Corresponding author's address:

Departamento de Estudios Pedagógicos de la Facultad de Filosofía y Humanidades. Universidad de Chile. Avenida Capitán Ignacio Carrera Pinto 1025, Ñuñoa, Santiago (Chile)

E-mail / ORCID

lorena.berrios@uchile.cl

https://orcid.org/0000-0003-3698-1712

margarita.calderon@uchile.cl

https://orcid.org/0000-0003-3805-5624

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Analysis of Pedagogical-Digital Competence in Teacher Educators: Practices and Perceptions

Análisis de la competencia didáctico-digital en formadores de futuros docentes: prácticas y percepciones

Lorena Berríos-Barra & Margarita Calderón-López

Abstract: The digital competence of future teachers has been a concern of public policy in Chile, reflected in the development of Information and Communication Technology (ICT) standards that emphasize the importance of incorporating digital technologies pedagogically in initial teacher education (ITE). A lack of digital pedagogical skills has been reported among teachers in training (Silva et al., 2019). The development of digital teaching competence (DTC) also involves those who train teachers. This study focuses on exploring the beliefs of university professors to analyze their impact on the use of technologies in ITE. A Sequential Exploratory Design (DEXPLOS), combining qualitative and quantitative methods, was conducted with teacher trainers. Content analysis was performed in the qualitative phase (n=13), and factorial analysis in the quantitative phase (n=67) using a questionnaire. The results reveal advances in the ethical and digital citizenship aspects of the DTC of the participating teacher trainers but do not suggest a reflective approach during practice, which affects the development of agency among future teachers. In summary, the didactic integration of digital technologies is not evident. The guidelines for didactic-digital competence highlight the importance of promoting and integrating these skills into teaching practices as an essential requirement to improve the conditions of children and adolescents facing the uncertainty of the 21st century.

Keywords: Digital literacy, Multiple literacies, Computer Literacy, Teacher Education, Beliefs.

Resumen: La competencia digital de los futuros docentes ha sido una preocupación de la política pública en Chile que se ha materializado con la elaboración de estándares TIC y que declaran la relevancia de incorporar pedagógicamente las tecnologías digitales en la formación inicial docente (FID). Se ha señalado una falta de competencias pedagógicas digitales en el profesorado en formación. El desarrollo de la competencia digital docente (CDD) atañe también a quienes forman profesores. El estudio se centra en explorar las creencias de docentes universitarios para analizar su impacto en el uso de las tecnologías en la FID. Se llevó a cabo un DEXPLOS (Cual-cuan) con formadores de docentes. Se realizó un análisis de contenido para la fase cualitativa (n=13) y factorial para la fase cuantitativa (n=67) a través de un cuestionario. Los resultados si bien revelan un avance en los aspectos éticos y de ciudadanía digital en la CDD de los docentes participantes, no se visualiza un enfoque reflexivo en las prácticas, que impacta en el desarrollo de la agencia de futuros profesores. En síntesis, no se percibe la integración didáctica de las tecnologías digitales. Dentro de las orientaciones para una competencia didáctico-digital, se revela la importancia de su promoción e inserción en las prácticas docentes como requisito esencial para mejorar las condiciones de niños y adolescentes que enfrenten la incertidumbre del siglo XXI.

Palabras clave: Alfabetización digital, Alfabetización múltiple, Competencia digital, Formación del Profesorado, Creeencias.

1. Introduction

The digital competence of future teachers has become a significant issue in public policies and education. The use of digital tools in the classroom is essential for fostering the skills and competences needed for everyday life (OECD, 2019), better addressing the rapid advancement of knowledge, meeting the challenges of the future, and developing critical thinking to combat disinformation (Frau-Meigs et al., 2017). In this context, the digital literacy of future teachers becomes increasingly important in addressing the digital divide and the lack of adequate digital infrastructure in schools (Rivera Polo, 2023).

However, several studies highlight a lack of pedagogical skills in using technologies in Initial Teacher Education (Silva et al., 2019). Cabello et al. (2020) conclude that the curricula and graduate profiles of Primary and Secondary Pedagogy programs at the national level do not incorporate digital technologies, even at the introductory basic level. On the other hand, students in Initial Teacher Education (ITE) are unfamiliar with using digital technologies as a pedagogical tool (Ayala, 2015; Sandoval Rubilar et al., 2017) and recognize that their teacher training has been based on the most basic and conventional practices, such as using PowerPoint, organizing work, and planning classes (Brun & Hinostroza, 2014).

The digital teaching competence of teachers in training is an important aspect in higher education programs and institutional profiles, as well as for the professors who implement these guidelines. In this respect, it is important to investigate the conceptions of professors involved in ITE and their pedagogical practices in teaching technology.

In the case of Chile, the limited development of digital teaching competence (DTC) in teacher training has promoted studies outlining follow-up actions for universities in implementing ICT standards (Silva, 2012). Similarly, research has shown that the pedagogical dimension of DTC is rarely present, and there is a need for training in digital technologies (Badilla-Quintana et al., 2013). Other studies have identified a discrepancy between the digital practices of pedagogy students and their pedagogical knowledge of digital technologies (Ayala, 2015; Sandoval Rubilar et al., 2017; Silva Quiroz, 2017), as well as their lack of autonomy in integrating these technologies to construct pedagogical knowledge (Cerda et al., 2017).

According to Modelski et al. (2019), the digital fluency of teachers and their teaching practices enable students to make connections that enhance their understanding of digital resources and technologies from a didactic perspective. In this regard, teacher trainers must be a model for the use of digital technologies (Santos et al., 2022) and encourage their use through didactic strategies, so that future teachers can incorporate and internalize digital technologies into their emerging professional practice.

The existing literature on DTC in teacher training is limited. A review by Esteve-Mon et al. (2020) concludes that digital competency models present a traditional view of the use of technological tools and that university professors, on average, have a low level of DTC. Similarly, knowing how to use ICTs does not necessarily equate to their appropriate pedagogical use.

In line with this, digital competence in university professors must include both a personal component and a professional commitment to its development and the generation of new knowledge (García Vélez et al., 2021). Therefore, it is crucial to move beyond the technical use of digital technologies toward a more reflective, collaborative, and inclusive application.

Studies on digital competences in university professors agree that faculty members have low digital competence in assessment and feedback (Santos et al., 2022; Torres Barbazal et al., 2022). This contrasts with the emphasis on the didactic use of technologies (Santos et al., 2022) and the medium-to-high level of digital competence, which, however, is weak in innovation (Cateriano-Chávez et al., 2021).

In general, the aforementioned studies emphasize the need for a more pedagogical integration of ICTs and methodologies that challenge their implementation (Cateriano-Chávez et al., 2022), especially in those responsible for training future teachers for 21st century society. Therefore, the challenge is to transition from digital teaching competence to didactic-digital competence for teachers in training.

1.1. Digital teaching competence and multiple literacies: A digital and critical didactic framework for ITE

The concept of digital teaching competence has been approached from various perspectives, highlighting the importance of didactics, mastery of digital skills, and the development of digital skills (Esteve-Mon et al., 2020; García Vélez et al., 2021; Verdú-Pina et al., 2023).

This article addresses DTC from a holistic and critical perspective, considering digital technologies as tools for reflection and didactic action. This view aligns with the definition proposed by Castañeda et al. (2018), who characterize it as «holistic, situated, oriented towards roles of performance, function and relationship, systemic, trainable and constantly developing» (p. 14). This conceptualization of DTC is closely related to everyday teaching practices and incorporates a dimension of social engagement. According to Esteve-Mon et al. (2016), DTC is not limited to the possession of skills, knowledge, and attitudes, but rather implies «the ability to put them into action, mobilize them, combine them and transfer them, to act in a conscious and effective way with a view to a purpose» (p. 47). This approaches a didactic dimension, as it involves engaging critically by integrating digital technologies into teaching practices.

As a way of addressing digital teaching competence from a didactic perspective, the pedagogical approach of multiple literacies has been considered (Cazden et al., 1996). This approach is linked to inclusion and social justice, proposing epistemic movements and selecting strategies based on context and promoting student agency (Cope & Kalantzis, 2023).

The pedagogy of multiple literacies is a framework that proposes knowledge processes to address experimentation, the conceptualization of theory, critical analysis, and the application of the knowledge addressed in classes. Additionally, this pedagogy encourages the appropriation and transformation of the world through its impact on its own context (Kalantzis et al., 2019). In this sense, it is possible to incorporate a critical dimension for reflection on the context and the possibilities of social

transformation through the realization of projects in communities. These projects allow students to apply their knowledge in the real world, promoting meaningful learning and engagement with their environment.

1.2. Teaching perceptions to promote the didactic use of digital resources

To understand DTC from a didactic approach, it is essential to consider the perceptions that university professors have about digital technologies within the framework of ITE. This exploration allows teachers to deepen their understanding of the use of digital technologies in the classroom, an aspect that has been identified as an obstacle to the effective integration of technologies in the educational process (Ottestad et al., 2014; Tondeur et al., 2017; Voogt et al., 2013).

It should be noted that this negative perception of the use of digital technologies contrasts with the favorable self-perception that university professors have of their own digital competence (Cateriano-Chávez, 2022). This dissonance highlights the need to understand the underlying conceptions that inform teaching practices in relation to digital technologies. To design more effective training strategies, it is necessary to promote an integrated and meaningful use of technologies in the classroom.

In the case of this study, perceptions have been considered from the extrinsic and intrinsic aspects that influence the belief system (Fons & Palou, 2014). In other words, the perceptions related to both professional practice and the action and the principles in that frame this action were considered. The latter involves implicit theories that constrain the way teachers approach and interpret different teaching-learning situations (Pozo et al., 2006, p. 70).

2. Method

This study aims to investigate the perceptions of university teaching staff regarding the use of digital technologies in the pedagogical field.

The general objective of the research is to analyze the perceptions of university professors who train teachers in the use of digital technologies from the pedagogical approach of multiple literacies. The study seeks to explore whether these beliefs influence the conception and use of technologies in their teaching practices for teacher training.

In this regard, three objectives have been proposed to guide the study:

a) Analyze the personal and professional use of digital technologies by university professors.

b) Describe the digital skills of teachers based on the DigCompEdu dimensions and their technological fluency.

c) Identify the degree of knowledge that faculty members have about multiple literacies in ITE.

A sequential exploratory design (DEXPLOS) with a qualitative emphasis was employed and its results were explored through an extended sample by using a questionnaire in a quantitative phase.

The sample for both the qualitative and quantitative phases is non-probabilistic (Hernández Sampieri et al., 2014) and purposive, as the aim of the research was to explore the conceptions of professors working in ITE. For the selection of the sample, the minimum requirement was to teach a pedagogy program and have at least three years of experience training teachers at the university level. The general criteria were based on the literature reviewed regarding the level of competence and use of digital technologies in ITE. Participants in the qualitative phase consisted of 13 professors from a public university. These participants taught on the degree programs of Pedagogy in Primary Education (6), Scientific-Humanistic Secondary Education with a specialization (3), Pedagogy in Kindergarten Education (2), Pedagogy in Secondary Education in Biology and Chemistry (1), and Pedagogy in Secondary Education in Mathematics and Physics (1). The characteristics of the participants are detailed in Table 1.

Table 1. Description of participants.

Participant	Description				
	Sex	Age	Field of expertise	ITE experience (<10, >10)	ICT training
D1	F	65	Didactics	>10	No
D2	F	55	Language	>10	Yes
D3	F	50	Psychology	<10	No
D4	F	56	Early Childhood	>10	No
D5	M	35	Mathematics	<10	Yes
D6	M	68	Curriculum	>10	No
D7	F	38	Language	<10	No
D8	M	38	Chemistry	<10	Yes
D9	M	60	Mathematics	>10	Yes
D10	F	40	Mathematics	<10	Yes
D11	F	55	Philosophy	>10	No
D12	F	55	Biology	>10	No
D13	F	38	Language	<10	No

The qualitative phase included interviews and observations of classes or digital didactic resources. The analysis of the interviews and observations of classes and didactic resources was conducted using mixed coding that integrated dimensions from the literature review and emerging categories aligned with the objectives of the study. The analysis was performed using Atlas.ti.v.8.4.5 software. The observation of the resources, which were provided by the participating professors, was carried out based on criteria that incorporated the dimensions of DTCs and digital fluency, in accordance with the European Framework for Digital Competence for Educators, or DigCompEdu (Redecker, 2017). Additionally, two dimensions were included: the didactic use of digital technologies, grounded in the pedagogy of multiple literacies, and pedagogical

interaction. The resources included classes (6), presentations (7), pedagogical material in PDF format (7), and digital pills (2).

For the quantitative phase, a questionnaire was applied, developed based on a literature review and the dimensions derived from the qualitative phase. The following dimensions emerged from the first phase of the study: use of technology and incorporation of digital tools (referring to the university professor as a technology user), digital technology for ITE (referring to the planning and execution of learning experiences with digital technologies), mastery of technology (addressing digital training) and the role of technologies in the classroom (exploring professors' beliefs and attitudes about technology and their role as teacher trainers).

The questionnaire was validated using Cronbach's alpha coefficient, which yielded a reliability statistic of .898, indicating internal consistency (Rodríguez-Rodríguez & Reguant-Álvarez, 2020) and an adequate level of reliability. A description of the items in the questionnaire can be found in Table 2.

Subsequently, university teacher trainers were invited to participate. The invitation was extended via social media, instant messaging, and email, specifying criteria for participation: university professors teaching in a pedagogy program, having at least 3 years of experience training teachers at the university level, and using digital technologies in ITE. In this phase, a total o 67 professors participated, representing public (n=46) and private (n=21) universities that met the selection criteria established in the qualitative phase.

For the questionnaire, a multivariate analysis was conducted using SPSS Statistics v.27 software and the exploratory factor analysis technique. This technique enables the identification of internal attributes not directly observable in the data, which underlie the relationships among a set of variables (Walker & Maddan, 2012), enabling the expression of a case.

Analysis models were developed based on the study objectives to explain the conceptions of digital technologies from a pedagogical approach, thereby expanding the results of the qualitative phase. For analyzing pedagogical resources, an observation guideline was prepared, incorporating areas of competence from DigCompEdu (professional commitment, teaching, and learning) and the processes of the multiple literacies pedagogical approach by Kalantzis et al. (2019), which include experimenting, analyzing, conceptualizing, and applying.

For both phases, participants were engaged through informed consent to ensure adherence to ethical principles, including rational understanding, voluntary acceptance, and the reversibility of the process (Villarroel Soto, 2018).

3. Results

The results address perceptions and beliefs regarding digital technologies, organized around three core concepts aligned with the research objectives: personal and professional use of digital technologies by university educators, digital teaching competence of teacher trainers, and the degree of knowledge that faculty members have about multiple literacies for ITE.

3.1. Personal and professional use of digital technologies

Qualitative data analysis categorized the interviewees as technology users. The participants were characterized based on their level of technology training and their self-perception as users. These dimensions revealed that the teacher trainers interviewed primarily developed their digital competence through self-directed learning. Seven professors reported a lack of formal technological training during their university education (D2, D3, D4, D5, D6, D7, D11). Only three educators indicated (D2, D8, D9) receiving formal instruction during their undergraduate studies, with a disciplinary distinction favoring scientific fields. Educators from scientific disciplines noted that technology played a more significant role in their undergraduate training, regardless of their age (D8, D9, D10).

The absence of formal university training in technology underscores the importance of self-directed learning in professional development. It should also be noted that most professors indicated that they used digital tools and Office programs, such as email, Word and PowerPoint, throughout their academic careers. PowerPoint, in particular, was frequently highlighted as a tool they continue to use consistently, in some cases even representing an advance from older technologies. This reliance reflects a comfort zone and the belief that teacher training aligns with transmitting content in a secure and fixed medium. The collaborative aspect of self-directed training was also highlighted, involving students (D1, D3, D4) or colleagues (D3, D5).

Similarly, most professors categorized themselves as basic-level technology users, employing traditional and/or commonly used tools in daily life, academia, and professional contexts. While not considering themselves experts, most of them affirmed that they use technology on a daily basis and that it has been a significant part of their pedagogical practice over the years:

> «I consider myself a good user. I'm not afraid of using technology; in fact, I like to use it for basic things in my personal life. I'm not very sophisticated in its use» (Professor D10).

In this sense, although the use of technologies was present in pedagogical practice in the pre-pandemic educational context, they were not central to teachers' pedagogical practice.

However, the 2020 health crisis is understood as a turning point in their educational trajectory regarding technology. The context of classes during the pandemic required teachers to become familiar with or deepen their use of new digital platforms such as Classroom, Google Forms, Moodle, and YouTube. These tools were used to interact didactically with students, both for the transmission or creation of content and for evaluative processes. Furthermore, it is notable that most reported using and mastering tools such as Zoom and Meet to establish telematic communication with their students. In this context, Zoom was highlighted for group work because it replicates in-person collaboration in an online format.

To qualify these results, the quantitative phase provided a broader characterization of university professors' personal and professional use of technologies. It is worth noting that the factorial analysis of the questionnaire was conducted using models that explain the consistency of the questions based on their correlation. The components account for the consistency of the correlation between the model's

questions. In this way, consistency is reinforced and indicates a trend. For better understanding, consistency is achieved with values above 0.80 or 0.90 (Rodríguez-Rodríguez & Reguant-Álvarez, 2020). In the case of the models, the predominant factors are those with values above this threshold and in correlation with two components.

Among the models obtained through factorial analysis, two predominant factors emerged regarding the use of digital technologies for communication with students and teaching. Regarding the first factor (component 1), university professors consider the use of technologies in the classroom a relevant tool for communicating with their students. One of the biases that may have been a conditioning factor was the remote classroom setting during the pandemic, wherein digital technologies were used to foster a more emotional connection with students.

The other predominant factor is the use of digital technologies to record activities with an emphasis on assessment (component 2). This reflects the use of analytics to assess learning rather than to enhance DTC in future teachers, as shown in Table 2.

Table 2. Personal and professional use of digital technologies based on their importance.

Factor	Component 1	Component 2
Tools for teaching	.874	-.114
Importance of using digital technologies in the classroom	.821	-.127
Communication with students	.761	-.338
Assessment and recording of activities	.706	.257
Use of technologies	-.075	.953

3.2. Digital competences of university professors on ITE

Most professors reported that the use of digital tools increased as a result of the health crisis. On the one hand, they described having to train in the use of different platforms. Additionally, they noted the need to innovate in how they conducted their classes and maintained contact with their students.

Regarding the configuration of the digital competences of the interviewees, it is significant that these competencies largely stemmed from informal experiences rather than their educational training or the institutions where they work. In this regard, the results of the quantitative phase revealed criteria used by university professors to incorporate digital technologies into their teaching practices, as well as aspects of digital citizenship that, it could be said, are not formally taught.

Within the observed models, the independent variables reflected the ethical criteria used by university professors when incorporating a digital tool. Both models identified the communality of two factors each (Table 3), allowing for the differentiation and analysis of the predominant factors in the development of digital teaching competencies among this group of university professors.

Table 3. Criteria for incorporating digital tools and ethical aspects.

Factor	Component 1	Component 2
Interaction between teachers and students	.816	.220
It is free to use or has a low cost for the educational institution	-.089	.727
Talking about plagiarism and intellectual property on the internet	.360	-.775
Using chat or audio to obtain feedback from the students	.812	-.075

According to Table 3, the criteria for using and selecting digital technologies can be distinguished. These technologies are perceived as facilitators of relationships with students and of learning, as they enable smooth interaction and personalized feedback, reflecting a pedagogical rather than formative or technical bias in how tools are viewed for assessment purposes.

Regarding the criteria for selecting technologies, teachers prefer to use tools that do not incur costs or are low-cost for the educational institution. For instance, Zoom is one of the most widely used platforms as it is provided by the institution.

In terms of aspects related to digital citizenship, teachers demonstrate an ethical and responsible approach to the use of technologies. For example, most faculty members value discussions with students about plagiarism and the misuse of online information. Additionally, during remote classes, they established recording protocols that required consent, an issue that is linked to citizenship and the ethical use of digital resources.

Moreover, interaction with students is important for university professors, who select the most suitable digital tools for this purpose, such as using audio and chat channels during synchronous classes.

3.3. Degree of knowledge that faculty members have about multiple literacies for ITE

This objective focused on identifying university professors' knowledge about multiple literacies as a didactic approach to digital technologies. It corresponds to a pedagogical dimension of knowledge, integration, and interaction with technologies for teaching purposes.

In the results of the qualitative phase, the analysis of the interviews revealed two key dimensions: motivation and attention and the didactic use of technologies to achieve learning objectives.

The importance of motivation and attention highlights the use of digital technologies to foster engagement with the content delivered during classes. Specifically, it is noted that visual and audiovisual presentation software enables content to reach a large number of students simultaneously, with fewer distractions, as the professor selects and organizes the information to sustain attention:

> «It helps me convey things in a less boring way, but there is also very interesting audiovisual material and I can share it with all of them at the same time. It's like bringing in a recess or something more festive or playful» (Professor D3).

The professors recognize that technologies are an integral part of students' lives outside the university teaching environment, making their inclusion in teaching a way to address their interests. In this regard, digital technologies provide communication channels that students use in their daily lives:

> «The use of computers, the use of other tools, the use of cell phones in class—it's something tied to the students. I think that for learning to be meaningful, we need to connect with their interests, and their interests lie in that direction» (Professor D7).

In this way, the faculty members perceive the relevance of digital technologies in ITE primarily in two aspects: the connection with students and as part of their world, culture, and imaginaries. From the perspective of teacher training, they believe that future teachers should be trained in the use of digital tools to establish links between their teaching practices and the university context.

In this regard, digital technologies are seen as more playful and relatable tools in connection with students' cultural practices and interests. This relationship facilitates the presentation of content and the achievement of teaching objectives:

> «Creating visualizations, engaging in a semiotic process (of semiosis and noesis) to be able to present the concept, having to verbalize the concepts you are working on, the situations, or how to solve a problem, or how you reflect on … they are support tools for achieving your objectives» (Professor D10).

From a didactic perspective, digital technologies are seen as tools that facilitate the exploration and use of various resources to strengthen the connection between the teacher, the learning objectives, and the curricular content developed in classes. This aspect is reinforced when comparing the use of digital technologies with other resources, as it is pointed out that they foster the understanding of content that could not be achieved with other means (for example, calculations that cannot be done by hand or with a calculator). Using such technologies would allow the exploration and analysis of content and processes that cannot be done using analog resources:

> «If I didn't have these technological means, it would only be what I could do by hand, and that, of course, limits the exploration of the behavior of some functions, of some variables» (Professor D9).

This disciplinary distinction is particularly emphasized in the Biology-Chemistry Pedagogy course, where it is noted that digital technologies encourage reflection on worlds that would otherwise be inaccessible because they are not perceptible to the human eye (animations, simulations, and illustrations of abstract content are inferred). It is underscored that it is necessary to reflect on the didactic use of technology in the classroom:

> «If you understand didactics as this space where the subjects relate to the resources, the curriculum, the teachers, and their intentions, clearly technologies play a really key role because they are in that corner of resources» (Professor D8)

In general, there is evidence of a positioning of digital technologies as tools that should be used from a critical-reflective standpoint rather than a merely technical one.

Regarding the knowledge processes related to multiple literacies, the observation of pedagogical practices revealed that experimentation of the new in relation to the known is the knowledge process that occurs most frequently. However, only 53.8% of teachers connect with students' previous experiences or present a resource that is linked to their prior knowledge. In this sense, this aligns with the noted playful aspect of digital technologies. Nevertheless, only 38% of teachers engage in conceptualization with their students, as they generally lean more toward teaching than learning. The knowledge process of "analyzing" multiple literacies is developed by 30.7% of the teachers through resources and classroom activities with digital technologies.

On the other hand, the dimension that appeared the least frequently was the application, either creatively or appropriately, of the knowledge addressed in classes. Only one of the participating professors demonstrated this practice in their classes, and 30.7% approach it without fully implementing it. However, despite the digitalization of teaching during the pandemic, most professors fail to promote student agency in using and incorporating digital technologies. Therefore, the adaptation of content and how students have opportunities to transform the content they develop in classes remains unclear. This aspect is identified as one of the lowest among the dimensions analyzed.

However, in the analysis of the questionnaire, the impact that the digital tool has on students and the didactic interaction enabled by the tool is evident. Tools that enhance creativity and information management were also observed, as shown in the chart (Figure 1). A second model focused on the independent variable of experience with the digital tool, which revealed conceptions about the interactivity it enables and its potential as a didactic tool (Figure 2).

The figure 1 demonstrates that professors view digital technologies as tools that foster processes of autonomy and motivation, which influence learning processes. However, autonomy is one of the most valued aspects, more so than motivation.

Regarding tools that enhance creativity and interaction, the professors report using them when they foster didactic interaction. That is, when they foster connections between the resource and the student and among students themselves, and not just between teacher and students. This is explained by the characteristics of the resources. For example, Mentimeter allows students to share their own ideas and comments without necessarily requiring teacher intervention and in the case of Jamboard, students can work collaboratively without teacher intervention.

With regard to tools that promote creativity and management, most teachers associate them primarily with the use of Excel and Canva. It should be noted that Canva, unlike Excel, is characterized by its multimodal nature, which makes it a versatile tool for creating engaging and dynamic educational materials.
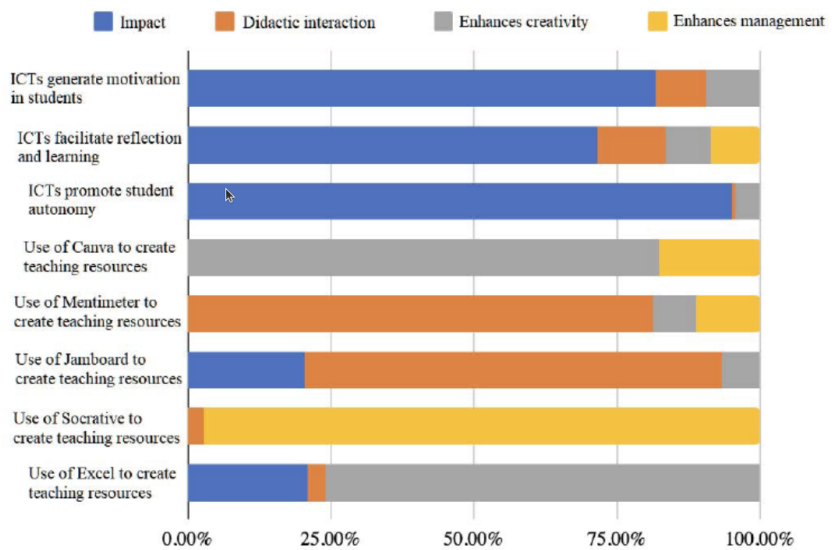
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Figure 1. Interacción didáctica y herramientas que potencian la creatividad y la gestión de la información.

Regarding experience with the digital tool, the interaction is understood as a space for connection and relating with students, occurring within the framework of what the tools allow them to do. As the tool facilitates greater interaction with students, it is perceived as didactic (e.g., Zoom or Google Meet). In contrast, PowerPoint, YouTube, and multimedia videos are relevant insofar as their interactivity replicates the traditional classroom, as can be seen in Figure 2.
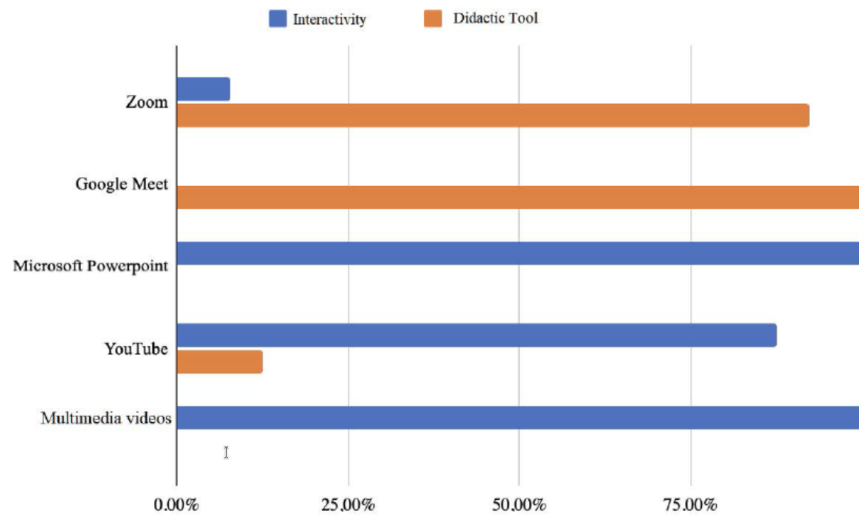

Figure 2. Concepción sobre la herramienta según la experiencia o conocimiento del docente universitario.

4. Discussion and conclusions

This study addressed teacher trainers' perceptions of the pedagogical use of digital tools in the university classroom to analyze their didactic digital competence.

Regarding the digital teaching competence of the participants, it is noteworthy that these competencies predominantly stem from informal experiences rather than from their formal training or the institutions where they work. These experiences shape their relationship with digital tools and their potential for interaction and didactic use. Furthermore, a clear distinction is made between the use of digital technologies pre- and post-pandemic and their impact on the relationship with digital technologies for teaching. In this regard, and given the importance of self-directed training, it can be inferred that the pandemic contributed to the teacher trainers' interest in deepening their knowledge about technology.

The participating faculty members express concern about the lack of systematic integration of digital technologies in ITE, as it currently depends largely on the initiative and individual training of each professor. While technologies are perceived as tools that facilitate learning in students considered digital natives, their current use mainly focuses on technical aspects, neglecting the reflective and intentional approach, which is an aspect that should be fundamental in their training. In this sense, ethical and citizen awareness emerges as a relevant aspect, as noted by Cateriano-Chávez et al. (2022).

The professors see themselves as users of technology, with a large majority of them reporting that they frequently use digital tools in initial teacher training. Thus, ICTs are a central or crucial element for the development of the classes they teach. The professors primarily use widely-known tools such as PowerPoint presentations or YouTube videos. While digital resources are employed to generate debates and reflections on various issues, it is unclear whether the teacher trainers instruct students on the use and understanding of these technologies. Instead, digital tools often seem to serve merely as channels or instruments to mediate dialogue, rather than being fully integrated into the educational process or fostering student agency. This situation contrasts with the ideal teaching model proposed by Santos et al. (2022), where digital technologies are used strategically to enhance learning and the development of critical skills in students.

Although the study has limitations, including a limited sample in the quantitative phase and the context in which it was conducted (pandemic and post-pandemic), it can be stated that the results obtained are significant and can guide the development of digital competence in initial teacher education, steering it toward a more holistic, integrative, and situated didactic-digital competence that emphasizes classroom teaching practices.

In this context, the results of this research confirm the importance of promoting digital competences that support the didactic use of technologies. Digital teaching competence (DTC) refers to the ability of teachers to effectively integrate their knowledge of digital technologies into the curriculum.

This integration should encompass the stages of planning, implementation, and assessment of teaching activities, with the objective of improving and facilitating the teaching process, as indicated by Esteve et al. (2016).

DTC implies that teachers consider their knowledge, attitudes, and skills about digital tools when planning their classes. Thus, the digital didactic integration of technologies would involve directing planning toward the learning objective so that future teachers have meaningful learning experiences and can integrate them into their own learning process. These aspects could be considered in future research aimed at gaining a deeper understanding of this integration in a larger sample and in more diverse application contexts.

The integration of digital technologies in education is an urgent necessity, as students are currently immersed in a world shaped by these tools. It is essential for teachers to take advantage of the opportunities offered by digital technologies to innovate in the teaching process, adopting a critical and reflective perspective on the tools they use.

For Chilean society, teachers with DTC are highly valuable. Although Chile has been a Latin American benchmark for the incorporation of programs to promote the integration of ICT in the school classroom (TALIS-OECD, 2018), there is still a long way to go in the incorporation of digital technologies as an integrated formative process that promotes the development of competencies in both students and teaching. The ability of teachers to integrate digital technologies into teaching contributes to the development of key competencies in students, which in turn improves the quality of education and active participation in society. Therefore, it is essential to include DTC in the curricula for education students in order to rethink training actions that ensure the integration of technologies, as suggested by Esteve et al. (2016), but also the ethical and critical aspects of their understanding.

When teachers are able to perform within a classroom applying DTC, the education of children and young people will be positively transformed, as their proper use «will condition, to some extent, the development of children's DC [digital competence] and how they will be able to become digitally competent citizens» (Santos et al., 2022, p. 50) to actively participate in society.

In summary, DTC involves both technical skills and a reflective pedagogical approach to the integration of technology, so that future teachers are able to incorporate new digital tools into teaching and promote their proper use.

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6. Annex I. Items and indicators of the questionnaire linked to the Digital Teaching Competence.

Ítem	Indicador
8.- How important is it to use ICTs in the classroom?	Where 1 is Not at all important and 5 is Very important
9.- Do you use ICTs in the classroom?	Yes (if you answer YES, please go to question 9.1 and then go to question 10 onward)
	No (if you answer NO, please go to question 10)
9.1 On a scale of 1 to 5 where 1 is Not at all important and 5 is Very important, please, indicate how important the use of ICT is for you for the following purposes:	Tools for teaching
	Communication with students
	Assessment and recording of activities
10. From the following reasons for the use of ICT in the classroom, select the three most important for your teaching work (where the first selection is the most important, the second selection is moderately important, and the third selection is the least important).	To encourage student motivation
	To encourage student attention
	To connect with students' daily practice
	They are necessary for educational work
	They allow transversal integration across disciplines
	They promote more dynamic interaction
	They facilitate administrative work related to teaching
	They support research processes
11.- How willing are you to incorporate digital tools into your pedagogical practice?	Where 1 is No willingness and 5 is Total willingness
12.- Of the ICT resources mentioned below. Select the level of use of each in your personal and/or work life (First selection – Very used, Second selection – Moderately used, Third selection – Rarely used).	Administration (Email, Moodle, Classroom, UCurso, etc.)
	Presentation (Power Point, Prezi, etc.)
	Pedagogical interaction (Menti, Simulations, Padlet, etc.)
	Communication (Zoom, Meet, Jipsy, etc.)
	Creation (Canva, Loom, Genially, etc.)
	Social interaction (Whatsapp, Facebook, Messenger, etc.)
	Assessment (Google Form, Baamboozlee, Kahoot, Socrative, etc.)
13.- For what reasons do you use ICT in your personal and/or work life? Select the 3 most used (First selection – Very used, Second selection – Moderately used, Third selection –Rarely used).	I use them now mostly for communication.
	I use them now mainly for presentation of content
	I use them now to create new resources (visual, sound, audiovisual, etc.)
	I use them now mainly for formative and summative assessment
14.- Do you consider the didactic use of ICT in the planning and programming of your courses?	Yes
	No
	Sometimes
	Don't know/Not applicable
15.- If you answered "yes" or "sometimes" to the previous question, how important are the following examples of the didactic use of ICT to you (where 1 is Not important at all and 5 is Very important)?	Innovating in assessment instruments
	Facilitating the exchange between students and teaching interventions, understanding the prior knowledge of the students
	Discussion and group work

Ítem	Indicador
	Organizing information
	Development of teaching material
	Creation of audiovisual material by students
	Development of concept maps
	Use of tools for deepening specialized knowledge of content
	Development of expository classes
	Development of online forums
	For assessment
19.- To what do you agree with the following statements?	Where 1 is Strongly disagree and 5 is Strongly agree
The error or failure of digital technology IS a relevant factor that you consider when deciding whether or not to implement it in your courses.	
The error or failure of digital technology is NOT a relevant factor that you consider when deciding whether or not to implement it in your courses.	
20. Of the following options, select the three most important criteria you consider when incorporating a digital tool into your teaching (Where the first selection is Very important, the second selection is Relatively important, and the third selection is Least important)	To improve student learning outcomes
	It is free or has a low cost for the educational organization
	It offers personalized and frequent feedback
	Suggestions from my educational organization
	For interaction between teacher and students
	To facilitate student learning
21.- Based on your experience or knowledge regarding the use of ICT, how much interactivity with students do the following tools facilitate? You should respond to each of the tools listed below.	Zoom
	Google Meet
	Microsoft PowerPoint
	YouTube
	Multimedia Videos
	Moodle
	Google Classroom
22.- How skilled do you think your students are in ICT?	1. Very poorly skilled
	2. Very skilled
23.- On a scale of 1 to 5, how much you agree with the following statements (1 is Strongly disagree and 5 is Strongly agree)	ICT can have a pedagogical use, as they are tools that generate motivation in students
	Digital tools facilitate reflection and learning
	Digital tools promote student autonomy in their teaching-learning process

Ítem	Indicador
24. What aspects of digital citizenship do you consider most important to include in your role as a trainer of teachers? (Indicate the level of importance of the following aspects of digital citizenship and check the boxes in the columns for your selections).	Recording the class with the consent of the students
	Discussing plagiarism and intellectual property on the internet
	Promoting safe use of the internet in their teaching
	The material shared is easy to access and read
	Attempting to diversify the use of platforms for the students
	Limiting the use of networks to protect your privacy and that of your students
	Using chat or audio to obtain feedback from the students
25. How important is it to you to use each of the following digital tools to create pedagogical resources? (1. Very important, 2. Moderately important, 3. Not very important)	1. Genially
	2. Power Point
	3. Canva
	4. Mentimeter
	5. Jamboard
	6. Zoom chalkboard
	7. Mote
	8. Kahoot
	9. Socrative
	10. Quizizz
	11. Google Classroom
	12. Excel
26. Regarding the level of flexibility of ICT tools to adapt to the university classroom, one could say they are:	1.Not adaptable at all
	5.Completely adaptable