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Article

# Digital teaching competencies in the teaching-learning process in times of covid-19

Competencias digitales docentes en el proceso de enseñanza-aprendizaje en tiempos de covid-19

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## Abstract

In the current context, the growing expectation of knowledge and application of new technologies and their applications produce important repercussions in all spheres of society, even more so during the pandemic caused by covid-19, therefore it is essential to reflect on their importance and implications. This study presents a theoretical overview of some meanings, concepts and models of digital competencies, socializes data that allow to demonstrate the level of development and usability in the Faculty of Philosophy, Letters and Educational Sciences of the Central University of Ecuador, finally aspects to deepen the subject and its relevance in the educational process are exposed.

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## Resumen

Las competencias digitales docentes en el quehacer educativo a nivel superior en el contexto actual, la creciente expectativa de conocimiento y aplicación de nuevas tecnologías y sus aplicaciones producen importantes repercusiones en todas las esferas de la sociedad, más aún durante la pandemia ocasionada por la covid-19, por ello es fundamental reflexionar su importancia e implicaciones. El presente estudio presenta un panorama teórico sobre algunas acepciones, conceptos y modelos de competencias digitales, socializa datos que permiten evidenciar el nivel de desarrollo y usabilidad en la Facultad de Filosofía, Letras y Ciencias de la Educación de la Universidad Central del Ecuador, finalmente se exponen aspectos para profundizar la temática y su relevancia en el proceso educativo.

**Palabra clave:** modelos de competencias digitales, docentes universitarios, tecnologías educativas, proceso de enseñanza-aprendizaje

## Introduction

Characterizing learning in virtual environments as a process of construction implies, essentially, affirming that what the learner learns in a virtual environment is not simply a copy or a reproduction of what in that environment is presented as content to be learned, but a reworking of that content mediated by the learner's cognitive structure, the same that is carried out as a function of, and from, a broad set of elements: basic cognitive capacities, domain-specific knowledge, learning strategies, metacognitive and self-regulatory capacities, affective factors, motivations and goals, mutual representations and expectation.

It is important that teachers develop digital competencies that strengthen study relationships and optimize their use in the teaching and learning process. The educational system includes the development of virtuality in the classroom to enhance this process. In this sense, the

mastery of digital competencies in virtual environments and information and communication technologies by teachers is essential.

The national education system demands a permanent process of updating, the faculties of education must consider scientific and technological advances to contribute efficiently in the training of future teachers. In the information and knowledge era, technological gaps between generations become a danger for the social exclusion of people who have not developed technological skills and incorporated digital concepts and skills that allow them to interact in all contexts. Thus, in the case study, the digital competencies of teachers at the higher level in times of covid-19 are of great importance in the teaching and learning processes, since they will allow optimizing resources and time. It is important to analyze the differences between digital natives and the so-called digital migrants to establish functional alternatives with pragmatic methodologies according to these realities; identifying the interests and needs of the teachers of the Faculty of Philosophy, as well as those of the students.

A university teacher (digital migrant) who has developed competencies in virtual environments, through training and qualification processes, will obtain levels of impact to technological usability in favor of the pedagogical process and thus will better fulfill its work in the training of future teachers (digital natives) who will join their efforts to contribute to significant changes in the country's education.

**A conceptual understanding of digital competence.**

Digital competence can be conceived as the theoretical review of the concept and its relevance to formal development in order to achieve digital literacy. Bawden (2008), Martin and Madigan (2006) and Deursen and Dijk (2010), present a conceptual model that distinguishes three areas of knowledge:

- Instrumental skills and knowledge, necessary for the management of digital tools, considering their interconnected, visual, dynamic nature.
- Advanced skills and knowledge, necessary to apply the instrumental abilities in digital environments, organized in progressive order, from the resolution of tasks, to the strategic

application to achieve integration in the personal life of each citizen.

- Attitudinal skills and knowledge, which represent ways of thinking and motivations that move citizens to act in certain ways in digital environments.

The implementation of technologies in the workplace must consider the development of competencies in employees, therefore it is essential to have a thorough knowledge. According to research conducted by the Organization for Economic Cooperation and Development (OECD), "the increased use of Information and Communication Technologies (ICT) has not only increased the demand for specialists, but also the development of competencies commonly known as soft skills". Companies, educational institutions and various organizations require their participants to demonstrate more interaction, collaborative work, responsibility to align with work requirements, innovative, strategic and creative thinking.

In recent years, there has been a certain consensus on the definition of "competencies", since these are not only based on knowledge and skills, but also include attitudes and values that are necessary for professional development. Thus, a person can be considered competent when he/she knows how to mobilize his/her personal resources (knowledge, skills, attitudes) and those of the environment (technology, organization, others) to respond to complex situations, including formal and informal procedures, thus constituting a capital for action linked to the ability to mobilize and take action Perez (2001).

**Digital competencies in the educational field**

In the last decade the term competency has been present in all educational fields and its importance is such that it is part of the educational curriculum in several countries. The concept itself has several meanings and is currently much discussed among education professionals. Among the definitions we have that it is the "Ability to deal effectively with a family of analogous situations, mobilizing consciously and quickly, relevant and creative, multiple cognitive resources: knowledge, skills, information, values, attitudes, schemes of perception, evaluation and reasoning" Perrenoud (2004). It is relevant that digital competencies are assumed as the most practical and measurable results of the training processes in relation to the new digital

literacy. For Rangel and Peñalosa (2013) the meaning of digital literacy, understood as a "construct, is limited briefly to cognitive processes that allow the acquisition of certain skills for the use of information and communication technologies and information management", although to be precise they assume that these processes are the product of training in the management of resources based on technologies of the information world, digital competencies should be understood under a holistic view that encompasses knowledge and skills of a technological nature.

According to the information compiled by Rangel and Peñalosa (2013) in their research on digital competencies in university teachers, they mention that there is no clear concession in this regard, they assume the following parameters: (a) processes mediated by the use of information and communication technologies where the university teacher should develop certain skills in computer techniques, constant professional updating, teaching methodology according to the challenges and attitude towards new technologies; (b) dimensions of formative traits that cover aspects such as instrumental management, cognitive capacity, the attitudinal factor towards new technologies and axiological strengthening according to all the above; (c) an approach to mechanisms related to knowledge management that focus on essential aspects such as the handling of basic notions about educational technologies, increasing the level of knowledge about new technologies and finally the implementation of knowledge generation mechanisms.

UNESCO in 2008 had established three approaches to digital competencies which are summarized as: (1) understanding and integration of technological competencies, (2) application of technological knowledge to solve real and concrete problems, and (3) production of new knowledge from the already generated. It can be said in this regard that the issue is not novel; but there is still a long gap to be bridged in many countries regarding the training of competitive teachers in the digital competencies approach since "it is clear that a teacher cannot make a student develop a competence that he himself does not possess in depth", Fernandez-Fernandez (2016).

**Perspectives on digital competencies.**

Marzal and Cruz (2018) bet on a proposal for a competency-based educational model for higher education, under which a series of changes should be structured by adopting new didactic schemes such as: (1) predisposition to develop attitudes that make it viable to channel new skills; but in an effective and efficient way by possessing techniques and tools according to the specialty to be developed; (2) development of digital competencies inherent to new interactivity platforms and where the empowerment of the learner is something tangible in the multiple forms of interactivity that are developed within the digitization of learning processes.

ICT Competency Standards for Teachers ( ISTE, 2008 )
Creativity and innovation
Teachers demonstrate creative thinking, build knowledge and develop innovative products and processes using ICT.

- Apply existing knowledge to generate new ideas, products or processes.
- Create original works as a means of personal or group expression.
- They use models and simulations to explore complex systems and issues.
- They identify trends and foresee possibilities.

**Communication and collaboration**

Teachers use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.

- They interact, collaborate and publish with peers, experts or others, using a variety of environments and digital media.
- Effectively communicate information and ideas to multiple audiences, using a variety of media and formats.
- Develop cultural understanding and global awareness by engaging with teachers from other cultures.
- They participate in teams that develop projects to produce original work or solve problems.

**Effective research and localization of information**

Teachers apply digital tools to obtain, evaluate and use information. digital tools to obtain, evaluate and use information.

- Plan strategies to guide the research.
- They locate, organize, analyze, evaluate, synthesize and ethically use information from a variety of sources and media.
- Evaluate and select information sources and digital tools to perform specific tasks, based on their relevance.
- Process data and report results.

Critical thinking, problem solving, and decision making.
Teachers use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.

- Identify and define authentic problems and meaningful research questions.
- They plan and manage the activities required to develop a solution or complete a project.
- Gather and analyze data to identify solutions and/or make informed decisions.
- They use multiple processes and diverse perspectives to explore alternative solutions.

**Digital citizenship**
Teachers understand the human, cultural and social issues related to ICT and practice legal and ethical behaviors.

- Promote and practice safe, legal and responsible use of information and ICTs.
- Exhibit a positive attitude towards the use of ICT to support collaboration, learning and productivity.
- Demonstrate personal responsibility for lifelong learning.
- They exercise leadership for digital citizenship

**Models for the development of digital competence of teachers**
The development of teachers' digital competencies has been addressed from different fields, both from research ( Cebrián de la Serna, 2003, 2004 ) and from educational policies and administrations, responsible for teacher training and professionalization. We will mention some proposals of interest.

**TPACK Model**
The TPACK model focuses on different formative dimensions related to the curriculum content or disciplines, the pedagogy or way of

teaching-learning that content, and the technology and resources they generate, as well as the relationships between these dimensions ( Jordan and Dinh, 2012; Koh et al., 2013 ). The model was formulated by Mishra and Koehler (2006 ) and distinguishes three basic training dimensions and the four intersections between them, identifying a total of seven dimensions:

1. Content Knowledge (CK): knowledge that the teacher has of the specific topics or area to be taught to the students, including, among them, concepts, theories, facts and procedures of his/her area.
2. Pedagogical Knowledge (PK): knowledge that the teacher has of the pedagogical activities, processes, practices or teaching-learning methods that could be used in the teaching-learning process and how they relate to the educational goals to be achieved. For example, it includes knowledge about techniques or methods that can be used in the classroom and strategies for student assessment.
3. Technological Knowledge (TK): knowledge that the teacher has of the different technologies to develop his/her teaching activity. For example, it includes knowledge of operating systems and hardware, how to install programs and how to create documents. They also point out as important the ability to learn and adapt to new emerging technologies.
4. Pedagogical Content Knowledge (PCK): didactic knowledge about a content area, which implies facilitating student learning in that area. This dimension includes knowing which teaching approaches and strategies best fit the content and how the different elements of the content can be worked on for effective teaching.
5. Technological Content Knowledge (TCK): knowledge on how to represent specific concepts with technology, i.e., it is the knowledge on how the technology and the content are
6. Technological Pedagogical Knowledge (TPK): knowledge of general pedagogical strategies that can be accomplished through technologies. This may include knowledge of tools that exist for a given task (e.g., monitoring attendance or assessment), the ability to choose a tool based on its effectiveness or appropriateness to the task, and the ability to apply pedagogical strategies when using technologies.
7. Technological Pedagogical Content Knowledge (TPACK): a teacher's knowledge of how to develop subject-specific

> teaching strategies using ICT to facilitate learning. Thus, it is a form of knowledge that goes beyond the three components (content, pedagogy and technology) and includes, for example, knowledge of pedagogical strategies that enable the use of technologies effectively to teach content and knowledge of what makes content easy or difficult to learn and how technology can help with some of the problems students face.

**UNESCO Models**

**ECD-ICT Project**

In 2008, UNESCO established the "ICT Competency Standards for Teachers" ( ECD-ICT Project ), which shows the need to include certain well-defined standards and objectives regarding this type of competencies, aimed at all educational levels. In this regard, the document points out that practicing teachers need to be prepared to offer their students learning opportunities supported by ICTs, to use them and to know how they can contribute to student learning, skills that are currently an integral part of a teacher's basic professional competencies. The document also emphasizes initial teacher training, indicating that traditional educational practices for training future teachers no longer help them to acquire all the skills necessary to teach their students and help them develop the competencies they need to survive in today's world of work. Analyzing what UNESCO proposes, we can affirm that the standards focus mainly on the creation or revision of technological training programs. Specifically, they present three approaches that are sequential and complementary, with a view to educational innovation:

1. ICT basics (knowledge and understanding of technology).
2. Knowledge deepening (application of technology to solve problems).
3. Knowledge generation (producing new knowledge and taking advantage of it).

**Secure and legal use of information through information and communication technologies.**

The use of information and communication technologies in educational processes leads to the idea that in the knowledge society it is necessary to consider a flourishing ethics with a reflective sense that responds to human demands in cyberspace based on solidarity and responsibility. Thus, Cortés (2005), who proposes "preconceptions about technoethics in adults", states that technological and communication development is producing significant changes, both quantitatively (amount of media

used and time devoted to them) and qualitatively (psychological and social influence of the media), which influence adults and he considers that they require an ethical analysis in three senses: conceptual, procedural and attitudinal.

Bunge (1977) understands by "technoethics the study of the moral codes inherent in the various branches of technology". In this sense, all human praxis can be criticized in the light of ethical and legal principles. Ethical principles arise not from technology, but from certain religions, ideologies and philosophies that have arisen in industrial societies. These innovations require human communities not only to show creativity, but also to take appropriate measures to ensure that scientific and technological advances are used for the benefit of the entire human species, UNESCO (2006).

**Innovative processes with information and communication technologies.**

Nowadays it is essential to adapt to technological advances to socialize and discuss scientific issues, we are part of a "network society", this has generated changes in politics, society, culture and of course in education, "there is a need to know and use information and communication technologies in each of the disciplines in order to have better results", Castells (2001). This leads to transform the educational processes being aware that the role of teachers is fundamental in the development of digital competencies to seek improvements in quality and efficiency required by society. Countries such as Singapore, Finland, the Republic of Korea and Chile, are examples of a positive transition of developing countries to an economy in exponential growth, "as a result of the relationship between educational reform, the use of information and communication technologies and the use of economic growth, which has allowed them to be in a knowledge society that is based on the recovery, use, evaluation, production and reuse of knowledge", UNESCO (2008).

The integration of information and communication technologies in the teaching and learning processes is a latent need, for which the teacher's skills to create innovative learning environments will be fundamental,

it is recommended to apply the dimensions proposed by the Ministry of Education of Chile in 2006:

- Operational management of software and hardware.
- Design of learning environments that favor the teaching-learning processes by integrating information and communication technologies.
- Include information and communication technologies in the curriculum through integration with pedagogical strategies.
- Critical evaluation and monitoring of the educational resources used and the learning environments created.

Achieving lifelong learning processes with the help of educational technology.
Legal and ethical use of information and resources used.

To this end, it is necessary for the government, ministries and institutions related to education to generate proposals for standards at the national level that are internationally contrasted, in order to guide and plan the competencies that teachers and students should develop or acquire in relation to information and communication technologies.

## Materials and methods

The present study was framed within a quantitative approach, since it has been structured on the basis of the collection and analysis of information gathered from different sources. The results obtained have been subjected to statistical-mathematical analysis by quantifying and presenting them from the study population and objectively obtained through the SPPS computer program in order to determine the subject of the study with a margin of effectiveness.

The level of the research is defined as descriptive, since it characterizes the level of teachers' digital competencies of a representative group through a statistical analysis. The data presented the distribution of teachers' digital competencies through frequencies and percentages, which have been supported through an analysis and argumentation based on the theoretical and scientific framework. It was contrasted with results of other researches in order to establish conclusions based on evidence. The study is of a transversal type considering that it was carried out with a specific population and at a specific time. The

execution of the instrument was carried out between December 2020 and January 2021.

The study population corresponds to a total of 180 teachers belonging to the Faculty of Philosophy, Letters and Educational Sciences, with a margin of error of 5% and 95% reliability. Finally, we worked with a sample of 90 teachers who were selected through simple random probability sampling and who agreed through a survey in which they gave their informed consent to participate in the research.

The technique used was the survey with the use of a questionnaire consisting of 39 items which were validated through the judgment of three experts, which allow the identification of teachers' digital competencies in their dimensions of ICT Competency Standards for Teachers, Content, Technological and Pedagogical Knowledge Model (TPACK) and the UNESCO Model ECD-ICT Project. through the selection option on a Likert scale of always, almost always, sometimes, almost never and never.

For the application of the questionnaire, the digital tool Microsoft Forms was used. Once designed, the link was sent to the e-mails of all the teachers of the Faculty with the authorization of the authorities for virtual access and participation, a strategy adopted due to the health emergency caused by the presence of Covid-19 worldwide.

The information obtained was organized by tabulating it in an Excel spreadsheet after data cleaning and then used as a basis for analysis and interpretation using the SPSS tool mentioned above.

To categorize into high, medium and low levels that are qualitative in nature.

The ordinal score was transformed into quantitative scores based on the likert scale used in the survey, by means of this process the responses of the subjects were converted into quantitative scores according to each one of the indicators of the dimensions. The score for each indicator was obtained by adding the direct scores of all the questions that are part of that indicator, once obtained, the direct scores for each dimension were calculated.

The Kolmogorov-Smirnov (K-S) statistical model was used to determine whether the distributions of direct scores for each indicator meet normality conditions, in order to use either the percentile method (PC) or the standard deviation (SD) method, as appropriate, to categorize the variables into three levels: high, medium and low.

## Results

To identify the digital competencies of the teachers of the Faculty of Philosophy, Letters and Educational Sciences in the periods 2019-2020, 2020-2020, the prevalence was analyzed according to the levels (high, medium or low) of digital competencies according to the six indicators of the ICT Competency Standards for Teachers - ECTD.

It can be observed that the percentages with the highest frequency of digital competencies teachers are in the Medium level of development, being the competencies of Communication and Collaboration and Creativity and innovation the ones that present a higher level of presence in the group of teachers investigated, where it is highlighted that teachers use digital media and environments to communicate and work collaboratively, to strengthen collective individual learning, as well as the promotion of students to make contributions and develop their creativity and innovation capacity in the educational context.

To determine models of development of digital competencies of teachers of the Faculty of Philosophy, Letters and Educational Sciences in the periods 2019-2020, 2020-2020. Based on the asymptotic significance analysis for the normality test it is found that:

To analyze the usability of the digital competencies of the teachers of the Faculty of Philosophy, Letters and Educational Sciences in the teaching-learning process in the periods 2019-2020, 2020-2020, it can be seen in the following table the relationship presented between the level of digital competencies according to the ECTD model versus the Usability of these competencies in the Teaching and Learning Process.

**Table 1.** *Crosstabulation table DS-ECTD-ICT Competency Standards for Teachers (grouped)*

| | | | DS-US-ECTD-ICT Competency Standards for Teachers (bundled) | | | Total |
|---|---|---|---|---|---|---|
| | | | UNDER | MEDIO | ALTO | |
| **DS-ECTD-ICT Competency Standards for Teachers (clustered)** | UNDER | Count | | 1 | 0 | |
| | | of total | 14,4% | 1,1% | 0,0% | 15,6% |
| | MEDIO | Count | | 52 | | 58 |
| | | of total | 3,3% | 57,8% | 3,3% | 64,4% |
| | ALTO | Count | 0 | | | |
| | | of total | 0,0% | 4,4% | 15,6% | 20,0% |
| Total | | Count | | | | |
| | | of total | 17,8% | 63,3% | 18,9% | 100,0% |

As can be seen, there is a direct relationship between the level of ICT competencies for teachers and their usability in the teaching and learning process, with the medium level being the most frequent, . It could be considered that the current situation due to the pandemic has favored the interest of teachers in developing these competencies, recognizing that their application has a favorable impact on education at all levels.

In the same way it can be seen that the level of digital competencies according to the TPACK model vs. the Usability of these competencies in the Teaching-Learning Process in the same way there is a considerable relationship .

**Table 2.** *Cross Table DS-MTPACK-Technological Pedagogical Content Knowledge Model (grouped)*DS-US-TPACK-Technological Pedagogical Content Knowledge Model (grouped)*

| | | | **DS-US-TPACK-Technological Pedagogical Content Knowledge Model (grouped)** | | | Total |
|---|---|---|---|---|---|---|
| | | | **UNDER** | **MEDIO** | **ALTO** | |
| **DS-MTPACK-Model of Technological Pedagogical Knowledge of Content (grouped)** | UNDER | Count | | | 0 | |
| | | of total | 15,6% | 4,4% | 0,0% | 20,0% |
| | MEDIO | Count | 1 | | | 52 |
| | | of total | 1,1% | 53,3% | 3,3% | 57,8% |
| | ALTO | Count | 0 | | | |
| | | of total | 0,0% | 6,7% | 15,6% | 22,2% |

| | | | | | |
|---|---|---|---|---|---|
| **Total** | **Count** | | **58** | | |
| | **of total** | **16,7%** | **64,4%** | **18,9%** | **100,0%** |

Finally, the level of digital competencies was established according to the UNESCO model vs. Usability of these competencies in the Teaching-Learning Process where similar results to the previous models can be observed.

**Table 3.** *Cross table DS-MUNESCO-UNESCO models ECD-ICT project (grouped)* PC-US-UNESCO-UNESCO*

| | | | PC-US-UNESCO-UNESCO Models ECD-ICT Project (grouped) | | |
|---|---|---|---|---|---|
| | | | **UNDER** | **MEDIO** | **ALTO** | |
| **DS-MUNESCO-UNESCO Models ECD-ICT Project (grouped)** | UNDER | Count | | 0 | 0 | |
| | | of total | 18,9% | 0,0% | 0,0% | 18,9 % |
| | MEDIO | Count | | 42 | 1 | |
| | | of total | 12,2% | 46,7% | 1,1% | 60,0 % |
| | ALTO | Count | 0 | 5 | | |
| | | of total | 0,0% | 5,6% | 15,6% | 21,1 % |
| **Total** | | **Count** | | | | **90** |
| | | **of total** | **31,1%** | **52,2%** | **16,7%** | **100,0 %** |

A from the results of the contingency tables of the three models, it can be concluded that there is a directly proportional relationship between the level of competencies and the usability of these competencies in the teaching and learning process, i.e., the higher the knowledge and level of development of digital competencies, the higher the usability in the ASP and vice versa, which means that

teachers put into practice their knowledge, skills and academic competencies in their teaching performance .

## Discussion

The seed project "Digital competencies of teachers of the Faculty of Philosophy, Letters and Educational Sciences during the academic periods 2019-2020; 2020-2020", reaches its final phase by presenting the conclusions of the research; this project from the time of its execution until the presentation of results experienced an unforeseen turn by the Pandemic COVID 19, which confined the world population and forced the educational processes at different levels to be carried out through digital media. This is how the researched topic that was previously considered as an alternative for teacher training became the only form of academic relationship, therefore it became a significantly relevant work and has fulfilled the objectives set.

It was determined that the teachers of the Faculty of Philosophy, Letters and Educational Sciences during the aforementioned academic periods demonstrated a medium level of development of communication and collaboration skills and creativity, showing a significantly moderate relationship in their applicability, knowledge and use of digital resources to teach classes, research and propose educational activities.

When talking about digital competencies of teachers, it is not limited only to the field of virtual classroom management as a mediator and link with students, but to a set of skills, abilities, knowledge, attitudes and values regarding the management, appropriation and usability of digital systems. This wide cyber world used for education has incalculable practical resources at this time of development and knowledge of the digital era.

It is identified that the teachers of the Faculty have developed competencies in the mentioned periods thanks to the possibilities offered by the virtual platforms, in the link with their peers, in the development of classes, in the teaching methodology, integrating in this way the face-to-face practice with the tele-education nowadays

required as a generalized alternative of academic instruction. It is evident the moderate appropriation of digital skills as it allows to effectively perform their academic work crossed by the contingency of COVID 19, regardless of the basic and constant use of the same resources to explore, it can be verified that the relationship with the possibilities that are in the cyber world and the vertiginous advances are still not sufficiently explored, are limited applications that are evident in the use of technological resources, being in a basic percentage so far.

There is a clear record of the ethical use and proper management of all the resources available for teaching.

The usability of teachers' digital competencies in the teaching-learning process represents a high level of management of these competencies, but there is still a low percentage of teachers who still do not do so, perhaps limiting themselves to the application of the virtual classroom as the current alternative that replaces face-to-face teaching. There is a direct relationship between the level of ICT competencies of teachers with their usability in the teaching and learning process, finally it is worth referring to the results of the contingency tables evidenced in the three digital models to conclude that, the existence of the relationship is proportional to the level of expected competencies in terms of their usability for the pedagogical process of teaching-learning, therefore, the relationship that exists with the greater development of knowledge of digital competencies, the greater the usability in the teaching-learning process and vice versa, concretizing in the academic praxis the expected competencies.

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