Digital skills of the high school teacher in the face of emergency remote teaching

Competencias digitales del docente de bachillerato ante la enseñanza remota de emergencia http://dx.doi.org/10.32870/Ap.v13n1.1991

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Palabras clave alfabetización digital;

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ABSTRACT

A diagnosis of the digital competencies of high school teachers applied at the beginning of emergency remote teaching due to Covid-19 is presented. The degree of knowledge was analyzed from the resignations of technological literacy and communication tools, the use of educational methodologies with information and communication technologies (ICT), the attitude towards the use of technology in teaching and the levels of teacher training. The present study is of a quantitative descriptive correlate nature; as an instrument a Likert-type survey was used, applied to 508 subjects from the technological baccalaureate subsystem. The results show that at the beginning of the pandemic the teacher had knowledge regarding the use of social networks, email and the word processors, however, they were unaware of the use of educational platforms for virtual teaching. The levels of association between the variables show that the development of their digital skills is related to both the institution of origin and the age of the teachers. This work helps to understand that teachers went through in the development of fundamental teaching competencies for distance learning through technological means.

RESUMEN

Se presenta un diagnóstico de las competencias digitales de docentes de bachillerato aplicadas a los principios de la enseñanza remota de emergencia por Covid-19. Se analizó el grado de conocimiento a partir de las dimisiones de alfabetización tecnológica y las herramientas de comunicación, el uso de metodologías educativas con tecnologías de la información y la comunicación (TIC), la actitud frente al uso de la tecnología en la docencia y los niveles de capacitación docente. El presente estudio es de carácter cuantitativo descriptivo correlacionar, y como instrumento se utilizó una encuesta tipo Likert, aplicada a 508 docentes de bachillerato. Los resultados demuestran que a inicios de la pandemia los profesores contaban con conocimientos respecto al uso de las redes sociales, el correo electrónico y los procesadores de texto; sin embargo, desconocían el uso de las plataformas educativas para una enseñanza virtual. Los niveles de asociación entre las variables demuestran que el desarrollo de sus competencias digitales se relaciona tanto con la institución de procedencia como con la edad de los docentes. Este trabajo ayudó a comprender el proceso que vivieron los profesores en el desarrollo de competencias fundamentales para una enseñanza a distancia a través de medios tecnológicos.

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INTRODUCTION

In the month of march 2020, a large number of schools throughout the world were compelled to close their gates at the threat of the dissemination of the virus causing Covid-19, which made educational institutions to elect telematics media to continue with their teaching activities. According to the United Nations Educational, Scientific and Cultural Organization (UNESCO), this lock down has had an impact on 90% of the world student population, which translated into more than 1.5 billion students affected during the greatest peak (UN News, 2020). For this reason, countries were urged to take measures to guarantee that the learning process continues as a result of the schools' lock down.

In the case of Mexico, on March 23, 2020, on-site teaching was discontinued following a decree disclosed at the Federal Official Gazette (DOF, by its acronym, in Spanish), dated March 16. This caused many teachers of the medium-higher and higher educational levels to adapt their teaching to distance education, by means of online teaching models, with no previous training or technological appropriation. This abrupt outbreak of onsite teaching changed the traditions and the practices of teachers as they were forced to use information and communication technologies (ICT). This phenomenon has caused that both professors and students develop a set of digital skills aimed to face the diverse circumstances they are undergoing.

Cabrales *et al.* (2020) have qualified this reality be means of the concept of emergency distance teaching, which gathers together a series of strategies to transfer the teaching-learning process towards the virtual mode, originally thought for on-site teaching mode. Meanwhile, this educational phase has been called emergency remote teaching (Emergency Remote Teaching, ERT) by Hodges *et al.* (2020), as he considered that this is a temporary change of on-site education in view of the circumstances of the sanitary crisis. In any case, this implies using completely remote teaching solutions for instruction which, would otherwise, be taught in the classroom, or by means of combined or hybrid courses, and which will go back to this format once the crisis or the emergency has decreased.

Although some teachers already used ICT in their normal lessons with the purpose of creating innovating didactics, not every professor did this in a constant and intended manner. For this reason, during the first two stages of the pandemic there arose the great question on how to assume a new role and how to take these new responsibilities (Niemi & Kousa, 2020).

It is important to mention that digital literacy of teachers has been one of the keys for success at the Covid-19 pandemic; furthermore, it has been shown that teachers with technological skills and with experience in virtual or remote teaching have been knowledgeable in adapting to distance learning (Alea *et al.*, 2020), which stimulates ideal didactic conditions to continue with the teaching-learning processes. Adapting to this new reality

has meant great efforts by students and teachers, and has given rise to new ways to see technology as an ally in educational processes.

It is so that this new educational stage has brought about a series of approaches for current educational systems, among which are: teaching skills, access to telecommunication services, speed of response in organizing institutions and educational coverage. The main challenge includes instruction required by teachers to adapt to new virtualization conditions in an emerging manner. Within the context of the crisis, another great challenge includes managing to respond to the professional type required by the society (Suarez, 2020). In light of the foregoing, in order to face this situation, centered instruction in pedagogy of digital technology is proposed and to adapt teachers to the new scenarios.

Trujillo *et al.* (2011) sustain that implementing technology depends, to a greater extent, on digital literacy and on factors associated thereto; therefore, this is one of the skills teachers require to perform in an education mediated by resources of telematics. To these authors, digital literacy may be addressed from four viewpoints: technique, which limits knowledge –how and why it works– and using Internet and computers; applied perspective, which consists of learning how to use technologies in a specific context to solve problems; social, understood as the human capital, and ethics, as a viewpoint for individual development.

Another approach to the topic is held by Bawden (2002), who designates the following as dimensions of digital literacy: tools, resource literacy, socio-structural, investigative, publication and dissemination of information, as well as critical thinking. From the previous approaches, it is possible to sustain that proper digital literacy is linked to the development of a set of capabilities and skills which the teacher ought to have in his baggage of digital competencies.

Currently, several studies refer to digital competencies, for example, Martinez-Garces & Garces-Fuenmayor (2020) agree on the fact that, during the pandemic, it is essential to have a capacity to adapt to these new educational demands, where virtuality, which was an option before, is nowadays practically mandatory; and to consolidate academic development, five competencies are proposed: computerization and information literacy, communication and cooperation, creation of digital content, security and problem solving. In addition, the results of a research done by Roman *et al.* (2020) mention the resilience capacity of teachers in the confinement period, therefore, instruction in neuroeducation is mandatory, using tools for online education and fostering socio-emotional skills to face changes.

At the beginning of emergency remote teaching, teachers were stressed, surprised, anguished and, to a lesser extent, afraid. Distance and virtual mode teaching were assumed as an ineludible professional commitment, mainly due to teacher's duty, since a teacher is paramount in conducting

the teaching-learning process (Picon *et al.*, 2020). The foregoing notwithstanding, there also has been differences regarding the willingness and skills of teachers to teach online, for some of them felt unprepared and needed support.

In this sense, the studies done by UNESCO (2019), where it is declared that digital competencies are essential for life, employment and integration into the current world. In the case of the teaching activity, a framework of rules has been created so that diverse countries implement actions for the development of competencies in ICT for professors. An example of this is incorporation of general plans for using ICT in education, like the so called "The ICT Competency Framework for Teachers (ICT CFT), where 18 competencies are identified to which teachers are to aspire, organized in six aspects of the professional practice:

- Understanding the role of ICT in educational policies
- Curriculum and assessment
- Pedagogy
- Application of digital competencies
- Organization and management
- Professional learning of teachers (UNESCO, 2019, p. 6).

In turn, other aspects are described in competency acquisition levels which, for the purpose of this work, concentrate in:

- Properly choosing ICT to support specific teaching-learning methodologies
- Defining the roles of the components of computer equipment and of common productivity applications, and being able to use them
- Organizing physical surroundings in a way that technologies are used for different learning methodologies in an inclusive manner (UNESCO, 2019, p. 7).

Digital competencies a teacher must have imply a positive attitude regarding ICT, know their use in the educational field and in his area of knowledge, in addition to using them with dexterity in his activities, such as text editing, managing email, and internet surfing. In addition, it is necessary that teachers have the habit of integrating the ICT curriculum, whether in an instrumental manner or as a didactic mediator for the cognitive development of students (Morales, 2013). Achieving this is a

challenge, as it requires infrastructure available, in addition to initial and permanent training in technological and pedagogical counseling.

Technical challenges in distance learning make the capacity of teachers essential to use technology, as active methodologies are required to prevent a negative influence in student motivation and learning (Ozkara & Cakir, 2018). For this reason, this work is concentrated in teachers' skills because, at the decision of closing schools abruptly, training and technological adaptation are unknown which teachers have developed to face a digital educational reality, where the professor is required to take control on design, development and implementation of diverse strategies by technological means. For this reason, the purpose of the research was to identify the digital competencies high school teachers had at the beginning of the emerging remote teaching in view of the pandemic caused by Covid-19.

DESIGN OF AND RESEARCH METHODOLOGY

This research was done in April 2020 with a quantitative, descriptive, correlational, non-experimental approach. Its purpose was to assess digital competencies and the degree of digital literacy of the professors at the beginning of the emerging remote teaching due to the pandemic caused by Covid-19, with the intention of becoming aware of digital literacy contexts of teachers and to propose training strategies.

The study population were teachers of the Medium Higher Education System of the College of Scientific and Technological Studies of the State of Jalisco. The sample, of the non-probabilistic type, included 508 volunteer professors, of a total of 936 active teachers of the 2020A calendar term, which corresponds to 95% of the level of confidence, with a 3% margin of error. Of this sample, 49% were men and 51% were women; age range was classified as follows: between 20 and 30 years (8%), 31 to 35 years (12%), 36 to 40 years (24%), 41 to 45 years (22%), 46 to 50 years (16%) and older than 51 years of age (18%).

To obtain information, a survey was designed and implemented, and for the construction of the instrument, four of the characteristics proposed by Hernandez *et al.*, (2016) were selected regarding competencies:

1) Technological: regarding knowledge in handling different ICT tools, such as understanding the use of some tools of the Web 2.0, in addition to knowing how to surf through that Web.

2) Communicative: knowledge and use of technological tools for an effective communication.

3) Pedagogical: aimed to different types of ICT integration knowledge in the teaching processes in the classroom and assessment processes from a pedagogical and didactic perspective.

4) Attitudinal: different motivations and affective dispositions with respect to their experience in the use of ICT in favor of students' learning (p, 8).

The instrument included 56 items distributed as follows: general data (45 items), technological literacy knowledge and communication tools (24 items), application of and educational methodologies with ICT (14 items), training in ICT (6 items), and attitude towards ICT in education (8 items). Designing the questions is based on the four points Likert's scale (null = 0, low = 1, good = 2, very good = 3, and excellent = 4), and for the attitude section a five-point scale was used (strongly agree = 5), agree = 4, do not agree, do not disagree = 3, disagree = 2) and strongly disagree = 1). The interpretation scale is shown in table 1.

Dimensions	Range	Category	
Technological literacy and	96-71	Outstanding	
communication tools	72-49	Notable	
Pedagogical methodology with ICT	48-25	Basic	
realgogical methodology with rer	25-24	Limited	
	40-31	Innovative	
	30-25	Proactive	
Attitude towards ICT in education	24-17	Neutral	
	16-9	Partially agree	
	9-1	Reluctant	

Table 1. Scale for the interpretation of the teacher's digital competences

To validate the instrument, the opinion of five experts who reviewed the content were taken into consideration. In addition, Cronbach's Alpha Test was conducted to validate the level of internal consistency, with a value result of 0.809, which is an indication that the questionnaire's consistency is high. For construct efficacy, a factor analysis was conducted by means of the Kaiser-Meyer-Olkin (KMO) Test to each of the four dimensions in the questionnaire. This test is proper, because "factor analysis works well if each item has an interval asymmetry quotient from +1 to -1, which is simpler when using graded response items, such as the Likert's type" (Lagunes, 2017. P- 10). The results of the KMO test (see table 2) show values greater than .7 and significance values are less than .05, therefore it can be confirmed that the items are related to each of their dimensions.

Dimension	КМО	Sig.	Bartlett (GL)
Technological literacy and communication tools	0.742	0	28
Pedagogical methodology with ICT	0.968	0	78
ICT training	0.866	0	10
Attitude towards ICT in education	0.811	0	28

Table 2. Kaiser-Meyer-Olkin test (KMO) and Bartlett processed in SPSS 22

The Google Forms platform was used to apply the questionnaire, and to process information the statistical SPSS version 22 software was used as well as the Excel application. To process data, frequency analysis and central tendency descriptive statistics was employed; in addition, the Chi-Square statistic test was applied to test the statistic correlation between the school of origin of the teacher, his academic degree and age, related with the level of competency in respect to instrumental knowledge of technology, knowledge of communication tools, and the pedagogic use of ICT and the attitude towards ICT in education.

RESULTS

In the results of the descriptive analysis regarding the instrumental knowledge of the different technological tools, using social networks shows greater knowledge, with an average of 3.56 points, followed by using text processors, with 2.56 points, managing email, with 2.55 points, and using internet browsers, with 2.46 points. When you see this, it is evidenced that the knowledge of teachers on the use of technology is practically characteristic of the basic tools for on-site teaching.

In contrast thereof, the lowest values were on using cloud storing managers (like Mega), with an average of 1.01 points, using Edmodo's platform and the educational social network, with 1.05 points, and using Slideshare, with 1.08 points. It must be mentioned that one of the preferred educational platforms –and the one with greater use– is Google Classroom, a tool integrated in the G Suite. With regards this platform, in the survey, teachers got an average score of 1.60 points, which is deemed as a low level of instrumental knowledge. Table 3 shows the distribution of the sample regarding instrumental knowledge of the different technological tools.

	Por	ontago	dietribu	tad by e			Lovol/	Stondard
Item	rere	rereentage distributed by scare			Media	media	deviation	
	0	1	2	3	4			
Word processors	0	6.7	44.9	33.3	15	2.56	Good	.832
Calculation sheet	4.1	24.8	40.7	22.4	7.9	2.05	Good	.976
Software to create presentations.	0.2	14.6	45.9	27	12.4	2.37	Good	.886
Peripheral elements	14.8	33.9	29.1	13.8	8.5	1.67	Good	1.141
Storage devices	9.3	32.9	33.5	15.4	9.1	1.82	Good	1.088
Using projectors	8.9	33.7	33.1	16.1	8.3	1.81	Good	1.073
Using email	0.2	6.7	46.3	31.7	15.2	2.55	Good	.835
Using internet browsers	0.4	9.6	47.2	29.1	13.6	2.46	Good	.859
Search pages	1.4	11	46.7	27.8	13.2	2.40	Good	.900
Using blogs	19.7	39.8	23.8	11.2	5.5	1.43	Low	1.094
Using wikis	27.4	39.2	18.1	10	5.3	1.27	Low	1.125
Using forums	11.4	39.6	29.7	12.6	6.7	1.64	Low	1.056
Using video repositories	23.8	40	19.1	13.6	3.5	1.33	Low	1.088
Use of Google Drive	13	34.3	30.7	14.8	7.3	1.69	Low	1.099
Use of Dropbox	25.2	33.7	25.2	9.8	6.1	1.38	Low	1.142
Use of Mega	38.6	36.8	13.8	6.7	4.1	1.01	Low	1.080
Use of OneDrive	26.6	37.6	20.3	11	4.5	1.29	Low	1.111
Moodle platform	17.9	32.5	29.1	14.6	5.9	1.58	Low	1.118
Classroom platform	17.7	32.9	27.2	16.3	5.9	1.60	Low	1.131
Edmodo platform	36.2	38.4	12.6	9.4	3.3	1.05	Low	1.080
Use of Pinterest	36.2	30.9	16.3	11.6	4.9	1.18	Low	1.184
Use of Instagram	31.9	28.5	21.3	11.6	6.7	1.33	Low	1.223
Use of SlideShare	36.6	34.8	16.1	9.1	3.3	1.08	Low	1.090
Use of social media	2.2	10.6	35.2	32.5	19.5	3.56	Very good	.990

Table 3. Knowledge of technology instruments and communication tools by the teacher

Note: on the scale 0=null, 1=low, 2=good, 3= very good and 4=excellent.

In respect to the pedagogic use of ICT and how to integrate them in the classroom (see table 4), the results are not encouraging, for they show that teachers had a low to null knowledge of the different technologies. Among the highest are educational videos, with 1.93 points, and collaborative work strategies, with 1.52 points, whereas the lowest is on gamification.

Table 4.	Knowledge of pedagogical methodologies to	0
	integrate ICT into teaching	

Item	Pero	centag	e distri scale	ibuted	l by	Media	Level/ media	Standard deviation
	0	1	2	3	4			
Inverted classroom	25.2	31.3	27.6	11.8	4.1	1.38	Low	1.108
Gamification	40.2	35	17.1	5.3	2.4	.95	Null	.999
Mixed courses	29.1	35.8	21.3	10.2	3.5	1.23	Low	1.087

On-line course	24	36	23.8	11.4	4.7	1.37	Low	1.108
Digital resource	21.3	34.4	29.1	11.2	3.9	1.42	Low	1.064
Repositories	31.7	36.6	18.7	9.8	3.1	1.16	Low	1.076
Web 2.0 creation	39	34.4	14.8	8.5	3.3	1.03	Low	1.086
Augmented reality	47.2	32.5	14.4	4.1	1.8	.81	Low	.952
Strategies for online collaborative work	16.3	35.8	30.9	13.4	3.5	1.52	Low	1.029
Educational videos	6.1	27.2	41.1	18.9	6.7	1.93	Low	.985
Creating educational videos	32.3	32.9	22.2	9.3	3.3	1.19	Low	1.088
Using simulators	39.4	33.1	15.7	9.1	2.8	1.03	Low	1.078
Digital assessment	40.2	33.1	16.1	7.9	2.8	1.00	Low	1.062

Note: on the scale 0=null, 1=low, 2=good, 3=very good and 4=excellent.

When computing technological and communication competencies of the sample, and as knowledge and use of communication tools are considered, the results show that 11% of teachers have an outstanding competency, whereas 20% is remarkable, 49% basic and 20% limited. Along with this, the aspect of pedagogic methodologies with ICT, only 5% is classified at an outstanding level, whereas 14.5% is identified as remarkable, 38% as basic and 42.5% as limited (see chart 1).



Chart 1. Percentage per categories of technological literacy and pedagogic methodologies with ICT.

When the 8 items were seen regarding attitude with the incorporation of ICT for teaching high-school level (see table 5), it was found that the flexibility offered by these tools for student learning was the item with the highest score, 4.25 points, and the lowest score, in respect to the mean, was for the idea that integrating ICT as a didactic tool implied time, with 2.29 points. With these data, it is possible to interpret that, in average, 65.9% of teachers have an innovating attitude, in accordance with the attitude scale proposed in table 5, whereas attitude of 28.3% is proactive (see chart 2).

Item	Per	centag	ge disti scale	Media	Standard deviation		
	0	1	2	3	4		
Incorporation of ICT in the classroom	2.6	1.8	6.5	50.8	38.4	4.21	.842
ICTs offer flexibility for learning	2.4	1.2	4.9	52	29.6	4.25	.802
ICTs are a distraction	20.5	35	19.7	17.5	7.3	2.56	1.202
ICTs promote creativity	2.4	2.8	7.9	52	35	4.15	.856
The phone is a distraction for learning	17.1	34.1	22.2	19.5	7.1	2.65	1.178
ICTs improve educational quality	3	2	11.8	50.4	32.9	4.08	.887
CTs involve time	28.9	36.8	15.7	13.2	5.3	2.29	1.171
ICTs are a potential, but I don't count on them	5.7	15.2	18.1	36.4	24.6	3.59	1.176

Table 5. Attitude to the didactic use of technology

Note: on the scale 1= very disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree and 5 = very agree.



Chart 2. Percentage of attitude levels of teachers to incorporate ICT to teaching.

In respect to the training received by professors, it was found that most of them have taken one or two courses on the use of technology (see chart 3); in spite of this, when following answers, it may be qualified that this training on the use of ICT as a pedagogical resource has been null for 15%

of the sample, low for 37.5%, good for 32%, very good for 11% and excellent for barely 4.5%. On the other hand, instrumental training in technology was considered by 19% of the sample to be null, by 38% to be low, by 29% to be good, by 10% to be very good and by 4% to be excellent.



Chart 3. Number of courses in the technological area taken by teachers.

In the correlation of the Chi-square test, on the association of variables (see table 6), values less than 0.05 were observed for the statistical test regarding the three dimensions proposed as a function of the school of origin of teachers, and the association values between the age range and knowledge regarding technological literacy and the application of educational technologies with ICT. For the attitude dimension in respect to ICT in education, the result was 0.89, which shows that attitude and age range are independent.

Variable vs Dimension	Chi-square tests		Symmetric me	netric measurements	
Level of study	Value Sig. asymptotic		Contingency coefficient	Approx. Sig.	
Technological literacy and tools communication	26.94	0.08	0.224	0.08	
Pedagogical methodology with ICT	14.5	0.696	0.167	0.696	
Attitude to ICT in education	10.29	0.59	0.141	0.59	
Teacher's proven campus					
Technological literacy and tools	203.96	0	0.535	0	

Table 6. Results of the association and independence through the Chi-square test

communication				
Pedagogical methodology with ICT	207.82	0	0.539	0
Attitude to ICT in education	103.011	0.043	0.411	0.043
Age category				
Technological literacy and communication tools	89.94	0	0.388	0
Pedagogical methodology with ICT	65.26	0	0.337	0
Attitude to ICT in education	9.53	0.89	0.136	0.89

DISCUSSION AND CONCLUSIONS

High-school teacher's profile in this study is basic level regarding digital competencies, and has an innovative and proactive attitude to integrate ICT in the classroom. These results, in contrast with the studies of Cepeda & Paredes (2020) and Bustos & Gomez (2018), are very similar, as they mention that high-school teachers' knowledge on hardware and software are low in average. Also, the data on table 3 are similar to those obtained in this study, because the scores are low regarding the instrumental part of the digital competency and pedagogic management of ICT. Where there are few initiatives to involve the creation of content. They are consistent with the study of Martinez-Garces & Garces-Fuenmayor (2020) while only a few teachers reach innovating and outstanding levels on the use of technology, which require that teachers' digital competency reinforcing plans be established in the short term.

When seeing the scenario optimistically, facing the development of new competencies enables the innovation of the teaching practice, where the professor seeks solutions he has not thought about before to propitiate students' learning. Thanks to this, when we get back to normality a more favorable forecast is expected for education, as we will have more skillful teachers and with greater experience on the use of ICT (Berry, 2020).

This research allowed us to understand that, at the reality of remote teaching through telematics means because of Covid-19, teachers find themselves in the need to face lack of knowledge of diverse didacticpedagogic methodologies to change technology into mediating instruments of learning. This can explain why many professors keep content, transmitting methodologies and the use of video-conferences as they would do it in a classroom session, which shows the reality of many teachers at the beginning of emergency remote teaching caused by Covid-19, since teachers and students had scarce digital competencies to face online teaching at the pandemic (Giraldez, 2020).

Data of this study are evidence of the current and urging need for teacher training, because it has shown that, in most of cases, the professors had not been involved in an instruction process aimed to use ICT for teaching, both on-site and online, and whoever was knowledgeable was because he/she had the initiative to learn them, generally through self-education. in addition, what has been found in the research may be used as support to give rise to suggestions aimed to strengthen teaching practices in on-site teaching and in the current, emerging one because of Covid-19.

First off, it is important to get an initial and continuing teacher instruction to guarantee a proper level of digital competency. This type of instruction ought to consider the technical use of tools and to guarantee pedagogicmethodological instruction on the innovating use of technology, that would insure mediation of a more active learning by students.

Conversely, in distance learning, a set of applications of the web may be incorporated, such as: tools for interactive presentations, gamification assessments and interactive boards, as well as tools for synchronous and asynchronous communication; however, we should not miss the purpose of the activity and consider that these tools are consistent with the students' possibilities.

Lastly, it is important reconsider online instruction assessment processes, with activities centered on the development of capabilities, therefore, the instruments used for on-site teaching may change or be adapted for virtual ends.

Thus, this study opens an avenue for future research works on the effects caused by emergency remote teaching caused by Covid-19. Among the potential fields, it is considered that more profound study may be necessary of the training levels inside each educational community, in relation with the results obtained in the correlation study of variables between the institute of origin and the level of competencies, which could explain that context does have an influence on the instruction of digital competencies.

Furthermore, the possibility is considered to analyze good teaching practices from this type of modality implemented by the sanitary emergency, and to do comparison studies between the results obtained at the beginning of the pandemic where this research is inserted, and those that may be obtained once the emergency remote teaching stage has come to an end; in this comparison, an advance would be expected in the level of competency of teachers.

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