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Experiences in the Training of Teaching Digital Competence for Using Digital Social Networks

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ABSTRACT

Background/purpose – The training of teachers to use digital social networks implies a change in the cultural paradigm and new alternatives for the development of their digital skills. This research analyzes the effectiveness of a workshop-structured massive online open course (MOOC) to develop the teaching of digital skills associated with using digital social networks for educational purposes.

Materials/methods – A quasi-experiment with pretest and posttest and intact groups was conducted. The population of the study was the teaching staff of Cuba's University of Informatics Science, with a sample of 30 teaching professors.

Results – The statistical results justify that in the two experimental groups, the implementation of the MOOC was satisfactory as significant differences were evident. The results suggest and affirm that MOOC-type online courses are an appropriate means for the continuation of teacher training as professional development. It concludes by arguing challenges in teacher training to develop their digital skills, highlighting: (1) technological, social, and educational imaginary; and (2) teaching digital culture vs. cultural codes of the student body.

Conclusion – The main contribution is the effectiveness of teacher training through the interaction and interactivity between the designed MOOC and learning activities conducted using Facebook, LinkedIn, and Telegram.

Keywords – digital competence, online courses, teacher education.

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1. INTRODUCTION

The digital competencies of teachers are not limited, as the TPACK model (Technological Pedagogical Content Knowledge) expresses, to the primary use of information and communication technologies (ICTs), but incorporate pedagogical criteria, educational context, and the educational application of technologies (Kong & Lai, 2021; Rodriguez et al., 2022). Mastering these competencies allows teachers to utilize a set of skills, attitudes, and knowledge to support and enhance student learning in various digital settings, e.g., virtual learning environments, educational games, personal learning environments, and digital social networks, amongst others. This requires the integration of pedagogical disciplinary knowledge, technological disciplinary knowledge, and technological pedagogical knowledge (Estrada-Molina, 2022; Skantz-Åberg et al., 2022).

Several theoretical models have been developed for digital teaching skills as well as frameworks, projects, and reference models. First, the research of Cabero-Almenara et al. (2020) stands out, as does the ICT competence framework for teachers proposed by UNESCO (2008). Additionally, there was DigiLit Leicester, a digital literacy project (Fraser et al., 2013), the DigComp models (versions 2.0, 2.1) of the European Union (Carretero, 2017), the model of the International Society for Technology in Education (2008), and the model of digital competence in Spain and Catalonia (Carrera & Coiduras, 2012).

In the scientific literature, different dimensions and nomenclatures have been established, with six common dimensions (language, technology, interaction processes, production and dissemination processes, ideology and values, and esthetics), with indicators related to digital teaching competencies (Barroso-Osuna et al., 2020; Mayor-Buzón et al., 2019). Recent studies (Durán et al., 2019; Ocaña-Fernández et al., 2020) have declared the importance of these dimensions in the formation of digital teaching competences and, with special interest, in the didactic use of virtual learning environments and digital social networks.

This justifies the importance of developing digital teaching skills for the educational use of digital social networks, which will enable teachers to be trained in the use of today's digital technologies that students use and that in turn have diversified contemporary learning scenarios (Fuentes-Cancell et al., 2021).

2. LITERATURE REVIEW

Despite the diversity of studies carried out on the development of digital teaching skills, limitations are still evident as there are no empirical findings related specifically to teacher training for the educational use of digital social networks (Gordillo et al., 2019; Hämäläinen et al., 2021; Torres-Hernández & Gallego-Arrufat, 2022). There is, therefore, a latent need for inservice teacher training of their digital skills.

In view of the need for teacher training to develop their digital skills in the use of digital social networks for educational purposes, new training actions should be initiated. One potential solution is through the use of massive online open courses (MOOCs) that promote virtual workshops (Estrada-Molina & Fuentes-Cancell, 2022).

Professional teacher development is a process that involves cognitive, socio-affective and professional change, characterized as cyclical (iterative), pedagogical reflection and problem solving related to educommunication, pedagogy, and education in a general sense (Marchant et al., 2022). Several studies have stated that the primary short-term scientific gains in teacher training consist of courses (face-to-face, blended, and distance education) and the

realization of workshops supported by learning activities that involve solving pedagogical professional problems (Pimienta et al., 2018).

The literature includes reports of pedagogical experiences in the use of courses with the MOOC format in order to develop digital teaching skills. However, several of these studies (Deng et al., 2019; Tang, 2021; Zhou et al., 2022) only show the essence of the questionnaire used and its results, but do not describe the pedagogical process employed, thereby limiting its replication. At the same time, other investigations that also use virtual courses and workshops for this purpose, have focused their attention on the results (Arquero et al., 2021; Nasution, 2022), leaving questions such as what were the objectives of each virtual workshop and how were those workshops developed? Since there is little current evidence on the effectiveness of MOOC-format courses and virtual workshops in teacher education (Estrada-Molina et al., 2022; Gordillo et al., 2019), further research is clearly needed in this area. A common feature found in the analyzed literature is that teacher training tends to use local and small samples as they solve learning problems in a given educational context. The current study examines the effectiveness of a MOOC-format course supported by a cycle of virtual teacher training workshops for the development of teachers' digital skills in using digital social networks for educational purposes.

3. METHOD

The research question of the study is to what extent do MOOC courses mainly structured as virtual workshops promote the development of digital skills in the teaching staff of a university?

3.1 Objectives

The aim of the research was to determine the effectiveness of a MOOC course, structured primarily with virtual workshops, in the development of higher education teachers' digital teaching skills associated with the use of digital social networks for educational purposes.

The following tasks were designed in pursuance of this overall objective:

- To develop a scale to record digital teaching competence associated with the use of digital social networks for educational purposes.
- To determine the validity of the ad hoc scale designed to assess the development of teachers' digital competence in the use of digital social networks for educational purposes.
- To determine from pre-experiment and actual pedagogical experiences, as well as from the theoretical analysis of similar investigations, what are the challenges of training teachers in the use of digital social networks for educational purposes.

3.2 Type of experimental design

The current study was formed as an experimental research, with a pre-experiment pretest, a posttest, and intact groups (Hernández-Sampieri et al., 2014). This type of design is considered an ideal experimental variant since the objective of the study was to check the effectiveness of using MOOCs to develop digital teaching skills.

3.3 Participants

According to Hernández-Sampieri et al. (2014), it is essential to calculate a valid sample size and to determine the appropriate sampling technique. There are two basic forms of

sampling, random (probabilistic) and non-random (non-probabilistic). In the case of the pre-experiment and its application in educational sciences and social sciences in general, either of the two classifications can be applied (depending on the objective and scope of the study), considering as a statistical recommendation that the minimum total of participative subjects is 17 since control over the sample is not mandatory.

The population of the current study consisted of teaching staff at the University of Informatics Science of Cuba, and the sample consisted of 30 higher education teaching professors. Two intact groups were formed, with teaching staff from the Computer Science department (G1, total 15 professors) and from Bioinformatics (G2, total 15 professors); selected as non-random sample units (Hernández-Sampieri et al., 2014). Both departments belong to the Faculty of Computer Sciences and Technologies. Regarding the general sociological and demographic data of the sample, the average ages of the participant teachers was 38.5 years (range: 30-45) for Group 1 (G1), and 40.15 years (range: 33-50) for Group 2 (G2), with 16 females and 14 males in total. In G1, 86.66% were graduates of Computer Engineering and 13.34% of Social Sciences, while in G2, 73.33% were graduates of Biochemistry and 26.67% of Social Sciences. In terms of the participants' teaching experience, 11 had taught for 4-10 years, 10 had taught for 11-30 years, and nine had taught for 31 years or more.

3.4 Instruments

To collect the research data, an ad hoc scale was developed with the purpose of assessing the development of the participant teachers digital competence in their use of digital social networks for educational purposes. The scale was designed based on six factors (language, technology, interaction processes, production and dissemination processes, ideology and values, and esthetics) and a global scale proposed and validated by Ferrés and Piscitelli (2012), with the annotations of George-Reyes and Avello-Martinez (2021). The 5-point, Likert-type scale (1 = *Not at all*, 2 = *A little*, 3 = *Some*, 4 = *Quite a bit*, 5 = *A lot*) consisted of six dimensions and 41 items (see Tables 1-3).

Table 1. Central trend descriptive statistics and data collection scale (adapted from Mayor-Buzón et al., 2019)

Dimension	Scenario	Items	$\bar{X}$	s	s^2	Cod.
Language	Scope of analysis	Teacher's ability to interpret information and content expressed by students in digital social networks through a process of interaction-communication.	4.03	.38	.14	I1
		Teacher's ability to analyze information and content expressed by students in digital social networks through a process of interaction-communication that includes the fulfillment of specific objectives and purposes.	4.97	.03	.001	I2
		Teacher's ability to understand the content for educational purposes (knowledge, attitudes, values) expressed by students in digital social networks through a process of interaction-communication.	4.45	.02	.061	I3

Dimension	Scenario	Items	$\bar{X}$	s	s^2	Cod.
		Teacher's ability to develop content that promotes training (instruction and/or education) of students through digital social networks.	4.86	.19	.035	I4
	Scope of expression	Teacher's ability to express themself through the functionality provided by digital social networks (uploading images, creating groups, web pages, video calls, microblogging, hashtags, tags, chat, etc.).	4.10	.30	.090	I5
		Teacher's ability to choose the most suitable digital social network functionality or resources according to the learning objective.	4.38	.03	.139	I6
		Teacher's ability to modify digital content and resources that they (or another teacher) developed in digital social networks using the given functionality.	4.34	.43	.187	I7
Technology	Scope of analysis	Teacher's understanding of the role of digital social networks in the school context, as well as its potential and effect on their professional work.	4.69	.28	.080	I8
		Teacher's ability to utilize digital social networks using multimodal and multimedia communication on the effectiveness of the training and instructional process.	4.97	.03	.001	I9
		Teacher's ability to function in hypermedia, transmediatic, and multimodal environments (Ramírez et al., 2016).	4.72	.20	.040	I10
	Scope of expression	Teacher's ability to adapt digital social networks to the objectives using assertive communication mechanisms.	4.86	.12	.014	I11
		Teacher's ability to design images, video, and audio for digital social networks and to edit according to educational purposes.	4.97	.03	.0001	I12

To evaluate the content validity (Delphi method), the expert technique was used, with 35 experts from Cuba, Ecuador, Spain, and Mexico, each holding a doctoral degree in education.

Table 2. Central trend descriptive statistics and data collection scale (adapted from Mayor-Buzón et al., 2019)

Dimension	Scenario	Items	$\bar{X}$	s	s^2	Cod.
Interaction processes	Scope of analysis	Teacher's ability to select from digital social networks the content that corresponds to the objectives of the professional in formation.	4.41	.45	.20	I13
		Teacher's ability to identify which digital resources should be used according to learning styles.	4.90	.16	.026	I14

Dimension	Scenario	Items	$\bar{X}$	s	s^2	Cod.
		Teacher's ability to perceive through interaction in digital social networks the system of motivation, emotions, and satisfaction manifested by students.	4.03	.03	.001	I15
		Teacher's ability to discern and manage the dissociations that sometimes occur between feeling and opinion, between emotionality and rationality (Ferrés & Piscitelli, 2012).	4.48	.25	.062	I16
		Teacher's understanding of the importance of using digital social networks in the educational context.	4.07	.13	.018	I17
		Teacher's mastery of digital social networks' definitions for educational purposes.	4.41	.24	.059	I18
		Teacher's ability to distinguish and differentiate messages from other cultures or contexts and to establish effective intercultural dialogue.	4.93	.06	.004	I19
		Teacher's ability to manage media leisure from digital social networks as an opportunity for students to learn.	4.41	.24	.059	I20
	Scope of expression	Teacher's ability to conduct collaborative work through connectivity and resource creation facilitated by digital social networks (Ferrés & Piscitelli, 2012).	4.41	.24	.059	I21
		Teacher's ability to interact with students from diverse backgrounds and cultures (Ferrés & Piscitelli, 2012).	4.93	.06	.004	I22
		Teacher's understanding of ethical knowledge, legal and behavioral norms in the use of digital social networks.	4.14	.12	.014	I23
Production & dissemination processes	Scope of analysis	Teacher's knowledge of the differences established between content production in digital social networks that contain representative information of certain groups, institutional entities, or individuals.	4.93	.06	.004	I24
	Scope of expression	Teacher's ability to work collaboratively in the development of multimedia or multimodal products, taking advantage of the potential of digital social networks (Ferrés & Piscitelli, 2012).	4.28	.20	.040	I25
		Teacher's ability to select significant messages, appropriating and transforming them to produce new meanings (Ferrés & Piscitelli, 2012).	4.24	.25	.064	I26
		Teacher's ability to share and disseminate information through digital social networks to increase the visibility of messages, in their interaction with students.	4.21	.16	.027	I27

Dimension	Scenario	Items	$\bar{X}$	s	s^2	Cod.
		Teacher's ability to manage one's identity online/offline and a responsible attitude to the control of private data (own or others') generated in the process of teacher-student and student-student interaction in digital social networks.	4.21	.16	.027	I28
		Teacher's ability to manage the concept of authorship, individual or collective, responsible attitude towards intellectual property rights, and ability to take advantage of resources such as creative commons (Ferrés & Piscitelli, 2012).	4.86	.12	.014	I29

The global questionnaire was found to have a good level of reliability, with a Cronbach alpha (α) value of .89. Reliability analysis of each dimension was calculated as follows: Language (α = .88), Technology (α = .86), Interaction processes (α = .85), Production and dissemination processes (α = .88), Ideology and values (α = .87), and Esthetics (α = .82). For the validity of understanding the questionnaire, a pilot study was administered with 23 teaching managers employed at the university where the study was conducted.

Table 3. Central trend descriptive and statistical data collection scale (adapted from Mayor-Buzón et al., 2019)

Dimension	Scenario	Items	$\bar{X}$	s	s^2	Cod.
Ideology and values	Scope of analysis	Teacher's ability to discover how media representations structure one's perception of reality, often through inadvertent communications (Ferrés & Piscitelli, 2012).	4.69	.21	.046	I30
		Teacher's ability to assess the reliability of information sources, drawing critical conclusions from both what is said and what is omitted (Ferrés & Piscitelli, 2012).	4.86	.12	.014	I31
		Teacher's ability to search, organize, contrast, prioritize, and synthesize information from different systems and different environments (Ferrés & Piscitelli, 2012).	4.48	.25	.062	I32
		Teacher's ability to identify in digital social networks the intentions or interests that contradict the ideologies and values established by the educational institution, respecting the criteria before it.	4.90	.09	.0009	I33
		Teacher's ethical attitude to downloading useful products for the teaching-learning process, discerning between useful documents and what is linked to other information.	4.45	.25	.061	I34
		Teacher's ability to analyze individual and collective virtual identities, and to detect stereotypes, especially in terms of gender, race, ethnicity, social class, religion, culture, disabilities, etc., analyzing their causes and consequences (Ferrés & Piscitelli, 2012).	4.52	.25	.062	I35

Dimension	Scenario	Items	$\bar{X}$	s	s^2	Cod.
		Teacher's ability to critically analyze and evaluate the effects of opinion creation and cultural homogenization on the interaction process of digital social networks as part of an educational process.	4.69	.21	.046	I36
	Scope of expression	Teacher's ability to use digital social networks for values education from an attitude of social and cultural commitment.	4.69	.21	.046	I37
Esthetics	Scope of analysis	Teacher's ability to generate motivation and pleasure through the educational use of digital social networks; as in it is not only what is communicated, but how.	4.90	.09	.009	I38
		Teacher's sensitivity to recognize when media does not fit the objectives or requirements established for the use of digital social networks.	4.10	.09	.009	I39
		Teacher's ability to relate and differentiate media productions in digital social networks to avoid overlap or repetition of content and form.	4.76	.18	.034	I40
	Scope of expression	Teacher's ability to produce elementary messages in digital social networks that are understandable and that contribute to increasing personal or collective levels of creativity, originality and sensitivity (Ferrés & Piscitelli, 2012).	4.86	.12	.014	I41

3.5 Procedures and data analysis

For the data analysis, central statistics, tests, and statistical techniques were employed (median, Kolmogorov-Smirnov, student's *t*, Cohen's *d*, and the estimation of the effect by *r*). Quantitative data were processed using IBM's statistical package SPSS v. 24.

The dependent variable of the study is the development of digital teaching skills associated with the use of digital social networks for educational purposes, whilst the independent variable is the design of a MOOC.

The statistical hypothesis (H_0) is that no changes are observed between the mean score obtained in the pretest and posttest evaluation of the questionnaire to measure the digital competences of teachers associated with the use of digital social networks for educational purposes. The hypothesis was tested at a significance level of .05.

A pretest (September-October 2020) was conducted prior to the MOOC course commencing, and the posttest (February-April 2021). was applied at its conclusion. The course was taught via a digital learning platform (Moodle), and covered topics related to digital social networks, virtual communities, digital identity, and educommunication. The course was designed as a set of digital educational resources and nine digital workshops. Workshops I, II, IV, V, VII, and VIII (see Tables 4-5) were designed according to the dimensions of digital competences. Figure 1 illustrates the relationships between workshops, digital social networks and digital skills dimensions.

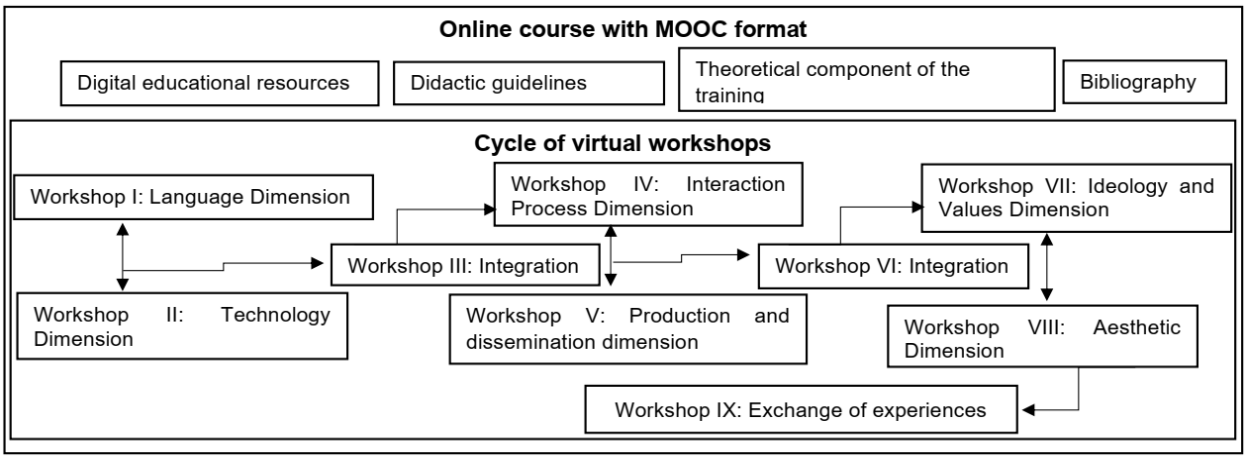

Figure 1. Workshops, relations, and general structure

Table 4. Virtual workshops (I-VI), digital social networks, and actions

Workshop	Social network/features	General actions
I	Facebook: Features	Dimension: Language
	Create, customize, and moderate a group and room	Development of a video and its socialization Development of a teaching guide (video)
II	Telegram: Features	Dimension: Technology
	Create and to design a group Create and configure a channel Create and moderate voice chat Set up privacy policies	Selection and application of Bots Develop educational materials Preparation and compartmentalization of didactic resources
III (Integrative Items I, II)	Functionality integration (Facebook and Telegram)	Integration activity (both Language and Technology dimensions)
	Facebook: Features Create and edit a page Link to created group page Create posts (not welcome)	List of content included in the group and on the page created Elaboration of contents and socialization of the same in the page and in its relation with the group
	Telegram: Features Create voice chat	Elaboration of comparative study (voice chat) and room (Telegram and Facebook)
IV	LinkedIn: Features	Dimension: Interaction processes
	Create, design, and edit account profile Extend network of contacts Create a group and associate members Make conversation Add a comment Find experts Create survey	Publication creation Identification of resources (feed) Customization of resources (feed) Conceptual map development and exchange Node preparation and relationship development Development of summary table
V	ResearchGate: Features	Dimension: Production and dissemination processes

Workshop	Social network/features	General actions
	Create, design, and edit profile Find and add related authors Create a DOI Add a review Open a debate Create statistical assessment Develop section Stats and RG Score	Publication insertion Formation of a network of followers Skills check Checking/reviewing publication copyright Creation of space for questions and answers Drafting of summary document
VI (Integrative Items IV, V)	Feature integration (LinkedIn and ResearchGate)	Integration activity (both Interaction processes and Production and dissemination processes)
	Determine related scientific publications (ResearchGate and LinkedIn) Determine articles cited or commented by other authors (ResearchGate) Create project (ResearchGate)	Enumeration and description of functionalities and resources (feed) Determination of similarities and differences between feeds of each digital social network

Workshops III and VI (see Table 4) conceived inclusive learning activities to systematize and consolidate the objectives of previous workshops. The final (IX) workshop (see Table 5) presents a socializing character, with experiences exchanged and reflection. All orientations of the workshops were conducted using Facebook. The procedure and tools designed were used after the consent of the participants had been obtained.

Table 5. Virtual workshops (VII-IX), digital social networks, and actions

Workshop	Social network/functionality	General actions
VII	Facebook: Functionality	Dimension: Ideology and values
	Create group (related activity: Workshop 1) Configure security policies Create group chat (voice chat) Moderate comments Create survey in the group	Establish dialogue Evaluate dialogue process Define and share security and privacy policies Evaluate levels of integration and hierarchy in communication Assess communication process stages Write down lessons learned
VIII	Facebook: Functionality	Dimension: Esthetics
	Create and describe group Create welcome post Form questions for group members Set up roles for administrators Set general configuration	Description of group from educational communication Application of writing and grammar rules Moderate comments Exchanges in mediated dialogue Application of pedagogical ethics
IX	Facebook: Functionality	Exchange of experiences

Workshop	Social network/functionality	General actions
(final workshop)	Edit a video Share various personal learning environments Create group chat and exchange	Feedback from previous workshops Learning experiences Assess effectiveness of workshops

The virtual workshops consisted of the following features:

Development of digital skills in and from digital social networks

The initial orientation and conducting of the virtual workshops was carried out using the Facebook digital social network. To this end, a Facebook "group" was created, with "rooms" added in order to enhance exchange and collaborative dialogue between participants. Therefore, the learning experiences of each teacher were shared.

Collaborative exchange of learning experiences using digital social networks

Learning activities encouraged interaction in various digital social networks (Facebook, Telegram, ResearchGate, and LinkedIn). In each activity conducted by each teacher, the necessary permissions were acquired in order that other participant teachers and those leading the training could view the pedagogical performance of each participant. The activities were oriented in and conducted within the digital social networks, thus promoting collaborative learning and interaction-collaboration through the digital social networks.

Systemic integration

Each virtual workshop conceived the integration between the components of its didactic design and its relationship between all of the workshops. To this end, integrative workshops were designed with the purpose of consolidating and systematizing the content from the realization of complex learning activities. The workshops were created according to the dimensions of the dependent variable, thus contributing to the formation of digital skills from its own unit.

By way of methodological guidance, the objectives that prevailed in the virtual workshops are set out as follows in accordance with the dimensions of digital competences.

Language

- To develop content that promotes student training through digital social networks.
- To didactically express through the functionality of digital social networks the content of the learning teaching process. (Features such as uploading images, creating groups, creating webpages or websites, video calls or video conferences, microblogging, hashtags, tags, chat, and surveys).

Technology

- To use digital social networks with multimodal and multimedia communication to support the effectiveness of the training and instructional process.
- To design and edit digital social network images, videos, and audio for educational purposes.

Interaction processes

- To identify from digital social networks the processes that support their functioning and interaction with emotions, motivation, and satisfaction generated in their link with these resources, students, and the teaching process.
- To implement a communication strategy in the LinkedIn digital social network through leveraging its functionality.

Production and dissemination processes

- To understand the differences established in the production of content offered in digital social networks that contain representative information of certain groups, institutional entities, or individuals.
- To develop multimedia or multimodal products that take advantage of the potential of digital social networks.
- To socialize information through digital social networks, increasing the visibility of messages and interaction with students.

Ideology and values

- To contrast, prioritize, and synthesize information from different digital social network systems and environments in the intentions or interests that contradict with the ideologies and values established by the educational institution.
- To employ digital social networks for values education from an attitude of social and cultural commitment.

Esthetics

- To encourage the educational employment of digital social networks, not only according to what is communicated, but in the way it is conducted.
- To develop elementary messages in digital social networks that are understandable and that contribute to increased personal or collective levels of creativity, originality, and sensitivity that are useful for students.

4. RESULTS

The study's findings are presented in relation to the proposed objectives.

Regarding the fulfillment of the first objective, the previous section shows the proposal of a scale allowing its application to other studies to measure the digital competencies of teachers in the use of digital social networks for educational purposes.

In the preliminary pretest and posttest analysis, the median associated with the digital competencies of teachers was determined. Figure 2 illustrates items in relation to the coding given in Tables 1-3.

Figure 2. Means obtained by each indicator according to size (G1_Pre: Group 1 pretest, G1_Post: Group 1 posttest, G2_Pre: Group 2 pretest, G2_Post: Group 2 posttest)

The results show certain limitations, and highlight the following:

- In Table 1, the dimensions of G1 that showed less development were Language (I1, I5-I6), Technology (I8, I11-I12), Interaction processes (I13-I21, I23), Production and dissemination processes (I27-I29), Ideology and values (I30-I31, I34-I37), and Esthetics (I39, I41).
- In Table 1, the dimensions of G2 that showed less development were Language (I2, I5-I6), Technology (I8-I9, I12), Interaction processes (I13,-I15, I17-I18, I20-I21, I23), Production and dissemination processes (I26-I29), Ideology and values (I31, I34-I36), and Esthetics (I40-I41).
- The indicators most affected by regularity, according to the pretest, were Language (I5-I6), Technology (I8, I12), Interaction processes (I13-I18, I20-I21), Production and dissemination processes (I27-I28), Ideology and values (I31, I34-I36), and Esthetics (I41). From a qualitative perspective, this analysis confirmed that both groups revealed shortcomings in the teachers' mastery of digital competences in their use of digital social networks for educational purposes, justifying the need for this study.
- Language: Items I5 and I6 presented the greatest difficulty for teachers of G1 and G2, respectively.
- Technology: It is clear that the most affected indicators affected the teachers' ability to perform properly in the field of analysis (G1 = 60%, G2 = 73.33%).
- Interaction processes: Recurring limitations in both groups highlighted didactic deficiencies in the management of media in digital social networks, and the identification of digital resources to be used according to the students' learning styles.

- Production and dissemination processes: Although teachers (G1 = 53.33%, G2 = 60%) experienced producing digital educational resources and the didactic use of learning management platforms, there exists a recurrent need to create indicators for the development of multimedia or multimodal products that take advantage of the potential of digital social networks.
- Ideology and values; Esthetics: Analysis and critical evaluation of the effects of opinion creation and cultural homogenization exercised in the interaction process of digital social networks needs to be enhanced.

To respond to the second objective, the following statistical hypothesis was designed:

H_0: No changes were observed between the mean score obtained in the pretest and posttest evaluation of the questionnaire to measure the digital competences of teachers associated with the use of digital social networks for educational purposes. The hypothesis was tested at a level of significance of .05.

The mean score of the dimensions for each group is shown in Table 6, with all following a normal distribution since their significance values of the Kolmogorov-Smirnov normality test were revealed to be greater than .05 (in this case, .132 < *p* > .388).

The results presented in Table 6 indicate that, for the two participant groups, implementation of the MOOC-format course was successful as significant differences were evident. In this sense, the effect size by *r* was found to be medium and large, respectfully (Cohen, 1988). In terms of the magnitude of the effect, the groups with mean values (*d* = 0.5-0.8) were Language (G1, G2), Technology (G1, G2), Interaction processes (G1, G2), Ideology and values (G2), and Esthetics (G1, G2), whilst the remaining quantities were considered large (*d* > 0.8). Based on the results obtained and their statistical interpretation, H_0 was rejected.

Table 6. Mean, standard deviation, mean difference, *t* Student, effect size and its estimate

Dimension	Groups	Mean	*N*	SD	Dif. Mean	*t*	Sig.	*d*	*r*
Language	G1_Pre	2.87	15	.352	-1.067	-4.036	.000	-1.464	-.590
	G1_Post	3.93	15	.961					
	G2_Pre	2.66	15	.488	-1.467	-6.389	.000	-2.338	-.759
	G2_Post	4.13	15	.743					
Technology	G1_Pre	2.87	15	.352	-1.133	-4.795	.000	-1.745	-.657
	G1_Post	4.00	15	.845					
	G2_Pre	2.73	15	.458	-1.467	-5.821	.000	-2.129	-.728
	G2_Post	4.20	15	.862					
Interaction processes	G1_Pre	3.00	15	.000	-1.067	-5.172	.000	-1.876	-.680
	G1_Post	4.06	15	.799					
	G2_Pre	2.73	15	.458	-1.467	-5.821	.000	-2.129	-.728
	G2_Post	4.20	15	.862					
Production & dissemination processes	G1_Pre	3.67	15	.488	-0.800	-4.361	.000	4.502	.913
	G1_Post	4.46	15	.516					
	G2_Pre	3.6	15	.828	-0.533	-2.117	.043	3.648	.876
	G2_Post	4.13	15	.516					
Ideology and values	G1_Pre	3.20	15	.414	-0.867	-4.111	.000	3.691	.879
	G1_Post	4.06	15	.704					

Dimension	Groups	Mean	*N*	SD	Dif. Mean	*t*	Sig.	*d*	*r*
Esthetics	G2_Pre	2.93	15	.704	-1.267	-5.027	.000	-1.840	-.677
	G2_Post	4.20	15	.676					
	G1_Pre	3.13	15	.352	-1.200	-6.542	.000	-2.389	-.766
	G1_Post	4.33	15	.617					
	G2_Pre	2.86	15	.640	-1.533	-7.273	.000	-2.667	.800
	G2_Post	4.40	15	.507					

5. DISCUSSION AND CONCLUSION

This study argues that the digital competencies of teachers' use of digital social networks for educational purposes goes beyond the individual training of teachers in ICT and education technology usage. The common European framework (DigComp, Carretero et al., 2017), the framework proposed by Cabero-Almenara et al. (2020), and other recent studies (Domingo-Coscollola et al., 2019; Durán et al., 2019; Ocaña-Fernández et al., 2020) have all expressed the importance of training teachers in the educational use of technologies, with special attention to digital social networks in consideration to the characteristics of today's 21st century students. In turn, although there are certain theoretical models (Prendes et al., 2018) aimed at training teachers in digital skills, these lack "an underlying pedagogical approach that serves as a theoretical basis" (Colás-Bravo et al., 2019, p. 31).

The current study presents adequate results in the development of teachers' digital teaching skills associated with the use of digital social networks for educational purposes, providing a basis for the design of innovative models to develop these skills based on the level of transfer and reliability of the proposed indicators.

As for the first objective, a scale was developed to measure the digital competences of teachers in their use of digital social networks for educational purposes. In total, 41 indicators were adapted (see Table 1) in relation to the six dimensions proposed by Mayor-Buzón et al. (2019).

As for the second objective, the results show that in order to develop these digital competences, the following aspects are deemed essential: (1) Orientation of learning activities in and from various digital social networks (Facebook, Telegram, ResearchGate and LinkedIn), and (2) collaborative teacher learning and the exchange of learning experiences. All this shows that much remains still to be done in the training of teachers, since a mastery of technological and computer skills does not necessarily imply that they are efficiently applied in the use of technologies for educational purposes, and even more so in terms of digital social networks (Durán et al., 2019).

The current study's results also show that, regardless of the branch of teaching (in this case, computer science, social sciences, and biochemistry), teachers' technological skills, or their level of ICT training, it is possible to further develop their digital skills. This finding concurs with similar results in other studies (e.g., Pérez-Calderón et al., 2021), whilst in contrast to other investigations (e.g., Wastiau et al., 2013).

Finally, with regards to the third objective, the results of the pedagogical, empirical, and retrospective analysis conducted at the end of the course revealed four challenges in the development of teachers' digital competences to enable them to utilize digital social networks for educational purposes:

- Digital social network functionality, educational practices, and personal learning environments

In the development of teacher training, we observed a diversity of configurations in the personal environments of teachers which, as is known in the scientific literature, involved different levels of content assimilation and consequently in its development of digital competences (Ramírez et al., 2020). This situation required the designing of personalized learning activities for each teacher, for which it was useful to establish relationships between their preferences in terms of digital social networks and the functionality offered.

- Communication, collaboration, and educational praxis

The realization of collaborative learning activities in digital social networks was profitable; however, the activities had a particularity, that the teacher should perform them within the same digital social network through their pedagogical action (i.e., every day). Irrespective of the subjects taught, the participant teachers' performance was visible for all who received the same training, and with the aim of promoting collaborative reflection and the constructive exchange of experiences. This led to an educommunicative challenge for the potential integration between the dimensions of Interaction processes, Production and dissemination processes, Ideology and values, and Esthetics (Domingo-Coscollola et al., 2019). Whilst encouraging results were achieved, it is important to highlight the need to continue to deepen the design of learning activities aimed at developing these dimensions from an integrative perspective.

- Technological, social, and educational imaginary

In order to learn, to unlearn, to know oneself, to impose oneself challenges, to know the scheme of educational, social, and technological representation of the university, the society (in this case, the University of Informatics Science, Cuba) and the individual must be fully involved in the challenges of orientation and implementation of learning activities. Therefore, it would be interesting to investigate the relationship between these three imaginaries and to examine their relationship in the domain of digital competences within a given educational, communicative, and social context, and to answer questions such as, How transferable and applicable are the digital competences established in the literature? and What is the relationship between the technological, social, and educational imaginary concerning the use of digital social networks by teachers and students? To address these questions would require an interdisciplinary analysis under the prism of social communication, the sociology of education, educational psychology, pedagogy, and based on the premise of the digital divide.

- Digital teaching culture vs. student cultural codes

In the pedagogical praxis of the teacher, we were able to observe that it is necessary to train teachers in the knowledge of the digital culture of today's students (who are digital natives). The gap between the cultural codes of students and that of their teachers is reaffirmed. Teachers must dedicate the time necessary and the literacy in this subculture; shortcomings that even today require systematic solutions to enhance the teacher-student relationship in the case of digital social networks (Camas et al., 2021).

Although the current study developed an adaptation to the theoretical proposal of the construct of teachers' digital competencies revealed by Mayor-Buzón et al. (2019), the study presented certain limitations regarding the number of participants and the type of design (pre-experiment, with pretest and posttest and intact groups). The authors acknowledge that the sample chosen (N = 30, divided into two groups of 15 teachers) was both local and small in size, and therefore other experimental designs that include control groups and larger samples could be considered in the future. However, the study reaffirmed the importance of MOOCs in teacher training through the development of an ad hoc scale that was designed to

evaluate digital teaching competence, contextualized to the use of digital social networks for educational purposes as a basis for future research. In addition, it is considered relevant that the development of items to measure digital teaching skills also lends itself to further refinement and development.

Finally, it is proposed to continue research in relation to teacher training and their educational utilization of digital social networks, as well as other qualitative or quantitative research in comparison to the results of the current study.

DECLARATIONS

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REFERENCES

Arquero, J. L., Romero-Frías, E., & Del Barrio-García, S. (2021). The impact of flow, satisfaction and reputation on loyalty to MOOCs: the moderating role of extrinsic motivation. *Technology, Pedagogy and Education, 31*(4), 399-415. https://doi.org/10.1080/1475939x.2021.2018031

Barroso-Osuna, J., Llorente-Cejudo, C., & Palacios-Rodríguez, A. (2020). Digital Competence and Identity in Social Networks. Perceptions of Teachers in Training. *AULA Revista De Humanidades y Ciencias Sociales, 66*(2), 53-64. https://doi.org/10.33413/aulahcs.2020.66i2.139

Cabero-Almenara, J., Barroso-Osuna, J., Palacios Rodríguez, A., & Llorente-Cejudo, C. (2020). Digital Competency Frames for university teachers: evaluation through the expert competence coefficient. *Revista Electrónica Interuniversitaria De Formación Del Profesorado, 23*(3). https://doi.org/10.6018/reifop.414501

Camas, L., Valero, A., & Vendrell, M. (2021). The Teacher-Student Relationship in the Use of Social Network Sites for Educational Purposes: A Systematic Review. *Journal of New Approaches in Educational Research, 9*(2), 137-156. https://doi.org/10.7821/naer.2021.1.591

Carretero, S., Vuorikari, R., & Punie, Y. (2017). *DigComp 2.1: The digital competence framework for citizens with eight proficiency levels and examples of use*. Publications Office of the European Union.

Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences* (2nd ed.). LEA.

Colás-Bravo, P., Conde-Jiménez, J., & Reyes-de-Cózar, S. (2019). The development of the digital teaching competence from a sociocultural approach. *Comunicar, 61*, 21-32. https://doi.org/10.3916/C61-2019-02

Deng, R., Benckendorff, P., & Gannaway, D. (2019). Progress and new directions for teaching and learning in MOOCs. *Computers and Education, 129*, 48-60. https://doi.org/10.1016/j.compedu.2018.10.019

Domingo-Coscollola, M., Bosco-Paniagua, A., Carrasco-Segovia, S., & Sánchez-Valero, J. A. (2019). Fostering teachers' digital competence at university: The perception of students and teachers. *Revista De Investigación Educativa, 38*(1), 167-182. https://doi.org/10.6018/rie.340551

Durán, M. C., Prendes, M. P. E., & Gutiérrez, I. P. (2019). Teaching Digital Competence Certification: a proposal for university teachers. *RIED. Revista Iberoamericana de Educación a Distancia, 22*(1), 187-205. http://dx.doi.org/10.5944/ried.22.1.22069

Estrada-Molina, O. (2022). The Effects of WhatsApp and Telegram on Student Engagement: An Analysis from the Mixed-Methods Approach. *Education Research International*, 2022, Article 2881404. https://doi.org/10.1155/2022/2881404

Estrada-Molina, O., & Fuentes-Cancell, D. (2022). Engagement and desertion in MOOCs: Systematic review. *Comunicar, 30*(70), 111-124. https://doi.org/10.3916/C70-2022-09

Estrada-Molina, O., Fuentes-Cancell, D. R., & Morales, A. A. (2022). The assessment of the usability of digital educational resources: An interdisciplinary analysis from two systematic reviews. *Education and Information Technologies, 27*(3), 4037-4063. https://doi.org/10.1007/s10639-021-10727-5

Ferrés, J., & Piscitelli, A. (2012). Media competence. Articulated proposal of dimensions and indicators. *Comunicar, 38*, 75-82. https://doi.org/10.3916/C38-2012-02-08

Fraser, J., Atkins, L., & Richard, H. (2013). *DigiLit Leicester. Supporting teachers, promoting digital literacy, transforming learning.* Leicester City Council.

Fuentes-Cancell, D. R., Estrada-Molina, O., & Delgado Yanes, N. (2021). Social networks: a socio-educational vision. Systematic review. *Revista Fuentes, 23*(1), 41-52. https://doi.org/10.12795/revistafuentes.2021.v23.i1.11947

George Reyes, C. E., & Avello-Martínez, R. (2021). Digital literacy in education. Systematic review of scientific production in Scopus. *Revista de Educación a Distancia (RED), 21*(66), Article 5. https://doi.org/10.6018/red.444751

Gordillo, A., López-Pernas, S., & Barra, E. (2019). Effectiveness of MOOCs for teachers in safe ICT use training. *Comunicar, 61*, 103-112. https://doi.org/10.3916/C61-2019-09

Hämäläinen, R., Nissinen, K., Mannonen, J., Lämsä, J., Leino, K. & Taajamo, M. (2021). Understanding teaching professionals' digital competence: What do PIAAC and TALIS reveal about technology-related skills, attitudes, and knowledge? *Computers in Human Behavior, 117*, Article 106672. https://doi.org/10.1016/j.chb.2020.106672

Hernández-Sampieri, R., Fernández-Collado, C., & Baptista-Lucio, P. (2014). *Metodología de la investigación*. McGraw Hill/Interamericana.

International Society for Technology in Education. (2008). *National educational technology standards for teachers*.

Kong, S.-C. & Lai, M. (2021). A proposed computational thinking teacher development framework for K-12 guided by the TPACK model. *Journal of Computers in Education, 9*(3), 379-402. https://doi.org/10.1007/s40692-021-00207-7

Mayor-Buzón, V., García-Pérez, R., & Rebollo-catalán, Á. (2019). Exploring factors predicting digital competence in social networking sites. Píxel-Bit. *Revista de Medios y Educación,* (56), 51-69. http://dx.doi.org/10.12795/pixelbit.2019.i56.03

Marchant, P., Cornejo, C., & Felmer, P. (2022). Student Insights in Mathematics Problem Solving: Cognition, Affect, and Gesture. *International Journal of Science and Mathematics Education*. Advance online publication. https://doi.org/10.1007/s10763-022-10270-w

Nasution, A. K. P. (2022). Social Media Used In Language Learning: Benefits And Challenges. *Journal of Linguistics, Literature, and Language Teaching (JLLLT), 1*(2), 59-68. https://doi.org/10.37249/jlllt.v1i2.396

Ocaña-Fernández, Y., Valenzuela-Fernández, L., & Morillo-Flores, J. (2020). The Digital Competence in the University Teacher. *Propósitos y Representaciones, 8*(1), Article e455. https://dx.doi.org/10.20511/pyr2020.v8n1.455

Pérez-Calderón, E., Prieto-Ballester, J. M., & Miguel-Barrado, V. (2021). Analysis of Digital Competence for Spanish Teachers at Pre-University Educational Key Stages during COVID-19. *International Journal of Environmental Research and Public Health, 18*(15), Article 8093. https://doi.org/10.3390/ijerph18158093

Pimienta, I., Barbón, O., Carballo, L., González, Y., & González, S (2018). Effectiveness of teachers workshop for designing didactic resources in the improvements of the quality of didactic guidelines. *Educación Médica Superior, 32*(3), 80-93. https://ems.sld.cu/index.php/ems/article/view/1407

Prendes, M. P., Gutiérrez, I., & Martínez, F. (2018). Digital competence: a need for university teachers in the 21st century. *Revista De Educación a Distancia (RED), 18*(56), Article 7. https://revistas.um.es/red/article/view/321591

Ramírez, A., Renés, P., & Aguaded, I. (2016). The presence of media literacy in Primary education curriculum assessment criteria. *Aula Abierta, 44*(2), 55-62. https://doi.org/10.1016/j.aula.2015.08.002

Ramírez, M., Rivas, E., & Rodríguez, J. (2020). Personal work and learning environments: a literature review. *Espacios, 41*(33), 13-23. https://www.revistaespacios.com/a20v41n33/20413302.html

Rodriguez, I., Barceló, Mª. L., Poveda, B., & López-Gómez, E. (2022). The Development of Competences in the Teaching Practicum: The Perspective of School Mentors as Assessors. *Educational Process: International Journal, 11*(2), 7-25. https://dx.doi.org/10.22521/edupij.2022.112

Skantz-Åberg, E., Lantz-Andersson, A., Lundin, M., & Williams, P. (2022). Teachers' professional digital competence: an overview of conceptualisations in the literature. *Cogent Education*, *9*(1), Article 2063224. https://doi.org/10.1080/2331186x.2022.2063224

Tang, H. (2021). Teaching teachers to use technology through massive open online course: Perspectives of interaction equivalency. *Computers & Education, 174*, Article 104307. https://doi.org/10.1016/j.compedu.2021.104307

Torres-Hernández, N., & Gallego-Arrufat, M. J. (2022). Indicators to assess preservice teachers' digital competence in security: A systematic review. *Education and Information Technologies, 27*(6), 8583-8602. https://doi.org/10.1007/s10639-022-10978-w

UNESCO. (2008). *Estándares de competencia en TIC para docents*. https://eduteka.icesi.edu.co/articulos/EstandaresDocentesUnesco

Wastiau, P., Blamire, R., Kearney, C., Quittre, V., Van de Gaer, E., & Monseur, C. (2013). The Use of ICT in Education: a survey of schools in Europe. *European Journal of Education, 48*(1), 11-27. https://doi.org/10.1111/ejed.12020

Zhou, N., Tigelaar, D. E., & Admiraal, W. (2022). Vocational teachers' professional learning: A systematic literature review of the past decade. *Teaching and Teacher Education, 119*, Article 103856. https://doi.org/10.1016/j.tate.2022.103856

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