

**LEVEL OF DOMAIN OF INFORMATION AND COMMUNICATION
TECHNOLOGIES IN PRIVATE PRIMARY SCHOOL TEACHERS**

***NÍVEL DE DOMÍNIO DE TECNOLOGIAS DE INFORMAÇÃO E COMUNICAÇÃO EM
PROFESSORES DE ENSINO FUNDAMENTAL PRIVADO***

***NIVEL DE DOMINIO DE LAS TECNOLOGÍAS DE LA INFORMACIÓN Y LA
COMUNICACIÓN EN DOCENTES DE ESCUELAS PRIMARIAS PRIVADAS***

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ABSTRACT: This research aims to identify the level of mastery and incorporation of Information and Communication Technologies (ICT) in teachers of private primary schools in the urban area of a city in southern Sonora, Mexico. A quantitative design of transectional type was used where 152 teachers participated. A survey was applied, divided into three sections: general data, working conditions for the use of ICT and digital competences that teachers must have; this last section evaluated the dimensions: ICT knowledge and basic uses, search and organization of information, media, digital citizenship and responsibility. The results show that the highest level of proficiency of teachers is in the dimension of knowledge and basic uses of ICT and the lowest, creation, transformation and presentation of information; this results presents an area of opportunity that can be solve by designing a training course that allows to reinforce or contribute to the development of the deficiencies found.

KEYWORDS: Information and Communication Technologies. Teachers. Primary education. Digital competences. Private schools.

RESUMO: Esta pesquisa visa identificar o nível de domínio e incorporação das Tecnologias de Informação e Comunicação (TIC) em professores de escolas primárias privadas na área urbana de uma cidade no sul de Sonora, México. Um desenho quantitativo do tipo transicional foi usado, onde 152 professores participaram. Foi aplicado um inquérito, dividido em três secções: dados gerais, condições de trabalho para o uso das TIC e competências digitais que o professor deve ter; esta última seção avaliou as seguintes dimensões: conhecimento e usos básicos, busca e organização da informação, meios de comunicação, cidadania digital e responsabilidade. Os resultados mostram que o mais alto

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nível de proficiência dos professores está na dimensão do conhecimento e usos básicos das TIC, sendo o mais baixo, criação, transformação e apresentação de informações, portanto, uma área de oportunidade que é apresentada, é o planejamento de um curso de formação que permite reforçar ou contribuir para o desenvolvimento das deficiências encontradas.

PALAVRAS-CHAVE: *Tecnologias de Informação e Comunicação. Professores. Ensino fundamental. Competências digitais. Escolas particulares.*

RESUMEN: *La presente investigación pretende identificar el nivel de dominio e incorporación de las Tecnologías de Información y comunicación (TIC) en los docentes de escuelas primarias privadas de la zona urbana de una ciudad del sur de Sonora, México. Se utilizó un diseño cuantitativo de tipo transeccional donde participaron 152 profesores. Se aplicó una encuesta dividida en tres secciones: datos generales, condiciones laborales para el uso de las TIC y competencias digitales que debe tener el docente; esta última sección evaluaba las dimensiones: conocimientos y usos básicos, búsqueda y organización de la información, medios de comunicación, ciudadanía digital y responsabilidad. Los resultados muestran que el nivel de dominio más alto de los docentes es en la dimensión de conocimientos y usos básico de las TIC y el más bajo, creación, transformación y presentación de la información, por lo que un área de oportunidad que se presenta es el diseño de un curso de capacitación que permita reforzar o contribuir al desarrollo de las deficiencias encontradas.*

PALABRAS CLAVE: *Tecnologías de la Información y Comunicación. Docentes. Educación primaria. Competencias digitales. Escuelas privadas.*

Introduction

The introduction of information and communication technologies (ICT) in Mexican classrooms has been gradual; strategic projects have been proposed such as the incorporation of technological infraestructura in schools (computer equipment for students, teachers, principals, Internet services, bandwidth expansion, etc.) teacher update and training programs at all educational levels have been proposed in order to facilitate educational practices and promote autonomous and meaningful learning in students and strengthen education in schools (HERNÁNDEZ; ACEVEDO; MARTÍNEZ; CRUZ, 2014).

In particular, the Secretaría de Educación Pública (SEP) throughout history has proposed various programmes to incorporate technology into basic education. Some of these initiatives are (GOBIERNO DE MÉXICO, 2016):

- Electronic computing in Basic Education (COEEBA) whose purpose was the development of computer workshops and laboratorios (1985).

- School network Edusat (1997); its emphasis was collaborative work, research and Exchange of ideas.
- Enciclomedia (2004) that allowed digital tooling to the fifth and sixth grade groups of all primary schools.
- Habilidades Digitales para Todos (2009), aimed to promote the efficient use of technology.
- My CompuMx (2013) whose purpose was to reduce the digital divide through the use of technology and the development of digital skills in a cross-cutting way.
- Digital inclusion and literacy program (PIAD), in 2005 where fifth and sixth graders were endowed by continuing the purposes of My CompuMx program.
- Digital Inclusion Program (2016) to make easier for students to appropriate and take control of their learning process, through Access to comprehensive and flexible digital educational tools and resources, as well as strengthen teacher training in the use of these tools.
- @aprende 2.0 (2007) program to promote teacher training, development of a platform with specialized content, classroom equipment and increased connectivity.

The main idea of the above programs are the technological equipment and the development of digital skills of students and teachers; as one of the main actors in the teaching-learning process and who bears responsibility for the integral training of students.

In 2005, a research was conducted in primary schools in Nuevo León state, the results of which show that most teachers stated that the Enciclomedia Program motivated students and forced them to make their classes more attractive; two-thirds, expressed unconformity with the training received or mentioned not having received it. In sum, they point out that they should modify their educational practice to guide students and motivate them in achieving their academic goals (SEP, 2012).

Rodríguez and Veytia (2017) argued for the existence of differences between the training that teachers received for the use of the ICT and the instruments with which their staying in service is evaluated.

The curriculum of teacher training 2011 and according to studies of the National Institute for the Evaluation of Education (INEE) states that teachers use technologies for teaching and professionalization purposes. However, the initial and continuing training programmes contradict this assumption. This supports the urgency of meeting teachers' needs

for the use of ICT; mainly those who were formed with different curriculums than the current one and whose professionalization is not in this area.

Approach to the problem

Nowadays, technological advances in all areas of society, the way teaching-learning processes are carried out has diversified; this has created new challenges for educational institutions, such as teacher training mainly in terms of the use, incorporation and adaptation of ICT to their teaching practices.

This leads to the development and strengthening of teachers' technological skills; which "refer to a system of cognitive arrangements that allow actions to be taken to ensure that the person performs in a technology-mediated environment and improves the process of teaching, learning and academic management" (MARQUÉS, 2008, p. 2), this in order to facilitate the teaching work.

Under this premise of improving skills in the use of teacher technology, Angulo, Pizá, García and Mortis (2012) conducted a study to determine the performance of primary school teachers with ICTs; found that teachers need to develop more skills in the use of technological tools, as well as greater knowledge of them.

In other research focused on full-time school teachers and their level of digital competencies, it was found that although teachers use their computers daily for various activities, they do not necessarily use them for the development of the teaching-learning process; a considerable percentage of teachers indicate that they do not know how to use technology in their classrooms, since they have little knowledge and skills in managing office automation programs; likewise, they demonstrated "regular mastery" in the area of communication through ICTs and "not mastery" in the creation of digital resources (RUÍZ; GARCÍA; MORTIS, 2016).

Andrade (2014) points out the importance of knowing the beliefs about the use of ICTs by primary school teachers since through them it is possible to visualize and understand their behaviors; as well as to identify if technology is a factor that offers advantages or disadvantages in the teaching-learning process. Additionally, he mentions that few teachers have the skills to handle computer programs such as Word, PowerPoint and Excel and know how to take advantage of these types of resources in the creation of learning environments.

The above is only a general overview of the situation experienced by teachers in terms of their skills and training needs; in that sense, it is necessary to train teaching professionals in the use of technology; since currently student learning is dominated by such tools, since they have them at home, access them elsewhere and use them in an uncritical and unthinking way; therefore, it is required that teachers have the necessary skills to guide students in the best possible way in the pedagogical use of ICT.

Therefore, this study focuses on teachers of basic education, specifically in elementary school in the private sector. It is important to mention that in southern Sonora, there are a large number of private primary institutions and most of them have adequate and sufficient technological resources, but it is not known precisely how teachers use technology and what application they give to it, and above all, the skills they have in that aspect. Therefore, it is considered necessary to identify what is the level of ICT mastery of teachers in private elementary schools in a city in southern Sonora. Mexico?

General objective

Identify the level of mastery that private elementary school teachers have according to their perception of the use of technology, in order to detect training and professional development needs.

Research Questions

1. What level of mastery do teachers in private elementary schools in southern Sonora have of managing and applying ICTs in their teaching?
2. What factors, such as age, gender, teaching experience, and courses received significantly impact teachers' level of ICT proficiency?

Theoretical foundation

The incorporation of information and communication technologies poses multiple challenges; one of them is the development of specific skills and abilities that facilitate their use and influence the improvement of educational processes. In that sense, teachers require a techno-pedagogical training and resources that allow them to maximize and potentialize their educational practices (IZQUIERDO; DE LA CRUZ; AQUINO; SANDOVAL; GARCÍA, 2017).

Gómez and Macedo (2010) mention that ICTs are important in the entire teacher training process, since they are a valuable tool to promote learning in students; their use allows the development of new educational practices since they generate the exchange of experiences, promote the strengthening of digital competencies, but above all, help in the creation of new learning environments.

On the other hand, the exit profile of teachers in training, according to SEP (2015), is an element that guides the curriculum and is made up of competences (knowledge, skills and attitudes) that must be demonstrated at the end of the training course. In relation to the use of technology, it is pointed out as a general competence that ICT should be used as a teaching and learning tool; and within this, some specific competences, such as: 1) use in a critical and creative way the productivity tools; 2) apply ICT tools and resources to obtain, communicate, collaborate and produce quality information; 3) develop projects based on the use of ICT; 4) generate flexible learning environments in the classroom by integrating ICT; 5) act ethically when dealing with information; 6) use digital tools in which the educational potential for their use is identified; 7) plan the use of the tools according to the educational environments and evaluate the impact they have on student learning; 8) create, review and use virtual educational communities by assuming different roles with ethical behavior within the community.

As for the term digital competence, its characteristics or dimensions are delimited by its definition, since "there is no generally accepted term to refer to it" (CARRERA; COIDURAS, 2012, p. 291). Thus, some definitions describe them as a set of knowledge, skills, abilities, attitudes and values that are required to efficiently use the technological resources available (LION, 2012); as well as to solve problems, develop critical thinking, manage, share and generate information, among other activities (FERRARI, 2012).

For some authors, digital competence consists of several categories or dimensions. Villa and Poblete (2007) point out three: 1) managing files, generating documents, browsing the Internet and using e-mail correctly; 2) editing documents, creating slides using a presentation program and simple web pages; and 3) editing complex documents and managing spreadsheets using functions and references.

Adell (2012) mentions five components: 1) informational competence, knowledge, skills and attitudes to work with information; 2) technological competence in the use of technological devices; 3) multiple literacy, ability to see and produce audiovisual material; 4) cognitive-generic competence, to generate knowledge from information and 5) digital

citizenship, complying with the rules and laws stipulated to live together through digital interaction.

Likewise, there are certain standards that allow the classification or assessment of the achievement of these competencies. UNESCO's ICT Competency Standards for Teachers project (2008) presents guidelines for teachers regarding training programs and course selection that allow them to play an essential role in the technological training of students. This program establishes three approaches: 1) basic notions of ICT, aims to increase technological understanding; 2) knowledge deepening, to use knowledge with ICT; and 3) knowledge generation, to increase the capacity to innovate with ICT, produce new knowledge and take advantage of it.

The International Society for Technology in Education (ISTE) is a global consortium that promotes "excellence in learning and teaching through innovative uses of technology" (ISTE, 2008; p. 8). Criteria for teachers relate to: a) facilitating student learning and creativity; b) developing learning experiences of the digital age; c) working in virtual environments; d) promoting digital citizenship and responsibility; e) demonstrating effective use of digital tools and resources.

The Chilean Ministry of Education establishes standards for initial teacher training. The proposal seeks to respond to the need to design and implement ICT standards that define a precise and agreed upon framework for the preparation of these professionals. The established standards are divided into five dimensions according to MINEDUC (2006): pedagogical area, social, ethical, legal and technical aspects, school management and professional development.

Finally, the Euro-Latin American Parliamentary Assembly (EUROLAT) mentions that such competences are: a) searching, integrating, creating and sharing information to generate and enrich new knowledge; b) networking for cooperation in virtual environments; and c) managing digital reputation (CABERO; MARÍN; LLORENTE, 2012).

Method

The study is a quantitative, non-experimental, transactional and descriptive research, because the variables were not manipulated, and the data were collected in a single moment with the purpose of describing the variable in its real context.

Participants

Obregon City, Sonora, Mexico, has 39 private primary schools, with a population of 268 teachers for the 2018-2019 school year. The participants were 152 teachers from 10 elementary schools, of which 124 were women (81.6%) and 28 men (18.4%). They have an average age of 33 years; and their years of experience as teachers were an average of 9 years. For selection purposes, a non-probability sample was used for convenience, since we only worked with schools in which the directors granted permission to apply the instrument.

Instrument

A questionnaire with a Likert-type response scale was applied. The first section consisted of eight items referring to socio-demographic aspects and the approach to ICT; the second, with seven items, referred to the working conditions for the use of ICT, where the response options were from 1 to 4 (never, sometimes, frequently and always); the last part was answered with a scale from 1 to 5, where 1 was not at all dominant, 2 little mastery, 3 regular mastery, 4 good mastery and 5 excellent mastery and was divided into five categories: 1) basic knowledge and uses of ICT, made up of 15 indicators; 2) use of ICT for searching and organizing information, with 15 items; 3) creation, transformation and presentation of information, 12 items; 4) use of the computer as a means of communication, 13 indicators and 5) digital citizenship and responsibility with 8 items.

The previous categories were taken from the National Standards of Information and Communication Technologies for teachers (ISTE, 2008), since according to the SEP, the programs related to the use of technology are based on those standards.

Regarding the analysis of the psychometric properties of the instrument, the validity of the content was carried out by five experts, who agreed on the relevance of the reagents. For reliability, Cronbach's Alpha was applied, which was .975, which can be considered excellent, according to De Vellis (2012).

Data analysis

SPSS version 22.0 was used. Descriptive tests were applied, and Spearman's correlation to determine possible relationships between age, teaching experience and training courses with the level of ICT mastery; as well as hypothesis tests for independent samples, in order to identify if the sex, degree of study or institution where the teacher works influenced the level of mastery of each one of the categories under study.

Results

The results are presented for each of the dimensions included in the instrument.

General aspects and approach to ICT

As for the degree of studies that teachers possess, 81.9% have a bachelor's degree, 13.2% a master's degree, 4.7% a specialty, and none of them have a doctorate. Regarding the place where they studied, 45.3% said they had graduated from a public university, 33.8% from private universities and 20.9% from the Escuela Normal Superior.

Regarding courses on the use of ICT, 40.7% mentioned that they have not taken any, 44.7% have received one or two courses, 12.7% three to four, and 2% five or more. With regard to working conditions in terms of the use of ICTs, 40.1% said that the institution always has computer equipment to serve them; 13.8% said that it is frequent; 32.2% said that it is sometimes, and 12.5% said that it is never. On the other hand, 70.41% of the teachers indicated that they always use the computer to do their school work, whether it be planning, activities, presentations, among others; 11.8% indicated that they sometimes use the computer; 11.2% indicated that they use it frequently and the remaining 4.6% mentioned that they never do.

Domain level of the categories analyzed

Basic knowledge and uses of ICT. This refers to the set of accumulated information concerning the operational parts of the computer; that is, they make use of multiple technological or computer means to store, process and disseminate all kinds of information for different purposes. In this category it was found that 48% of the teachers show excellent command; 30.3%, good command and 16.4%, regular command.

Use of ICT for the search and organization of information. It is the process that favors the learning of the people referred to the search and evaluation of patterns of information organized in a coherent way to favor the potential of the technological tools. It was obtained that 36.8% of the teachers are in excellent command and in good command, 33.6%.

Creation, transformation and presentation of information. It consists of the use of technological tools and computer programs to carry out activities and educational

information; it provides inputs to collect, process and present data. In this dimension most of the teachers are in the level of excellent domain with 30.9% and 29% in good domain.

Use of the computer as a means of communication. This refers to the ability acquired within the field of computer science that allows the subject to interact with the computer in such a way that he or she is able to recognize and achieve personal and academic goals through the use of specific software. In this category it was obtained that 46.1% of the teachers present an excellent domain, good domain 30.9% and regular domain 13.2%.

Digital citizenship and responsibility. It is related to the understanding of human, cultural and social issues regarding the use of ICT. In this area, 33.6% are in excellent command and 35.5% in good command.

Table 1 shows the overall results in each of the categories and levels evaluated. It can be seen that in all dimensions, teachers consider that they favorably dominate the indicators analyzed; this is due to the fact that the highest percentages are found in the excellent and good domains. However, although the highest percentage is in the excellent category, in the category of creation, transformation and presentation of information there are low levels of mastery and it is precisely there where they would require training to strengthen their development.

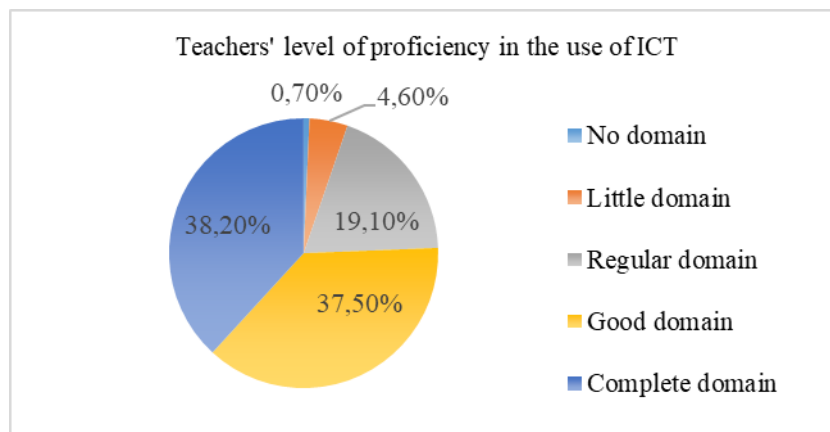
Table 1 – Percentage Distribution by Dimension and Domain Level

Indicators	Frequency (%)				
	No domain 1	Little domain 2	Regular domain 3	Good domain 4	Excellent domain 5
Basic knowledge and uses of ICT.	0.7	4.6	16.4	30.3	48.0
Use of ICT for the search and organization of information.	1.4	5.2	23.0	33.6	36.8
Creation, transformation and presentation of information.	2.0	11.7	26.4	29.0	30.9
Use of the computer as a means of communication.	2.6	7.2	13.2	30.9	46.1
Digital citizenship and responsibility.	2.7	9.8	18.4	35.5	33.6

Source: Prepared by the authors

On the other hand, figure 1 shows the percentage of mastery that on average was obtained in the five dimensions.

Figure 1 – Teachers' level of proficiency in the use of ICT.



Source: Prepared by the authors

Relationship between the ICT domain level and other study variables

Table 2 presents a summary of the correlations (Spearman) found in each of the dimensions analyzed and their relationship to the age of the participants. As it can be observed, four of the five dimensions have a significant but negative correlation; that is, the older the teacher, the lower the domain he or she presents; the one of computer use and digital citizenship and responsibility, does not have a significant correlation; that is, everyone performs the activities related to this dimension equally; since age does not influence his or her level of domain.

Table 2 – Correlations of the level of mastery by dimension according to age.

Indicators	Correlations Age Significance	Correlation Coefficient
Basic knowledge and uses of ICT.	.001	-.269**
Use of ICT for the search and organization of information.	.000	-.321**
Creation, transformation and presentation of information.	.001	-.279**
Use of the computer as a means of communication	.002	-.255**
Digital citizenship and responsibility.	.249	-.094

Source: Prepared by the authors

Another analysis was made with the years of teaching experience. The dimensions of knowledge and basic uses of ICT and the use of ICT for the search and organization of information show a significant correlation (negative); that is, the greater the teaching experience, the less mastery there is of the indicators established in the instrument.

This could have a relationship with age, teachers already have a deep-rooted way of teaching and hardly dare to incorporate new technological elements. As for the remaining

dimensions, they do not have a significant correlation; that is, everyone can carry out the related activities independently of their experience.

As for the courses received in the last two years related to the use of technology, it was obtained that only the dimension of creation, transformation and presentation of information has a significant correlation; the greater the number of courses, the greater the mastery in the use of technological resources. It is worth mentioning that this dimension is the one that requires more practice on the part of the teacher, since it is where they obtained a lower level of mastery.

Finally, the hypothesis test was carried out for independent samples in order to identify whether sex, the institution where the teacher works, and his/her academic degree influence the level of mastery in the use of technology. In this regard, it was obtained that these factors do not significantly impact any of the dimensions under study.

Conclusions

As for the research questions posed, the first one related to the level of mastery in digital skills that primary school teachers in private schools have, it was obtained that, in general, they are in a good level of mastery. The dimension with an excellent command was knowledge and basic uses of ICT with 48% and the smallest was citizenship and social responsibility. This is contrary to what Ruiz, García and Mortis (2016) obtained, who point out that full-time primary school teachers were in excellent command of the digital organization dimension and computer ethics, and where they have regular mastery is in the creation of digital resources.

Similar results were found by Vázquez, Castro, Villavicencio, González, Ochoa, Muñoz and Fonllem (2009, p. 17) who show that teachers possess a level of digital competencies that ranges from regular to acceptable; they point out that “teaching and learning processes are regularly put into practice by incorporating the use of ICTs”; likewise, they mention other aspects outside of ICT training and mastery that affect the non-use of ICTs.

Regarding the second research question, it is pointed out that the existing relationship between some sociodemographic factors, such as age and years of teaching experience, present a significant negative correlation; the older the person is and the more years of teaching experience, the less control they have in the different analysis categories. These results coincide with the findings of García, Mendivil, Ocaña, Ramírez and Angulo (2012),

who point out that these factors have a negative impact on the domain of ICT. The other variables (sex, courses received in the last two years, academic grade, computer use) did not present a significant relationship in the dimensions studied.

Although the findings of this study could be considered good, areas of opportunity were detected in which it is possible to influence; it is the case of the dimension of creation and use of information through diverse technological tools, as well as a significant improvement in the pedagogical use of the computer. This is similar to what was found by Cruz (2014), who points out that teachers in the Dominican Republic have weaknesses in the use of computers and computer applications; the greatest need they have is in the use of Internet services and tools, as well as in the knowledge of didactic functions for the effective use of ICT in planning, curriculum development, and educational organization.

Based on the results obtained, several guidelines are established to go deeper into the subject:

1. Enrich the results by collecting qualitative information, by considering the opinion and experience of teachers regarding the teaching and learning process, through the application of ICTs in schools.

2. Develop and implement a training program for teacher training in the use of ICTs in their teaching-learning processes.

4. Implementation and constant monitoring regarding the use of technology for the development of digital competences as a support to students within the classroom.

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