease of personalized use. These findings support the importance and potential benefit of the continuous and effective use of these tools to improve the educational experience and promote more interactive and meaningful learning.

Conclusions

The COVID-19 pandemic accelerated the need to incorporate digital tools and infopedagogical resources into education. However, a gap was identified between trained teachers and those who still need to acquire digital competencies. Therefore, teacher training in infopedagogical resources is essential to address current challenges and ensure quality education. Collaboration among governments, educational institutions, and international organizations is crucial to closing existing gaps and preparing educators for the future of teaching.

After analyzing the results of the pretest applied to 43 teachers, it was evident that while most possess knowledge of Web 3.0 tools, their effective use is not guaranteed. It was highlighted that the most commonly used tools focus on communication, sidelining the creation of more interactive pedagogical resources. Additionally, the preference for traditional presentation methods, such as PowerPoint, suggests resistance to adopting more innovative approaches. Therefore, the adoption of more interactive, learning-oriented digital pedagogical tools is essential, particularly to strengthen assessment and effective feedback.

Based on the data collected after the experimentation phase, it was concluded that participants have a positive perception and high acceptance of the use of Web 3.0 tools, gamification, and digital technologies in their professional and educational environments. The efficiency, usefulness, and satisfaction provided by these tools were emphasized, as they accelerate educational tasks, enhance communication and collaboration, and support meaningful learning. Moreover, there was a perceived ease in using these technologies, along with a growing interest in their continuous integration into the educational setting.

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