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Digital competence for teachers
Perspectives and foresights for a new school

Competencia digital docente
Perspectivas y prospectivas para una nueva escuela

English Edition

INDEXED INTERNATIONAL SCIENTIFIC JOURNAL

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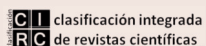
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C O N T E N T S

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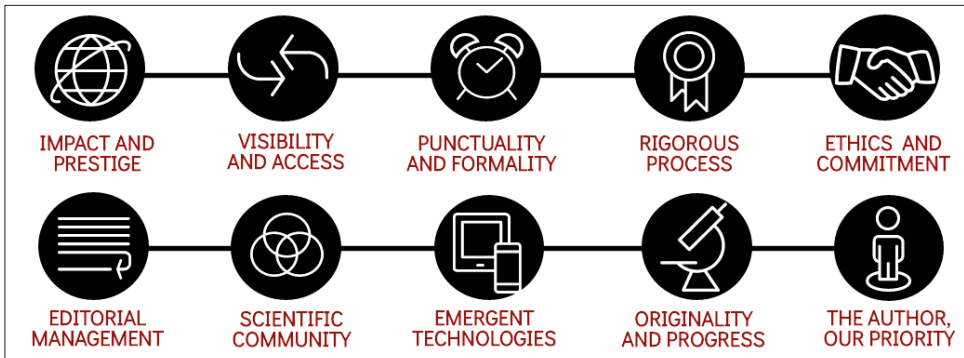
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Special

Topic Issue

Digital competence for teachers

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Perspectivas y prospectivas para una nueva escuela

Understanding social and cultural aspects of teachers' digital competencies

Comprendiendo los aspectos culturales y sociales de las competencias digitales docentes

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ABSTRACT

Many European governments, including Norway, have ambitious educational policies regarding digitalisation. Many businesses and policymakers pay great attention to the use of digital technologies in education in order to meet the future demands for a competent and qualified workforce. Among researchers and policymakers, there is a general consensus that the professional teacher is a key figure for the successful implementation of digital technologies in schools. Many expectations have been placed upon professional teachers regarding the implementation and use of digital technologies. The professional teacher is, to a certain degree, supposed to independently decide how digital technologies should be used in the classroom. This paper discusses what the concept of a 'professional digitally competent teacher' may mean in the context of schools. It also argues the need for a greater understanding of professional digital competence, one which takes into consideration various social and cultural aspects with regard to technology, schools and the teaching profession. In unpacking the social and cultural conditions for implementing technology in a professional teaching context, I will draw on concepts from the constructivist understanding of technology, namely, the 'domestication of technology'.

RESUMEN

Muchos gobiernos europeos, incluido el de Noruega, tienen políticas educativas ambiciosas en materia de digitalización. Muchas empresas y responsables políticos prestan gran atención al uso de las tecnologías digitales en la educación para satisfacer la futura demanda de una mano de obra competente y cualificada. Entre los investigadores y los legisladores, existe un consenso general al considerar a los docentes profesionales como una figura clave para la aplicación con éxito de las TIC en la escuela, en lo referente a su implementación y su uso, y se han depositado muchas expectativas en ellos. Se supone que el docente profesional debe, hasta cierto punto, decidir de manera autónoma cómo se han de utilizar estas tecnologías digitales en el aula. Este artículo analiza lo que puede significar el concepto de «docente profesional digitalmente competente» en el contexto de la escuela. También argumenta sobre la necesidad de una mejor interpretación de la competencia digital profesional, que tenga en cuenta diversos aspectos sociales y culturales en relación con la tecnología, las escuelas y la profesión docente. Al analizar las condiciones sociales y culturales para implementar la tecnología en un contexto de enseñanza profesional, nos basaremos en el enfoque constructivista de la tecnología, en concreto, la «domesticación de la tecnología».

KEYWORDS | PALABRAS CLAVE

Cultural values, digital competence, digitalisation, domestication of technology, moral economy, social conditions, teacher professional competence, technology adaption.
Valores culturales, competencia digital, digitalización, domesticación tecnológica, economía ética, condiciones sociales, competencia profesional docente, adaptación tecnológica.

1. Introduction

In a relatively short period of time, the role of the teacher has undergone a dramatic change. The expectations placed on schools have increased, because knowledge and digital competence have gained more importance in the development of society. In the public debate in Norway, one element that has been particularly emphasised is the huge impact that new digital technologies have had on all aspects of civil and professional society and that schools must be able to prepare students for the digital professional lives they have ahead of them. Such technology deterministic arguments have been articulated by politicians and school leaders and are supported by technology experts and the commercial computer industry at large (Egea, 2014; Hammond, 2014). Although it is difficult to find explicit claims of technological determinism, the view persists in many everyday accounts of digital technologies (Selwyn, 2012). The slow changes and adaptions to technology in schools have often been explained by teachers' tendencies to have a reactionary attitude towards using digital technologies and towards changing their teaching practices. Such claims have, to some extent, found support by research that reveals there is a gap between the technology available for education and teachers' actual use of technology in the classroom (Cuban, 2001; Jurica & Webb, 2016; Selwyn, 2010; Wachira & Keengwe, 2011; Winner, 2009). Research has also indicated that teacher training is too slow in responding to technological developments and fails to provide pre-service teachers with the necessary digital competence for integrating technology into their future professional contexts (Elstad & Christophersen, 2017; Instefjord & Munthe, 2017).

There is a general consensus in the research community and among policymakers that teachers' digital competence refers to their skills, knowledge, and attitudes towards using digital technology. It is clear that these issues are important for understanding how technology is adapted and used in schools. In addition, I will argue that a teacher's competence in translating the use of technology between different contexts which also takes into account the social and cultural aspects of digital technology is of equal importance.

The aim of this paper is therefore to examine the social and cultural conditions needed to implement digital technologies in the classroom and to explore what knowledge and competencies are required of the professional teacher. In order to address these issues, I will explore the phenomenon of 'digitalisation' and its connection to schools, teaching and digital competence. To unpack the contextual conditions required for implementing technology in teaching practices and schools, I will draw on the theoretical concept from the constructivist understanding of technology, the 'domestication of technology' approach (Berker, Hartmann, Punie, & Ward, 2006; Silverstone & Hirsch, 1992). In the discourse surrounding digital competence and the use of technology in schools, which to a large extent have been focused on the potential technology has for enhance learning (Oliver, 2011; Selwyn, 2012), the domestication perspective represents an alternative conceptual framework for understanding the social and cultural aspects regarding the implementation and adaption of technology in schools.

2. Digitalisation and new competencies

The technological imperative in education is connected to the more general development and digitalisation of society and the need for new competencies. Rationalisation is often the most obvious motivation for digitalisation, at least in the initial stages. Workers and workflows can be replaced with digital technologies, either with ATMs and mobile payment solutions within the financial sector, or with robots within the classical industrial production sector, such as the car industry. Rationalisation, however, only represents one side of digitalisation. The other side is about innovation, new products, new services, and new cultures. The digital society has changed the industrial society's mode of production towards innovation, new products, new lifestyles, and even new business models (Tapscott & Williams, 2006). It has been claimed that the crucial institutions in these new dynamics are the educational institutions, which play a completely new role in the 'knowledge society' than they did in the previous industrial society. Such claims has ideological underpinnings which implicitly understands knowledge as a productive force (Friesen, 2008). Although schools and universities look largely the same, both on the inside and on the outside, their function and role have nevertheless changed. The late modern society is characterised by a profound socio-cultural change, not merely a technological shift. In the discourse surrounding knowledge, competencies and digitalisation, education is emphasised as some of the most important premises for the

development of society (Egea, 2014). This includes acknowledging a clear linkage between the use of digital technology in the classroom at micro level and social structures of society such as global economics, as well as political and cultural institutions at macro level (Selwyn, 2010). With that background, the term 'digital competence' is highly political, reflecting the beliefs and assumptions regarding the kinds of competencies that are needed for the future societies (Ilomäki, Paavola, Lakkala, & Kantosalo, 2016).

3. Professional digital competencies

Rapid technological developments and changes put great demands on the professional teacher. These demands are not only in relation to adopting the new digital technologies as they are introduced and made available for education but also to understanding the political and cultural dimensions of digital technologies in relation to schools and society. The omnipresence of digital technologies, which undergo continuous developments and alterations, has changed the expectations placed on the professional teacher. Most people expect a professional teacher to be able to use new technologies to teach different subjects, teach pupils to be digitally competent for the future, communicate with parents and perform administrative tasks.

However, it is important to emphasise that a unilateral focus on technology's use and adaption fails to take into account the interplay between the social and cultural aspects of educational institutions (McDonagh & McGarr, 2015). An instrumental understanding of technology where schools, or educational institutions

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in general, are expected to adapt to and make use of technology at more or less the same pace as they are introduced to the consumer market will result in a kind of cultural lag. Crucial factors such as the organisational, political, economic and cultural considerations will pattern the design and implementation of technology.

Teachers are faced with a situation where they require skills not only to use digital tools but also to teach pupils how to practically use these tools. In addition, they should be competent in facilitating the pedagogical use of these devices in order to enhance the pupils' learning in all subject areas (Almerich, Orellana, Suárez-Rodríguez, & Díaz-García, 2016; Güne & Bahçivan, 2018; Ilomäki & al., 2016; Mishra & Koehler, 2006). While the first refers to what can be understood as practical instrumental skills in using digital devices, the latter is much more complex and ambiguous and includes pedagogical, ethical and attitudinal dimensions.

In the early days of digitalisation within education, much effort was spent in increasing schoolteachers' competencies in the practical use of digital technology. This is in part due to the fact that digital technologies at that time were much more complicated to use, and the ability to use these devices was seen as valuable on its own terms. Today, the situation is somewhat different. Digital devices such as computers, tablets and mobile phones have become common in every sphere of society, and the devices' user interfaces have become considerably easier to use. The current challenge that teachers face is not, therefore, how to practically use computers or other digital devices but how to implement and use digital technology within the framework of a teaching and learning context.

It is not unreasonable to claim that a teacher's ability to use digital devices, both for professional and private use, is more or less assumed by society. To put it another way, there is an expectation that today's professional teacher will have the digital competencies to adapt to new and emerging digital technologies as they are made available to the public. In the context of Norway, this expectation is explicitly stated in

the Ministry of Education, Digitalization Strategy for Basic Education 2017-2021 (2017). This document claims that one of the main obstacles to achieving better results through the use of ICT in schools is related to the teachers' lack of professional digital competence. The term 'professional digital competence' is a new concept in the research community, which is rooted in the larger body of research around digital literacy and competence (Buckingham, 2006; Ilomäki & al., 2016; Johannesen, Øgrim, & Giæver, 2014; Koltay, 2011; Pettersson, 2018). Considering that the concept is a relatively new addition to the discourse around digital competence in schools and teacher training, there is at present no clear and precise definition of the term (Gudmundsdottir & Hatlevik, 2018; Lund, Furberg, Bakken, & Engelien, 2014; Pettersson, 2018). Lund and others (2014) propose a need to shift the understanding of digital competence away from general skills that are suitable for all situations to an understanding of professional digital competence that includes both generic and a specific teacher profession skills.

> Professional digital competencies require practical skills in using digital tools, which are applicable across multiple subjects and teaching situations, as well as competencies in translating and making digital devices applicable to different subjects and situations.

This argument calls for a more context-sensitive approach that emphasises the need for understanding professional digital competence in relation to the different contexts in which digital devices are applied. It also emphasises the need to educate pre-service teachers in translating digital technology in order to make it relevant for the different situations and subjects into which they are integrated. To this argument, I will add that we are, in fact, not just dealing with one kind of professional digital competence, because competence does not exist without knowledge. And since 'knowledge' is always knowledge about something specific, and 'competence' is knowledge put into action, then consequently, 'competence' is also always competence in something specific. In terms of being a professional teacher, we are discussing several kinds of professional digital competencies. Professional digital competencies require practical skills in using digital tools, which are applicable across multiple subjects and teaching situations, as well as competencies in translating and making digital devices applicable to different subjects and situations. Professional digital competencies also involve skills in translating digital skills from the private domain to a public professional practice domain. This is more than a two-step process of transferring personal digital competencies, knowledge and experience to a given professional setting or applying a set of rules or learned strategies from manuals or lectures to a professional practice. Instead, it is a dialectical process in which digital competencies in one context reveal deficiencies in another and contribute to deeper digital competencies across different domains. A conceptual definition or demarcation of 'professional digital competence' would therefore be futile, because we are dealing with a set of several overlapping professional digital competencies. The cognitive activity of moving digital competencies from one domain to another implies a process of translating digital technology from one field of application to another. Being a professional, digitally competent teacher is therefore to a lesser degree a question of being able to adapt to or appropriate digital technologies but is more about having the ability to translate technologies across different domains. In order to unpack and clarify my arguments on what such a translation process might imply, I will, as mentioned in the introduction, draw on concepts from the constructivist understanding of the 'domestication of technology' approach.

4. Domestication of technology

In the beginning of the 1990s, Roger Silverstone and his colleges introduced the analytical concept of 'domestication' (Silverstone & Hirsch, 1992). The concept was developed to describe and analyse the process of how people adapted (media) technology in their homes. The domestication perspective represented an alternative to the more established understanding of the adaption and use of technology,

which saw this introduction and use as rational, linear and instrumental. As a critique of technological determinism, the theory of domestication focuses on actions and social practises as well as the symbolic interpretations of objects (Caron & Caronia, 2001; Muñoz & Sørensen, 2015; Silverstone, 2006). The adoption and use of technology went through four sequential phases of domestication. The first phase described 'appropriation', whereby technology was transferred from the market to the users. The second phase was about 'objectivization', whereby technology became a physical part of the home and part of the user's cognitive reality in regards to their conscious choice around aesthetics and expressions (Silverstone, 2006; Silverstone & Hirsch, 1992). The third phase concerned 'incorporation', whereby technology became part of people's daily routines and practises. In this third phase, technology was converted from a commodity to an object with a certain purpose that was fully integrated into the user's lifeworld. The fourth phase involved 'conversion', whereby technology changed from something existing on its own terms to something that could be presented to the outside world. It is obvious that different technologies are functional and are developed and designed for specific purposes. However, this does not prevent people from using them in ways or cultural contexts other than what they were designed for (Silverstone, 2006). The conversion phase is therefore about a reconnection and redefinition of the relationship between the home and the outside world. This can be described as a crossroads, where cultural expectations and social practices face challenges with technology. On the one hand, the object in question is designed and constructed to serve certain functionalities, as designers in the 'laboratory' have specific ideas about the ideal and optimal use of the object. On the other hand, the users themselves decide and define the application and use of said object. Conversion is also about understanding users' resistance and scepticism when cultural expectations and social resources are challenged by technology. Through these four phases, technology moves from being an exotic and complex novelty to becoming an integrated part of everyday life and routines that every household member takes for granted (Silverstone, 2006). The concept of domestication highlights the fact that using a specific kind of technology is never a passive action. The user does not necessarily follow the scripts and predesigned purposes of the technology, and they do not necessarily interpret the technology in the same manner as the designer. Users will always contribute to defining, or even redefining, the kind of role and significance that technology should have. The interactions between people and technology will always constitute a meeting between two active parties.

The domestication perspective provides an analytical framework based on the complexity of everyday life and technology's role within rituals, routines and social structures (Berker & al., 2006; Selwyn, 2012). Etymologically speaking, 'domestication' refers to taming something that is wild and is related to how people adapt and translate technology and content to their homes. The point of departure for the domestication perspective is the view that seeing technology as simply functional is insufficient. Instead, technology must be understood and interpreted as meaningful and must be integrated into the socio-cultural context of its use in meaningful ways. Specifically, this means that technology will not become functional until it is classified and accepted within a social and cultural order. Since technology is always part of a cultural and social order, it will also be a part of a moral economy.

The term 'domestication' was originally developed to understand the use of technology in people's private homes. One can therefore ask whether this framework is suitable for shedding light on and understanding the use of technology in other social contexts, such as schools, since it is analytically based on the clear distinction between the public and private sphere. However, if we analytically restrict the meaning of the term to 'tame', referring to the processes around adapting and redefining technologies to specific contexts and value orientations, we can open up an analytical understanding of how different media technologies are understood, implemented and translated into different contexts (Berker & al., 2006; Habib & Sønneland, 2010). In using 'domestication' as an analytical lens, we can have a framework for understanding the process of adapting, integrating and redefining technology within the context of schools.

Unlike private homes, schools are considered to belong to the public sphere (for example, in Norway, 91% of primary schools are public). Though schools are either classified as public or private, they are nonetheless all under governmental regulation and have to abide by national curriculums. However, when we move from the institutional level into the actual school buildings and classrooms, we find many of the same characteristics regarding the adaption and use of technologies as those we find within private

homes. Schools have clear perceptions, agreements and rules regarding the kinds of technologies and media content that are suitable or unsuitable. Schools ask similar questions about technology to those asked by the private sphere, such as when it is considered appropriate to use technology, how much time should children spend using digital media, and what kind of content is acceptable according to the values of the private culture. As the awareness and cultural understanding of the private sphere are separated from the public sphere, the rationale for what is considered right or wrong is sometimes even incorporated into the design by several consumer technologies. For example, Apple devices have software for parental controls preinstalled on their iPhones, iPads and Macs. Such controls make sense for parents who want to monitor their children's activity, but they do not make sense when using an Apple device in a business or academic context. Schools are supposed to be a protected environment and are even free from advertising and marketing campaigns, something which is regulated by law in Norway. In addition, there are culturally established norms and regulations that clearly regulate the suitability of different kinds of technology and content. There are also norms and regulations that relate to when and how technology should be applied. These kinds of socially constructed beliefs and attitudes have more in common with the moral economy of private homes than the public sphere or even workplaces.

Based on such a premise, we will be able to better understand how the interpretation, implementation and use of technology take place inside schools as well as how and why most teachers relate to using technology in the classroom. Such normative orientations related to the use of new kinds of technology are very common (Ward, 2006), and thus reveal that the use of technology also represents an expression as well as a value orientation. These kinds of moral orientations regarding the use of technology are, of course, part of people's private lives, but they can also be linked and understood in relation to professional ethics, such as the teaching profession. In order to clarify this argument, I will now present some empirical examples from my own previous research (Engen, Giæver, & Mifsud, 2014; 2018a; 2018b).

5. Designing practices with tablets and wearables

Between 2011 and 2014, two research colleagues and I were involved in a research project focusing on the implementation and use of the iPad in a primary school in Oslo, Norway (Engen & al., 2014; 2018a). Methodologically this study was based on observation. Observations were supplemented by video recording and interviews. The interviews with the pupils were conducted in-situ in order to gain an understanding of the pupils' perspectives of the different activities. Considering that the iPad was released to the consumer market just a year earlier, is it clear that this particular school can be considered an early adopter of this particular kind of technology. The decision to acquire and use the iPad for teaching and learning was, however, made by the school management team, and the teachers had little or no influence. The management's understanding of the iPad was shaped by how it had been advertised as a simple and intuitive device. The management team, therefore, saw no need for formal training on how to implement the device in a pedagogical context. Nevertheless, the teachers were given the opportunity to borrow the iPads during their leisure time and holidays in order to familiarise themselves with the technology. It is important to emphasise that the context in which the teachers' self-learning took place was their own private spheres, and consequently, their understanding of the device was shaped more or less exactly according to the design's intended purpose. When the teachers later introduced the iPad to the pupils, it was solely the teachers' responsibility to understand and translate the technology from the context of being a private consumer to a formal teaching and learning situation at school. Aside from technological guidelines relating to the procedures for installing apps, general maintenance, and charging the iPads overnight, the teachers were left alone in deciding what subjects, teaching activities and apps to use to support the pupils' training. In the early phases of our research, we observed that the pupils were mostly using the iPads for drill exercises using dedicated apps that had a clear gaming factor. Learning activities that included more production-related tasks on the iPad were almost entirely absent. The management, teachers and pupils were obviously facing challenges in converting and translating the technology from a device that was designed and intended for the consumer market and for private use over to a school context. In the early version of the system's software, there was no support for saving and retrieving previous work. The iPad was designed as a personal device and thus had no capacity to support multiple users on the same

device. In terms of domestication, at this early stage of adopting the technology, the management, teachers and pupils' understanding of the iPad was too limited to translate it from the private consumer market to a fully functional domesticated device within a school context. This issue also became evident when we observed how the teaching process with the iPads was organised. During this early phase of our research, we observed that the iPad was mainly used to support activities that can be described as repetitive, fact-based learning, and it was used to a much lesser degree in learning activities centred around reading and writing skills or the learning of concepts. Obviously, the teachers struggled a great deal in determining what kind of technology the iPad represented and how to make it fit into the pedagogical context of a classroom (Engen & al., 2014).

A year later, we con-ducted a follow-up study in order to see if there had been any changes (Engen & al., 2018a). The teach-ers had already made plans for a week-long project in which the pupils were to work in groups to construct and write a fairy tale, using the iPad as an integrated tool to construct the nar-rative. Besides a clear instruction to use the app 'BookCreator' as a tool for producing their fairy tales, the pupils were free to use any of the available features, such as the built-in camera and audio recorder and any other software installed on the iPads.

> Etymologically speaking, 'domestication' refers to taming something that is wild and is related to how people adapt and translate technology and content to their homes. The point of departure for the domestication perspective is the view that seeing technology as simply functional is insufficient.

As researchers, we were present for the five days while the pupils worked on the project as well as one day the following week when the pupils presented their fairy tales and gave each other feedback. During the week-long project of developing a fairy tale, we observed how the iPad, which was originally designed as a personal device to consume content, was not simply used as a tool for producing a multimodal text, but it had also been domesticated and translated into the school context. On the one hand, the tablet functioned as a regulator for interactions by supporting individual contributions to the project, regulating the social organisation of the group(s) and ensuring that each pupil contributed to the story. On the other hand, the tablet also supported group collaboration, allowing the pupils to lay the screen flat so that everyone could take part in the group decisions. The tablet was an unobtrusive tool that mediated interactions, integrated seamlessly with the project and with other tools and brought together several modalities. One can say that the process of domestication had reached a point where the iPad had become fully associated with practices, meanings and other devices. This process has a close associative connection with what Bruno Latour calls 'sociotechnical assemblages' (Latour, 2005).

In the summer of 2015, the same group of researchers initiated a research project on the use of smartwatches in another school in Norway (Engen & al., 2018b). The aim of our research was to examine whether a wearable device could be integrated into a secondary school classroom context. We wanted to gain insight into whether, and how, smartwatches could support learning while also exploring the concerns associated with cyber ethics. Data were collected by video-recorded classroom observations from all lessons during a two-week research period. In addition, field notes were taken from walking around the classroom and observing the pupils. The teacher was also interviewed after the two-week period. Unlike the iPad project, this project was researcher-driven, in that the technology was introduced to the school by the researchers and was withdrawn after the 14 days of the project had ended. At that time, smartwatches with sensors and GPS tracking possibilities were a relatively new device on the consumer market. Besides looking into cross-subject possibilities, such as letting the pupils produce bodily data during their physical education classes and subsequently bringing these data to their mathematics and social studies classes, we also focused our research on privacy issues. Privacy issues were important due to the fact that

the pupils were underage and that this technology differed from mobile devices, as it was unobtrusive, hyper-personal and could measure personal statistics, such as health data. The domestication process of translating a fitness device targeted at the consumer market to a classroom context was not only the responsibility of the teacher but also of us as researchers due to the research design and the experimental character of the study. In planning and preparing the study, one of our main concerns was to protect the pupils' privacy and protect them against marketing campaigns about fitness. We believed that the influence of such campaigns might have caused harm to any pupils who were already suffering from body image problems.

Without going into the practical and technical details, in short, the pupils did not participate in syncing the devices and did not interact with the external repositories on the Internet. The pupils' names and other personal data were anonymised. Of course, this was based on research ethical considerations, but in retrospect, this was also based on the moral economical beliefs that we as researchers had regarding the kinds of technology and features that did and did not belong in a classroom. The teachers also had to unpack the technology and translate it from being a fitness device targeted at the mainstream consumer market to a tool for a professional teaching situation. The experiment with the watches during the period of the project was fully integrated with the ordinary teaching activities and the pedagogical rationale for these arrangements. Integrating a new technological device will always require a focus on the cognitive reality regarding the awareness of the ethical and professional judgements of teachers. In terms of domestication, the process never fully reached the conversion phase within the school context because of the experiment's relatively short time period and because of its strong dependence on the practical and technical support of the research team.

These empirical examples pinpoint and illustrate several issues when it comes to adapting and using digital technology in a school context. First, they tell us that the incorporation and conversion phases for new kinds of technology in a school context are rather long. Both teachers and pupils experienced challenges with learning how to translate and use a technological device intended for the private consumer market to a teaching and learning situation within the framework of a classroom. Second, they illustrate that a teacher's professional digital competencies are about much more than being able to use a specific digital device. Instead, it is more closely related to the ability to reconnect and redefine the relationship between schools and the outside world. Most digital devices and forms of technology are designed and constructed in a 'laboratory' to serve certain functions. The technology designers have specific ideas about the kind of use the device is designed for, which in many cases is not directly aimed at supporting learning activities in schools. However, in schools, it is the teacher who must decide and define the device's application and use. Therefore, it is not hard to understand why teachers sometimes express resistance and scepticism when their cultural expectations and social resources are challenged by technology pushing its way into schools. The process of implementing new technology in teaching and learning practices in schools cannot be predicted or standardised in any detail. The two empirical examples above clearly show that technologies need to be situated both practically and symbolically and emphasises how the process of appropriation, reconfiguration and conversion of digital technology in the classroom is entangled in the normative beliefs and cultural practices. The empirical cases also highlight how teachers and students make sense of and understand technical objects within a concrete contextualized setting. In terms of teachers' professional digital competences, it stresses teachers' abilities in incorporating digital technologies into daily routines, activities and practices in the classroom and converting them into something that has distinct purposes that are fully integrated with the other activities in the classroom. It also sheds light on the teachers' need for competencies in translating and converting technology into an object on its own terms within the framework of a school, as opposed to the outside world. At a broader level, it shows why assumptions that technology unilaterally will determine educational practises, rather than being shaped in interaction with pedagogical practices, is fundamentally wrong.

6. Conclusions

This paper has explored the social and cultural conditions for using digital technologies in schools and teaching, in connection with the kinds of competencies that are required by the teacher. In unpacking these

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issues, two arguments have been highlighted. The first is about the term 'digital competence' in relation to be a professional teacher in the late modern knowledge society. I have argued for a need to move away from understanding the notion of 'digital competence' as general knowledge and skills that are suitable for all situations without reference to any specific domain or context. The term teachers' 'professional digital competence' must be closely linked to situations and concrete uses, and it is thus no longer possible to speak of just one kind of digital competence but rather of several inter-connected digital competencies. I have argued that the decisive competencies that are required by teachers in order to make use of digital technologies to support teaching and learning activities are their ability to translate and reconfigure digital technologies across different domains and contexts. Given the fact that most digital hardware and software technologies are designed for domains and purposes other than supporting classroom activities, there is a need for a kind of reconfiguring or translation process to make technology suitable for the classroom. The cognitive activity of facilitating the use of digital technologies in the classroom must heavily involve the teacher, for several reasons. Teachers' professional digital competence is therefore much more than instrumental skill-based competencies: it requires a conceptual knowledge of the social and cultural aspects of digital technologies' role and transformative potential in the late modern society. It requires an awareness and knowledge of how to use technology in the classroom and, at the same time, how to design practices within a context that (often) has strict normative beliefs and orientations regarding what is and is not appropriate. This represents an understanding of 'competencies' that differs radically from the neoliberal notions and conceptions of knowledge and competencies as being commodities on the labour market. In the discourse around the significance and new role of education in the knowledge society, it is expressed that schools need to adapt to the political, economic and technologic domains of society in order to deliver competencies for the future. The ability of education to adapt to and use digital technology is articulated as decisive in order to fulfil these goals. I have argued that such deterministic understanding of technology fails to understand the uptake of ICT in schools. What policy makers or the commercial industry claim is slow appropriation of technology in school, is instead about the fact that the teacher is having a professional value-oriented approach in order to contextualise the use of technology shaped by emerging pedagogies.

References

Almerich, G., Orellana, N., Suárez-Rodríguez, J., & Díaz-García, I. (2016). Teachers' information and communication technology competences: A structural approach. *Computers & Education*, *100*, 110-125. https://doi.org/10.1016/j.compedu.2016.05.002

Berker, T., Hartmann, M., Punie, Y., & Ward, K.J. (2006). *Domestication of media and technology*. Maidenhead: Open University Press. https://doi.org/10.4324/9781315630397-3

Buckingham, D. (2006). Defining digital literacy – What do young people need to know about digital media? *Nordic Journal of Digital Literacy*, *2006*(4), 263-277. http://bit.ly/2EfsQaF

Caron, A.H., & Caronia, L. (2001). Active users and active objects: The mutual construction of families and communication technologies. *Convergence*, *7*(3), 38-61. https://doi.org/10.1177/135485650100700305

Cuban, L. (2001). *Oversold and underused: Computers in the classroom*. Cambridge: Harvard University Press. https://doi.org/10.1016/s0272-7757

Egea, O.M. (2014). Neoliberalism, education and the integration of ICT in schools. A critical reading. *Technology, Pedagogy and Education*, *23*(2), 267-283. https://doi.org/10.1080/1475939X.2013.810168

Elstad, E., & Christophersen, K.A. (2017). Perceptions of digital competency among student teachers: Contributing to the development of student teachers' instructional self-efficacy in technology-rich classrooms. *Education Sciences*, *7*(1). https://doi.org/10.3390/educsci7010027

Engen, B.K., Giæver, T.H., & Mifsud, L. (2014). Out of the WILD and into the schools: iPads from a domestication perspective. The Society for Information Technology & Teacher Education International Conference. http://bit.ly/2JpiSHQ

Engen, B.K., Giæver, T.H., & Mifsud, L. (2018a). 'It's a fairy tale'; Using tablets for creating composite texts. *Journal of Interactive Learning Research*, *29*(3), 301-321. http://bit.ly/2JpcUqv

Engen, B.K., Giæver, T.H., & Mifsud, L. (2018b). wearable technologies in the k-12 classroom —cross–disciplinary possibilities and privacy pitfalls. *Journal of Interactive Learning Research*, *29*(3), 323-341. http://bit.ly/2Yx0aSb

Friesen, N. (2008). Critical theory: Ideology critique and the myths of e-learning. *Ubiquity*, *2*, 1-13. https://doi.org/10.1145/1403922.1386860

Gudmundsdottir, G.B., & Hatlevik, O.E. (2018). Newly qualified teachers' professional digital competence: Implications for teacher education. *European Journal of Teacher Education*, *41*(2), 214-231. https://doi.org/10.1080/02619768.2017.1416085

Günes, E., & Bahçivan, E. (2018). A mixed research-based model for pre-service science teachers' digital literacy: Responses to 'which beliefs' and 'how and why they interact' questions. *Computers & Education*, *118*, 96-106. https://doi.org/10.1016/j.compedu.2017.11.012

Habib, L., & Sønneland, A.M. (2010). From alien to domestic? Virtual learning environment use from a domestication perspective. *Journal of Online Learning and Teaching*, *6*(4). http://bit.ly/2Jobz3f

Hammond, M. (2014). Introducing ICT in schools in England: Rationale and consequences. *British Journal of Educational Technology*, *45*(2), 191-201. https://doi.org/10.1111/bjet.12033

Ilomäki, L., Paavola, S., Lakkala, M., & Kantosalo, A. (2016). Digital competence - An emergent boundary concept for policy and educational research. *Education and Information Technologies*, *21*(3), 655-679. https://doi.org/10.1007/s10639-014-9346-4

Instefjord, E.J., & Munthe, E. (2017). Educating digitally competent teachers: A study of integration of professional digital competence in teacher education. *Teaching and Teacher Education*, *67*, 37-45. https://doi.org/10.1016/j.tate.2017.05.016

Johannesen, M., Øgrim, L., & Giæver, T.H. (2014). Notion in motion: Teachers' digital competence. *Nordic Journal of Digital Literacy*, *4*, 300-310. http://bit.ly/2Hocoqn

Jurica, J., & Webb, L. (2016). The use of technology in K-12 classrooms. The Society for Information Technology & Teacher Education International Conference. http://bit.ly/2EaMMez

Koltay, T. (2011). The media and the literacies: Media literacy, information literacy, digital literacy. *Media*, *Culture & Society*, *33*(2), 211-221. https://doi.org/10.1177/0163443710393382

Latour, B. (2005). *Reassembling the social: An introduction to actor-network-theory*. Oxford: Oxford University Press. https://doi.org/10.17323/1726-3247-2013-2-73-87

Lund, A., Furberg, A., Bakken, J., & Engelien, K.L. (2014). What does professional digital competence mean in teacher education? *Nordic Journal of Digital Literacy*, *9*(4), 280-298. http://bit.ly/2HrZJ69

McDonagh, A., & McGarr, O. (2015). Technology leadership or technology somnambulism? Exploring the discourse of integration amongst information and communication technology coordinators. *Irish Educational Studies*, *34*(1), 55-68. https://doi.org/10.1080/03323315.2015.1010292

Ministry of Education and Research (Ed.) (2017). Framtid, fornyelse og digitalisering. Digitaliseringsstrategi for grunnopplæringen 2017-2021. http://bit.ly/2LO5nn3

Mishra, P., & Koehler, M.J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record*, *108*(6), 1017-1054. https://doi.org/10.1111/j.1467-9620.2006.00684.x

Muñoz, L., & Sørensen, K. (2015). Consumer, client or citizen? How Norwegian local governments domesticate website technology and configure their users. *Information, Communication and Society*, *18*(7), 733-746. https://doi.org/10.1080/1369118X.2014.993678

Oliver, M. (2011). Technological determinism in educational technology research: Some alternative ways of thinking about the relationship between learning and technology. *Journal of Computer Assisted Learning*, *27*(5), 373-384. https://doi.org/10.1111/j.1365-2729.2011.00406.x

Pettersson, F. (2018). On the issues of digital competence in educational contexts – A review of literature. *Education and Information Technologies*, *23*(3), 1005-1021. https://doi.org/10.1007/s10639-017-9649-3

Selwyn, N. (2010). Looking beyond learning: Notes towards the critical study of educational technology. *Journal of Computer Assisted Learning*, *26*(1), 65-73. https://doi.org/10.1111/j.1365-2729.2009.00338.x

Selwyn, N. (2012). Making sense of young people, education and digital technology: The role of sociological theory. *Oxford Review of Education*, *38*(1), 81-96. https://doi.org/10.1080/03054985.2011.577949

Silverstone, R. (2006). *Domesticating domestication. Reflections on the life of a concept*. Maidenhead: Open University Press. https://doi.org/10.4324/9780203401491

Silverstone, R., & Hirsch, E. (1992). *Consuming technologies: Media and information in domestic spaces*. London: Routledge. https://doi.org/10.4324/9780203401491

Tapscott, D., & Williams, A.D. (2006). *Wikinomics: How mass collaboration changes everything*. New York: Portfolio. https://doi.org/10.1111/j.1468-0270.2008.864_2.x

Wachira, P., & Keengwe, J. (2011). technology integration barriers: Urban school mathematics teacher's perspectives. *Journal of Science Education and Technology*, *20*(1), 17-25. https://doi.org/10.1007/s10956-010-9230-y

Ward, K. (2006). *The bald guy just ate an orange. Domestication work and home*. Maidenhead: Open University Press.

Winner, L. (2009). Information Technology and educational amnesia. *Policy Futures in Education*, *7*(6), 587-591. https://doi.org/10.2304/pfie.2009.7.6.587

The development of the digital teaching competence from a sociocultural approach

El desarrollo de la competencia digital docente desde un enfoque sociocultural

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ABSTRACT

Many Nowadays, digital teaching competence transcends the individual training of teachers in ICT. The European framework DigCompEdu, highlights that teachers must train students in the application of digital technologies in a critical and responsible way, in terms of information, communication, content generation, wellbeing and problem solving. Despite the good intentions to systematize a common model of development of digital competence, it is detected that the proposals lack a pedagogical approach that serves as a theoretical framework for them. This paper proposes a development model of the digital teaching competence based on the sociocultural approach through four constructs: Command, Preference, Reintegration and Appropriation. For this study, an ad hoc scale is created to record the digital teaching competence through the development of this in their students and empirical evidences are provided. A survey type design is proposed. The sample consists of 1,881 students of compulsory education in Andalusia (Spain). SPSS is used to analyse data. The average general results for each of the dimensions studied reveal a medium level of development of digital competence. It is concluded that there is still too much to be done in terms of teacher training in ICT, being necessary to provide them strategies for the development of this in their students.

RESUMEN

En la actualidad, la competencia digital docente trasciende de la formación individual del profesorado en materia TIC. El marco europeo DigCompEdu incide en que el profesorado tiene que capacitar al alumnado en la aplicación de las tecnologías digitales de forma crítica y responsable en cuanto a información, comunicación, generación de contenido, bienestar y resolución de problemas. Pese a las buenas intenciones para sistematizar un modelo común de desarrollo de la competencia digital, se detecta que las propuestas carecen de un enfoque pedagógico que sirva de base teórica de los mismos. Este trabajo propone un modelo de desarrollo de la competencia digital docente basado en el enfoque sociocultural mediante cuatro constructos: Dominio, Preferencia, Reintegración y Apropiación. Para ello, se elaboró una escala ad hoc para registrar la competencia digital docente a través del desarrollo de esta en sus estudiantes, aportando evidencias empíricas. Se plantea un diseño de tipo cuestionario. La muestra se compone de 1.881 estudiantes de educación obligatoria de Andalucía. Para el análisis de datos se utilizó SPSS. Los resultados promedios generales por cada una de las dimensiones estudiadas revelan un nivel medio de desarrollo de la competencia digital. Se concluye que aún existe mucho por hacer en cuanto a la formación del profesorado en materia TIC, siendo necesario facilitarles estrategias para el desarrollo de esta en sus estudiantes.

KEYWORDS | PALABRAS CLAVE

Digital competence, teachers, sociocultural approach, ICT, education, training, students, survey.
Competencia digital, profesorado, enfoque sociocultural, TIC, educación, formación, estudiantes, encuesta.

1. Introduction and state of the art

In recent years, a paradigm shift has occurred in the understanding of what it means to be a teacher with a high level of digital competence. Nowadays, it is no longer the one who uses the technologies best or has the most knowledge of them, but rather one who is able to take advantage of this background for the development of his/her own students' digital competence. This is, in our view, the novelest contribution of the "European framework for the digital competence of educators. DigCompEdu" (Redecker, 2017). Under this view, teachers, through their practice and intervention in the classroom, become key players responsible for the overall development of their students, both personally and professionally, in a cultural scenario dominated by digital technologies. By analyzing the scientific literature on digital competence development models, this evolution can be observed (Ferrari, 2013; INTEF, 2017a; Carretero, Vuorikari, & Punie, 2017; Redecker, 2017). From the first moment, where importance was placed on the particular training of teachers to now, where the development of teachers' digital competence is expected to go further, achieving its development and transfer among their students.

In this sense, two proposals are particularly important and worthy of mention. On is the Common Framework of Digital Competence for Teachers (INTEF, 2017a) developed within the School's Digital Culture Plan by the National Institute of Educational Technologies and Teacher Training (INTEF for its Spanish initials) of Spain, which is articulated through major proposals of international teaching frameworks, such as those by UNESCO (2008) and ISTE (2008). There is also the European DigCompEdu framework, drawn up by the Joint Research Centre (JRC) of the European Commission, which has precedents for several European projects, such as the "DigEULit: A European framework for digital literacy" (Martin & Grudzlecki, 2006) and the "DIGCOMP: A framework for developing and understanding digital competence in Europe" (Ala-Mutka, 2011; Ferrari, 2013). Considering both proposals and the key areas on which they are structured, it can be observed that the European proposal, DigCompEdu (Redecker, 2017), contains many of the findings of the Spanish proposal, which could be considered as an evolution and natural continuation of the latter (Table 1). The main advance lies in the last points of the European model, in which teachers are seen as capable of empowering their students through the development of students' digital competence while focusing on subjective aspects, such as student well-being. However, and despite good intentions to systematize a common model for the development of digital competence in a measurable way, in both cases, these proposals lack an underlying pedagogical approach as their theoretical basis.

Table 1. Areas of teachers' digital competence development proposed by INTEF and DigCompEdu		
INTEF		**DigCompEdu**
Information and information literacy	1	Professional commitment
Communication and collaboration	2	Digital Resources
Digital content creation	3	Teaching and learning
Safety	4	Assessment
Problem solving	5	Student Empowerment
-	6	Enabling students' digital competence

Based on the foregoing, this study aims to propose a model for the development of teachers' digital competence based on the Vygotskian sociocultural approach. Specifically, a proposal will be developed for indicators to record whether teachers are succeeding in enabling the development of their students' digital competence, which corresponds to the sixth and final development area proposed by the DigCompEdu framework (Redecker, 2017). This contribution is interesting, in line with the Erasmus+ project "Developing ICT in Teacher Education" (DiCTE, 2017), since, in order to propose different teacher training programs or plans for the development of digital competence, these must be based on a theoretical pedagogical model or approach. We understand that the sociocultural approach, due to its particular characteristics and constructs, is an ideal frame of reference to generate items that measure the impact of teachers' digital competence development through its development in their students.

1.1. The evolution of teachers' digital competence

In the first decade of the 21st century, international organizations, such as UNESCO (2008) and the International Society for Technology in Education (ISTE, 2008), developed ICT competence standards for teachers, which marked the beginning of an exploration of models for the development of digital competence in teachers. In Spain, the ideas proposed by these sources are included in the project "Common Framework of Digital Competence for Teachers" (INTEF, 2017b). This framework is also influenced by two models of compression of digital competence: The European project DIGCOMP and the one developed by the Basque Government's Department of Education (2012), which sought to develop a theoretical framework for the conceptualization of digital competence. Broadly speaking, this proposal, developed by INTEF, was intended to provide a descriptive framework to guide both the training and assessment processes of digital competence. This model is linked to reductionist approaches to digital competence (Van-Deursen & Van-Dijk, 2009), since this competence is broken down into basic technical skills in the use of technology (Søby, 2013) and into formal skills that allow subjects to improve their personal and/or social development, offering them divergent opportunities (Kwan, 2001; Correia & Teixeira, 2003).

This conception was systematized in the DIGCOMP project for the creation of a model for the "Common European Framework of Digital Competence", in which the levels of acquisition of competence development range from a technical and instrumental command, to deep levels of development where other skills and advanced knowledge are incorporated, as well as attitudes linked to the use of digital technologies (Ferrari, 2012), conceived strictly from an internal and individual perspective, focused on teaching staff. However, in recent years, the development of digital competence has involved going beyond the particular knowledge, skills and attitudes that teachers must develop for individual improvement, requiring them to develop the digital competence of their students. In other words, the proposal is to move from individual teacher empowerment in a technological world to proposals for transferring the development of competence to students. This is where the European framework DigCompEdu (Redecker, 2017) is situated, indicating that teachers need to enable students to apply digital technologies critically and responsibly in terms of information, communication, content generation, well-being and problem solving. The inclusion of this facet in the development of teaching competence implies a conception of digital competencies as transforming and empowering skills. Recent studies, aligned with the research line on new literacies (New Literacies Studies), advocate, from sociocultural approaches, a conception of digital competence that contemplates subjective aspects (Area & Ribeiro, 2012; Van-Deursen & Van-Dijk, 2016; De-Pablos, Colás, Conde, & Reyes, 2017). In this line, Van-Deursen & Van-Dijk (2016) conclude that, through communicative skills and content creation, subjects can transfer their own competencies in an expansive way. Teachers must therefore be able to generate educational interventions in their praxis to transform their students through the development of digital competence.

Once the previous points have been laid out, it is troubling that, from an educational standpoint, no theoretical support has been provided to the approaches developed. In other words, a gap has been identified in terms of the pedagogical basis for these proposals. However, in order to establish educational training suggestions for the development of this competence, it would be advisable that these be developed on a theoretical pedagogical framework. In the following section, the sociocultural approach is discussed as a possible solution to the identified deficiencies.

1.2. The sociocultural approach as a framework for the development of digital competence

As mentioned earlier, the DigCompEdu framework (Redecker, 2017) states that teachers must train students to apply digital technologies through their teaching-learning praxis. For the sociocultural approach, learning is an interactive process between the subject and the context, understanding both the social and cultural aspects. These coordinates fit with the approaches introduced by the DigCompEdu framework, which promotes a phenomenon of transfer of digital competence development from teacher to student. It is precisely through social interaction that the teacher has the capacity to generate the ideal setting for technological learning. According to this, the teacher becomes a key element for the development of students' digital competence. The actions of teachers in classrooms (inter-psychological plane, external to

subjects) modify their students (intra-psychological plane, internal to subjects). For Martínez (1999), the internalization, meaning the reconstruction of an inter-psychological operation in an intra-psychological one, should not be understood as a reproduction of the social behaviors that occur in the environment, but rather it implies transformations in structures and learning that are internalized. Therefore, from the uses and applications made by teachers due to their level of digital competence, students will internalize methods of digital competence development. In this way, ICTs are conceived as artifacts or mediating tools located between the inter- and intra-psychological processes created in the teaching-learning processes (Onrubia, 2005; Coll, Rochera & Colomina, 2010), so it is up to teachers, depending on their own level of digital competence, to offer different training opportunities that allow their learners to increase their potential to develop and become active agents in society. From this perspective, the construct of agentiality (Zinchenko, 1985), also makes sense, as the capacity that people have to carry out actions after the influence of their different referents (Giddens & Turner, 1990). Establishing a connection between the sociocultural Vygotskian approach and the theory of activity (Leontiev, 1978), considered as the evolution of one's own approach (De-Pablos, 2006), the observation of the activities that are carried out in classrooms becomes a key indicator to analyze the internal development of subjects. Therefore, through the analysis of manifest and explicit actions related to the digital uses and applications proposed by teachers in the classroom, it would be possible to record the levels of digital competence development for both teachers and students (Conde, 2017).

After exposing the coordinates through which new trends in teachers' digital competence connect to the sociocultural approach, in the following part, a theoretical model is presented to enable the assessment of the development of the aforementioned competence. This model intends to set the theoretical basis to generate indicators that assess whether teachers enable the development of digital competence in their students through daily ICT activity in the classroom. This is done using four constructs derived from the sociocultural approach, specifically: Command, Preference, Reintegration and Appropriation.

1.3. Sociocultural model for the development of teachers' digital competence

Firstly, for the development of digital competence at an instrumental level, the Command construct is of special interest, alluding to the frequent practices carried out by people through mediating instruments as a consequence of their adaptation to the contexts in which they develop (De-Pablos, 2006). Within this level, basic instrumental skills would be found, such as access to or operation of ICTs at the user level (Colás, Rodríguez, & Jiménez, 2005). Therefore, in order to ensure the development of digital competence at the instrumental level, teachers need to include in their teaching, practice activities that enable their students to use digital tools at a basic and technical level.

Secondly, on a strategic and operational level linked to the activation of digital competence for problem solving, the constructs of Preference and Reintegration emerge. Preference is linked to those situations where subjects prefer to use digital resources, as opposed to other solutions, when giving answers to daily problems (Colás, Rodríguez, & Jiménez, 2005). For Wertsch (1994), this reveals a subjective and implicit process of decision making that evidences the level of internalization of competence, considering technological tools as the most appropriate. In this sense, in order for students to prioritize the use of ICT tools in the classroom, teachers have to generate scenarios in which the use of such tools is required until students spontaneously activate their choice. This level also includes the development of skills and strategies that allow subjects to establish new uses, spaces and practices through ICT. This manifestation is clearly divergent from the technologies. Here lies the sociocultural construct of Reintegration, which refers to the transfer of valid cultural artefacts from one context to another, completely different scenario (De-Pablos, 2006). This involves a more complex process than that of Preference, as it implies the ability to expand individual and social capital through technologies. In this sense, teachers have to activate their ability to innovate and design activities where their students are able to implement their digital competence to perform tasks beyond the context where they have developed or learned, transferring them to their environment and, ultimately, generating social impact.

Finally, at an even more expansive level of digital competence, Appropriation is found. It is associated to the activity of subjects when they go beyond dominating a practice, making it their own; internalizing it

and making it part of themselves (Bajtín, 1981; Wertsch, 1994). At this level, subjects have appropriated the digital culture by assuming its rules, identifying its characteristics and being part of it. Therefore, competence goes beyond the instrumental and requires skills that manifest the interpretation they make of reality through ICT, constructing its meaning and internalizing its narratives. Thus, in order to ensure that students appropriate the digital culture, teachers must generate training scenarios in which technologies are naturally included, and emotional aspects such as the well-being of students within ICT learning environments become especially significant.

Next (Figure 1), the theoretical model for the development of digital competence in students, proposed by teachers from a sociocultural perspective, is presented graphically, detailing the constructs that operationalize it. Now that this model, based on sociocultural approach constructs, has been proposed to articulate the development of digital competence, it is necessary to transfer it to practice and empirically record levels of digital competence based on the ability of teachers, through their teaching practice, to develop this competence in their students.

Figure 1. Model for the development of digital competencies based on the sociocultural approach
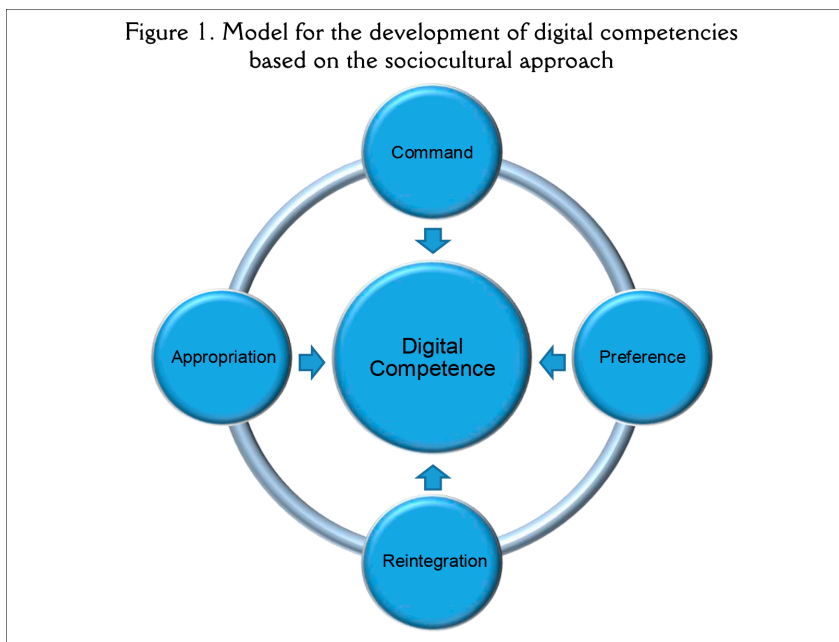
2. Materials y methods

2.1. Objectives

This study sets out the following objectives:
- To formulate a scale to assess teachers' digital competence through its development in their students from a theoretical model based on the sociocultural approach
- To ascertain the levels of teachers' digital competence development through empirical evidence from the students' viewpoint.

2.2. Method

This quantitative study is non-experimental, ex post facto and cross-sectional in nature. According to Ala-Mutka (2011), survey methods and, specifically, questionnaires, are ideal tools for providing information on the digital uses, knowledge, perceptions and opinions of subjects. In addition, leading agencies such as Eurostat and Ofcom use these data collection techniques when assessing subjects' digital skills. Therefore, a survey design with an ad hoc scale containing subjective perceptions of the students was used in order to approach the proposed scientific objectives.

Table 2. Data collection scale and central tendency descriptive statistics						
Construct	Item	$\bar{x}$	s	s^2	Min.	Max
Command	I do schoolwork assigned to be done with the computer without problems	4.00	1.24	1.54	1	5
	I know how technologies work, and I also use them to do my homework	3.48	1.40	1.96	1	5
	When I can, I do homework assignments on my computer	3.00	1.57	2.46	1	5
	I am familiar with the legal and ethical aspects of computers and the Internet	3.06	1.57	2.46	1	5
	I am familiar with and use basic computer equipment	3.82	1.45	2.11	1	5
	I access and use different digital platforms (Moodle, Helvia, etc.)	2.41	1.55	2.39	1	5
	I often use computers or tablets with my group of friends or classmates	3.13	1.49	2.22	1	5
	I find interesting things on the Internet for learning school content	3.25	1.38	1.90	1	5
Preference	In class we are assigned tasks that I would do better with a computer	3.18	1.49	2.22	1	5
	In class I have felt the need to use the computer to work, even when the teacher does not pose the activity to use computers	2.74	1.52	2.33	1	5
	I learned things at school that I wouldn't be able to do without a computer now	2.83	1.54	2.36	1	5
	For me, digital resources have as much value as non-digital resources	2.92	1.53	2.34	1	5
Reintegration	I use the Internet in very different ways to do things that interest me	3.79	1.37	1.88	1	5
	I need the Internet to do things, even if I am not asked to do them with it	3.07	1.52	2.31	1	5
	I use the computer to do things no one has ever taught me	3.19	1.59	2.52	1	5
	Although no one has taught me, I could use the computer to do classwork more easily	3.38	1.49	2.22	1	5
	I would know how to use the computer and the Internet to learn much more than I learn	3.55	1.41	2.00	1	5
Appropriation	When I use digital technologies in the classroom:					
	I am curious about the new things I learn	3.88	1.25	1.55	1	5
	I feel more support from my teachers	3.12	1.43	2.06	1	5
	I take pride in the things I do	3.81	1.31	1.72	1	5
	I have greater confidence in myself	3.45	1.40	1.96	1	5
	I feel well	3.64	1.34	1.80	1	5
	I have greater confidence. I do not feel as nervous	3.21	1.49	2.22	1	5
	I have fun. I am less bored with the things we do	3.52	1.46	2.13	1	5
	If I were not allowed to use technologies, I would feel very dissatisfied	3.21	1.56	2.42	1	5
	I notice that we, the students, are better friends	2.82	1.48	2.18	1	5
	Overall, I appreciate the diversity of things the Internet has to offer	3.50	1.43	2.05	1	5

2.3. Sample

The sample in this study was comprised of a total of 1,881 compulsory education students in the Autonomous Community of Andalusia. Following simple random sampling criteria for infinite samples (populations greater than 100,000 subjects), this sample is statistically significant with a confidence level of 99.7% (3σ), where the estimated values of p and q (probabilities with which the phenomenon occurs)

are 1% and 99%, with a margin of error of ±0.68% . In addition, and in order to obtain a sample that is as representative as possible, purposive sampling was conducted, selecting subjects immersed in schools with teachers who have a long history in the use and application of ICTs (more than 10 years). Therefore, the participants belong to sample units that were selected on a non-random basis, but according to characteristics relevant to the study (Hernández, Fernández, & Baptista, 2003). As for the sociodemographic data of the sample, the average age of the student body is 12 years (s=2.2), with an age range between 7 and 17 years. In terms of gender, the sample is balanced, with 51% male and 49% female. A similar proportion is maintained with respect to educational level, with 47% enrolled in Primary Education and 53% in Secondary Education.

2.4. Instrument

In order to collect data that respond to the proposed objectives, an ad hoc scale was prepared with the intention of ascertaining the levels of development of teachers' digital competence through empirical evidence of its progress in the student body.

This was designed taking as a reference the four constructs of the sociocultural approach proposed in the theoretical section: Command, Preference, Reintegration and Appropriation. A Likert scale was designed (from 1 to 5, in which 1=Never, 2=Rarely, 3=Sometimes, 4=Often and 5=Always), made up of four dimensions with a total of 27 items that inquire about the knowledge, skills, abilities, attitudes and emotions of students derived from classroom teaching practices in which they are using digital technologies (Table 2). Thus, from the students' perception, empirical evidence is obtained from the development of teachers' digital competence in educational contexts.

In order to guarantee the validity of the instrument's content, in the first stage, an expert validation was performed. Additionally, in order to guarantee the cognitive validity of the questionnaires, i.e. for students to understand the meaning of the items that make up the scale, data were collected in person so that a researcher could explain and clarify each of them. This was fundamental for the students at the Primary Education level. The global questionnaire had good reliability or internal consistency, given that it obtained a Cronbach's Alpha (α) of .892. If a reliability analysis is performed for each sociocultural theoretical construct, for Command, an α=.714 was obtained; for Preference, α=.789; for Reintegration, α=.771; and, finally, for Appropriation, α=.812.

2.5. Data analysis

For data analysis, statistical techniques describing frequencies (%) and central trends (mean, maximum and minimum, standard deviation and variance) were used. The statistical package SPSS v. 24 was used for processing quantitative data.

3. Analysis and results

Results are structured according to the objectives set out in the study. In the previous section, where the data collection instrument is presented, an account is given of the results obtained in connection to the first objective of this work, consisting of the preparation of a scale that enables the recording of the development of teachers' digital competence through the development of this competence in their students from theoretical constructs derived from the sociocultural approach: Command, Preference, Reintegration and Appropriation (Table 2). The construction of this scale allows its applicability to other studies on the development of digital competencies in school classrooms. As for the second objective, about ascertaining levels of development of teachers' digital competence through empirical evidence from the students' point of view, the descriptive results incorporated in Table 2 reveal that most of the average scores are around 3, the mean value of the scale.

At the instrumental level, where the construct of Command is located, it is worth noting that the item that obtained the highest average score is "I do schoolwork assigned to be done with the computer without problems" ($\overline{X}$=4, see Table 2), which indicates that the completion of the digital activities proposed in the classroom is quite manageable for the learners.

On the opposing side is the item "I access and use different digital platforms" ($\overline{X}$=2.41 see Table 2 so it appears that the use of platforms such as moodle or Helvia is unusual in classrooms. If we look at

Figure 2, the data reveal that more than half of the students recognize that, with a frequency of "often" and "always", they know and use basic computer equipment in their schools, they know how the technologies work, they apply them to their homework, and they complete their homework without problems.

Figure 2. Level of development of digital competence linked to the Command construct in percentage
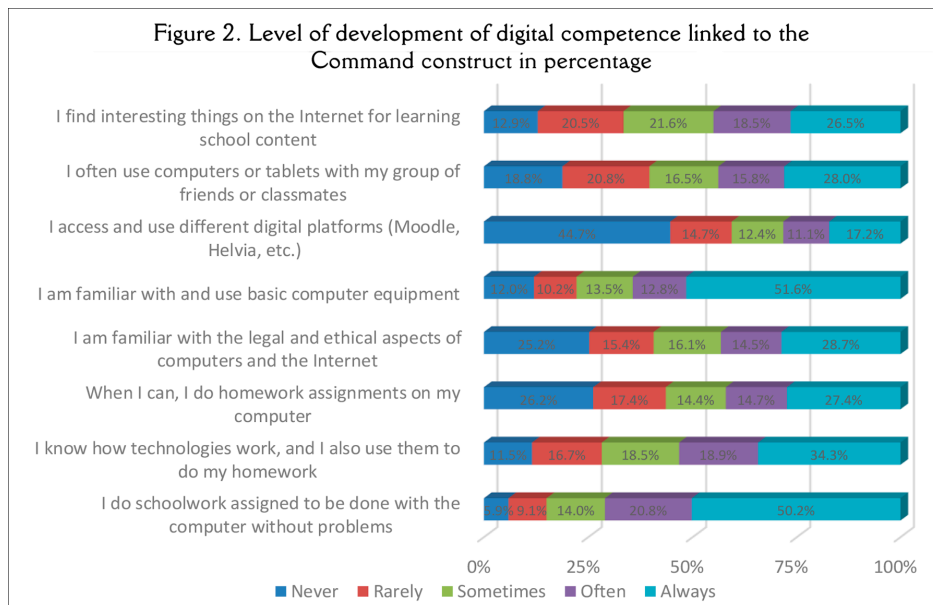
Secondly, on a strategic level, broadly speaking, students display a medium-low Preference for the utilization of digital tools (see Table 2). The average score obtained in the item "In class I have felt the need to use the computer to work, even when the teacher does not pose the activity to use computers" ($\overline{X}$=2.74), exemplifies this trend: students sometimes have this need, but it is not very frequent. Figure 3 below shows how the distribution of students in the items linked to this construct is quite similar in the intermediate values ("rarely", "sometimes" and "often") while the majority are accumulated in the extremes (around 50% of the students), 25% in "never" and the other 25% in "always". This polarization would indicate that there are teachers who strongly promote this prioritization of digital resources in their teaching practice and others who do not.

Figure 3. Level of development of digital competence linked to the construct of Preference in percentage
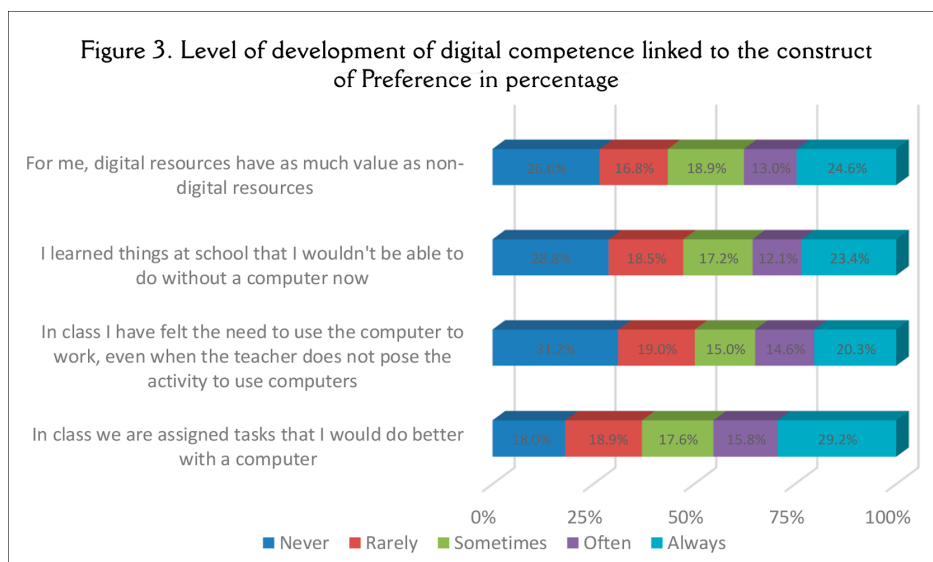
At this same level, in terms of Reintegration, although the averages are at an intermediate value, more positive values are obtained (Table 2). The "I use the Internet in very different ways to do things that interest me", with an average near 4 ($\overline{X}$=3.79), affirms that working with interesting content allows students to use the Internet operationally to do new and divergent things.

Figure 4. Level of development of digital competence linked to the Reintegration construct in percentage
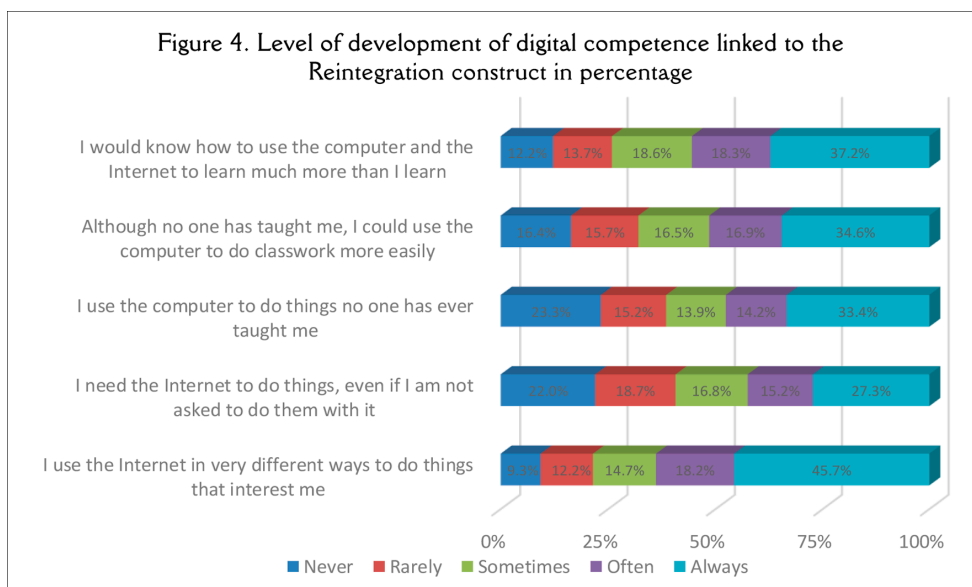
Based on an analysis of frequencies in %, in Figure 4, this positive trend can be confirmed since the majority of the students, around 70%, are somewhere between the mean value of the scale ("sometimes") and the most positive values ("often" and "always"). It could be argued that teachers offer their students opportunities for the development of digital competence in its most creative and free facet.

Figure 5. Level of digital competence development linked to the Appropiation construct in percentage
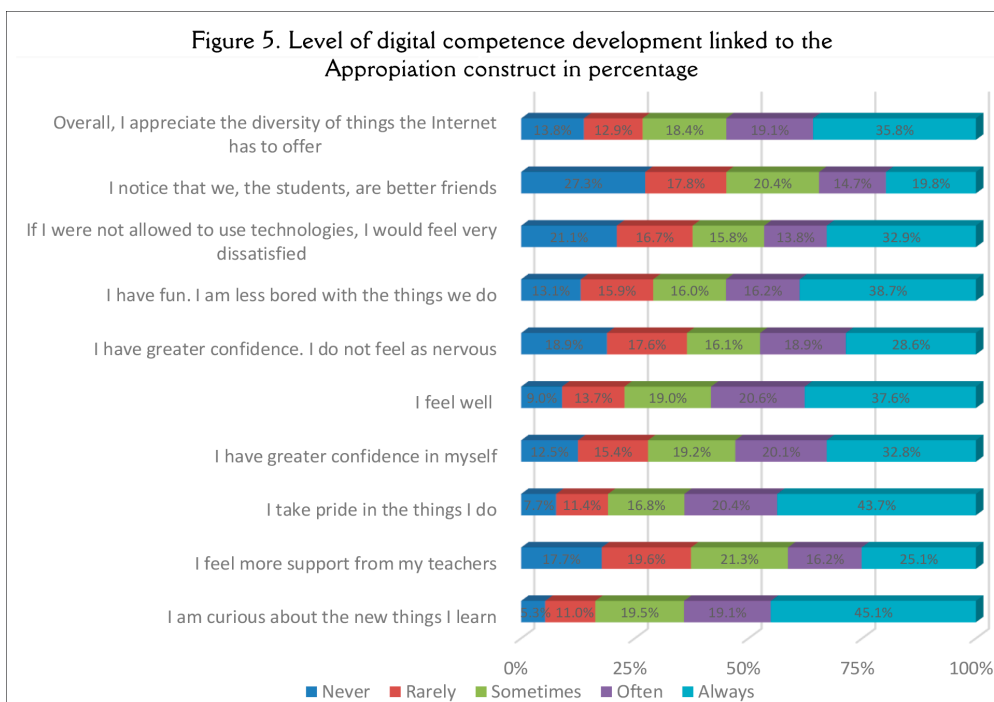
Finally, at the expansive level, there is a medium-high trend in the average scores obtained (Table 2). Thus, with regard to Appropriation, students seem to reveal that the teaching practices proposed by teachers have a positive effect on their inclusion in the digital culture. Only, the item "I notice that we, the students, are better friends" ($\overline{X}=2.82$), obtains an average score of less than 3, which would indicate that schoolwork with ICT does little to favor the cohesion of the class group and, perhaps, enhances a more individual dimension. That is to say, through the didactic interventions by teachers, the development of their students' digital competence is activated at an intermediate level. To complement these central trend statistics, Figure 5 below also shows a positive trend. As it was in the case of Reintegration, in most of the items almost 70% of the students are grouped in the mid and high values of the scale. Only the item with the lowest average score is the exception to this trend. In this way, in general, it could be said that teaching practices encourage students to develop a positive emotional state in learning environments in which ICTs are present.

4. Discussion and conclusions

This study highlights how, at present, teachers' digital competence transcends beyond the individual teacher training in ICT, requiring the development of teaching practices that generate it in students. The European DigCompEdu framework (Redecker, 2017) emphasizes in particular the need for teachers to enable students to use digital technologies critically and responsibly in terms of information, communication, content generation, well-being and problem solving. Thus, special importance is given to teacher mediation to generate interactive practices with digital technologies in order to develop their students personally, professionally and socially (Martin & Grudziecki, 2006; Van-Deursen & Van-Dijk, 2016). These ideas are associated with other authors who emphasize that teachers' digital competence would have to go beyond an individual teacher's conception and manifest its agentiality through their students' empowerment (Castañeda, Esteve & Adell, 2018). This is where the Erasmus+ project "Developing ICT in Teacher Education" is situated, seeking to explore the training dimensions of teachers for the development of their digital competence. However, despite the good intentions to systematize a common model for the development of digital competence in a measurable way (Carretero, Vuorikari, & Punie, 2017; Redecker & Johannessen, 2013), these proposals lack an underlying pedagogical approach as their theoretical basis.

This work illustrates how the sociocultural approach can be an ideal pedagogical theoretical approach that serves as an underlying basis for the generation of innovative models for the development of teachers' digital competence due to the transfer and operationalization potential of its constructs. Addressing the first objective of this study, a reliable scale has been designed to empirically assess levels of development of teachers' digital competence by implementing different sociocultural constructs such as Command, Preference, Reintegration and Appropriation.

As for the second objective, the results of the study shed light on the level of development of teachers' digital competence in terms of the capacity of teachers to generate this competence in their students. Based on the results obtained, it is concluded that teachers, through their educational praxis, develop the digital competence of their students at an intermediate level. This suggests that there is still much to be done in terms of teacher training in ICT, and that strategies that enable them to create more opportunities for the development of digital competence in their students need to be provided.

As limitations to the study, due to the innovative nature of this proposal, it should be noted that the application of the sociocultural approach to the development of area 6 of the European DigCompEdu framework has been developed (Table 1). In this sense, and prospectively, it would be interesting to delve into the other areas of the framework in order to fully operationalize it from the sociocultural approach. In addition, it is considered that the generation of items to record the development of the digital competence lends itself to greater debugging, deepening, transfer, etc., in future research. Finally, by way of foresight, the proposal is to continue researching this issue from the point of view of the teachers themselves, as well as to conduct other exploratory lines of a more qualitative nature in order to contrast these results in a more profound and comprehensive manner.

Funding Agency

References

Ala-Mutka, K. (2011). *Mapping digital competence: Towards a conceptual understanding*. Luxembourg: JRC-IPTS. https://bit.ly/1p477BJ

Area, M., & Ribeiro, T. (2012). De lo sólido a lo líquido: Las nuevas alfabetizaciones ante los cambios culturales de la Web 2.0. [From solid to liquid: New literacies to the cultural changes of web 2.0]. *Comunicar*, *38*, 13-20. https://doi.org/10.3916/C38-2012-02-01

Bajtín, M. (1981). *Estética de la creación verbal*. México: Siglo XXI.

Carretero, S., Vuorikari, R., & Punie, Y. (2017). DigComp 2.1: The digital competence framework for citizens with eight proficiency levels and examples of use. https://bit.ly/2pGtGII

Castañeda, L., Esteve, F., & Adell, J. (2018). ¿Por qué es necesario repensar la competencia docente para el mundo digital? *Revista de Educación a Distancia*, *56*, 1-20. https://doi.org/10.6018/red/56/6

Colás, P., Rodríguez, M., & Jiménez, R. (2005). Evaluación de e-learning. Indicadores de calidad desde el enfoque sociocultural. *Teoría de la Educación*, *6*(2). https://bit.ly/2NAGWH1

Coll, C., Rochera, M.J., & Colomina, R. (2010). Usos situados de las TIC y mediación de la actividad conjunta en una secuencia instruccional de educación primaria. *Electronic Journal of Research in Educational Psychology*, *8*(21), 517-540. https://doi.org/10.25115/ejrep.v8i21.1384

Conde, J. (2017). *La mediación de las TIC en la creación de ambientes de aprendizaje y el logro de competencias digitales. Tesis Doctoral*. Sevilla: Universidad de Sevilla. https://bit.ly/2BX87ae

Correia, A.M.R., & Teixeira, J.C. (2003). Information literacy: An integrated concept for a safer Internet. *Online Information Review*, *27*(5), 311-320. https://doi.org/10.1108/14684520310502261

De Pablos, J. (2006). El marco del impacto de las tecnologías de la información. Herramientas conceptuales para interpretar la mediación tecnológica educativa. *Telos*, *67*, 68-74. https://bit.ly/2ED8Hf8

De-Pablos, J., Colás, P., Conde, J., & Reyes, S. (2017). La competencia digital de los estudiantes de educación no universitaria: variables predictivas. *Bordón*, *69*(1), 169-188. https://doi.org/10.13042/Bordon.2016.48594

Departamento de Educación del Gobierno Vasco (Ed.) (2012). Competencia en el tratamiento de la información y competencia digital. Marco Teórico. https://bit.ly/2TrJYCGT

DiCTE (Ed.) (2017). About DiCTE project. Developing ICT in teacher education. https://bit.ly/2TkTVlp

Ferrari, A. (2012). *Digital competence in practice: An analysis of frameworks*. Sevilla: JRC-IPTS. https://doi.org/10.2791/82116

Ferrari, A. (2013). *DIGCOMP: A framework for developing and understanding digital competence in Europe*. Sevilla: JRC-IPTS. https://doi.org/10.2788/52966

Giddens, A., & Turner, J. (1990). *La teoría social hoy*. Madrid: Alianza.

Hernández, R., Fernández, C., & Baptista, P. (2003). *Metodología de la investigación*. México: McGraw-Hill.

INTEF (Ed.) (2017a). *Marco Común de Competencia Digital Docente*. Madrid: Ministerio de Educación, Cultura y Deporte. https://bit.ly/2jqkssz

INTEF (Ed.) (2017b). Comparativa Marco Competencia Digital Docente y Marco Europeo: DigCompEdu. https://bit.ly/2EvmymL

ISTE (Ed.) (2008). NETS for teachers: National educational technology standards for teachers. https://bit.ly/2UaLExK

Kwan, M. (2001). Cyberspatial cognition and individual access to information: The behavioral foundation of cybergeography. *Environment and Planning B*, *28*, 21-37. https://doi.org/10.1068/b256

Leontiev, A. (1978). *Activity, conciousness and personality*. Englewood: Prentice Hall.

Martin, A., & Grudziecki, J. (2006). DigEuLit: Concepts and tools for digital literacy development. *Innovations in Teaching & Learning in Information & Computer Sciences*, *5*(4), 246-264. https://doi.org/10.11120/ital.2006.05040249

Martínez, M. (1999). The sociocultural focus in the education and development. *Revista Electrónica de Investigación Educativa*, *1*(1), 16-36. https://bit.ly/2IJ0r1d

Onrubia, J. (2005). Aprender y enseñar en entornos virtuales: actividad conjunta, ayuda pedagógica y construcción del conocimiento. *Revista de Educación a Distancia*, *2*, 1-12. https://doi.org/10.6018/red/50/3

Redecker, C. (2017). *European framework for the Digital Competence of Educators: DigCompEdu*. Luxembourg: EU Publications. https://doi.org/10.2760/159770

Redecker, C., & Johannessen, O. (2013). Changing assessment - Towards a new assessment paradigm using ICT. *European Journal of Education*, *48*(1), 79-96. https://doi.org/10.1111/ejed.12018

Søby, M. (2013). Learning to be: Developing and understanding digital competence. *Nordic Journal of Digital Literacy*, *8*(3), 135-138. https://bit.ly/2ThuTUr

UNESCO (Ed.) (2008). ICT competency standard for teachers. https://bit.ly/2TsJsER

Van-Deursen, A., & Van-Dijk, J. (2009). Using the Internet: Skill related problems in users' online behavior. Interacting with. *Computers*, *21*(6), 393-402. https://doi.org/10.1016/j.intcom.2009.06.005

Van-Deursen, A., & Van-Dijk, J. (2016). Modeling traditional literacy, Internet skills and internet usage: An empirical study. *Interacting with Computers*, *28*(1), 13-26. https://doi.org/10.1093/iwc/iwu027

Wertsch, J.V. (1994). The primacy of mediated action in sociocultural studies. *Mind, Culture and Activity*, *1*(4), 202-208. https://bit.ly/2UkuBco

Zinchenko, V.P. (1985). Vygotsky's ideas about units for the analysis of mind. In Wertsch, J.V. (Ed.), *Culture, communication and cognition: Vygotskian perspectives* (pp. 94-118). New York: Cambridge University Press.

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Teacher's digital competence among final year Pedagogy students in Chile and Uruguay

Competencia digital docente en estudiantes de último año de Pedagogía de Chile y Uruguay

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ABSTRACT

The development of Teacher's Digital Competence (TDC) should start in initial teacher training, and continue throughout the following years of practice. All this with the purpose of using Digital Technologies (DT) to improve teaching and professional development. This paper presents a study focused on the diagnosis of TDC among ITT senior students from Chile and Uruguay. A quantitative methodology, with a representative sample of 568 students (N=273 from Chile and N=295 from Uruguay) was designed and implemented. TDC was also studied and discussed in relation to gender and educational level. Results showed a mostly basic level for the four dimensions of the TDC in the sample. Regarding the relationship between the variables and the TDC, the planning, organization and management of spaces and technological resources' dimension is the only one showing significant differences. In particular, male students achieved a higher TDC level compared with female students. Furthermore, the proportion of Primary Education students with a low TDC level was significantly higher than other students. In conclusion, it is necessary, for teacher training institutions in Chile and Uruguay, to implement policies at different moments and in different areas of the ITT process in order to improve the development of the TDC.

RESUMEN

El desarrollo de la Competencia Digital Docente (CDD) debe iniciarse en la etapa de formación inicial docente (FID) y extenderse durante los años de ejercicio. Todo ello con el propósito de usar las Tecnologías Digitales (TD) de manera que permitan enriquecer la docencia y el propio desarrollo profesional. El presente artículo expone los resultados de un trabajo con estudiantes de último año de FID de Chile y Uruguay para determinar su nivel de CDD. Para realizar el estudio se utilizó una metodología cuantitativa, con una muestra representativa estratificada de 568 estudiantes (n=273, Chile; n=295, Uruguay). Los datos se analizaron en relación al género y nivel educativo. Los resultados mostraron, para las cuatro dimensiones de la CDD, un desarrollo básico. Respecto a la relación entre las variables estudiadas y la CDD, destaca el porcentaje de hombres que alcanza competencias digitales avanzadas para la dimensión de Planificación, organización y gestión de espacios y recursos tecnológicos. También para esta dimensión la proporción de estudiantes de Educación Primaria con un desarrollo de CDD básico es significativamente superior al del resto de estudiantes. Como conclusión destacamos que es necesario que las instituciones formadoras de docentes implementen políticas a diferentes plazos y en diversos ámbitos de la FID como el sistema educativo, la formación y la docencia, para mejorar el nivel de desarrollo de la CDD.

KEYWORDS | PALABRAS CLAVE

ICT standards, digital competence, teachers training, assessment, educational technology, high education, pedagogy, educational system.

Estándares TIC, competencia digital, formación de profesores, evaluación, tecnología educativa, educación superior, pedagogía, sistema educativo.

1. Introduction

Digital competence (DC) is one of the key competences of the modern citizen. Over a decade ago, the European Commission (2018) considered that citizens should have some key skills to prepare them for adult life, to enable them to actively participate in society and to continue to learn throughout their lives. As one of these skills, DC must be considered broadly, in all educational systems (curricula, resources and support for training, continuous competency updates, teacher training, equity, special needs, educational policies, etc.). In a broader context, UNESCO (2015: 40-47), within the Education 2030 Framework for Action, highlights the potential of digital technology (DT) and the importance of technological skills training as part of programs to enter the labor market. In this reality, the teaching staff plays a key role to ensure that future citizens make effective use of digital technologies for their personal and professional development.

Various international reports highlight the need for well-trained educators in the use the DT for teaching (INTEF, 2017: 2; Redecker & Punie, 2017: 12; UNESCO, 2015: 55; 2017: 20), Teachers with an adequate level of Teacher's Digital Competence (TDC), which is understood as the "set of abilities, skills, and attitudes that teachers must develop in order to be able to incorporate digital technologies into their practice and their professional development" (Lázaro, Usart, & Gisbert, 2019: 73). This concept is in line with proposals concerning recent developments, which define TDC, and emphasize the need to harness the potential of DT in the learning processes of future citizens of a digital society. Teachers themselves demonstrate, in their training needs, that TDC is one of their priorities (European Commission, 2015: 11). Specifically, the collection of knowledge, attitudes and skills that make up TDC are defined in different frameworks and standards that serve as referents for the training and evaluation of this competency: MINEDUC-Enlaces (2008; 2011), ISTE (2008), Unesco (2008 y 2018), Fraser, Atkins, & Richard (2013), Ministerio Educación Nacional (2013), INTEF (2014; 2017), DigiComp (Redecker & Punie, 2017). If we analyze the dimensions of TDC considered here, we can see that the focus is on didactic-pedagogical aspects, teacher professional development, ethical and safety aspects, search and management of information, and in the creation and communication of content. Most of them are directed toward TDC of in-service teachers, who may be able to assimilate initial or basic levels as a minimum requirement as a student pursuing a degree in education or pedagogy to complete their training at university.

1.1. TDC in initial teacher training

In education degree programs, DC has a different hue than in other areas of education. Initial Teacher Training should include digital training for the future teachers, so they are able to use digital technology in their professional activity (Escudero, Martínez-Domínguez, & Nieto, 2018; Papanikolaou, Makri, & Roussos, 2017; Prendes, Castañeda, & Gutiérrez, 2010).

Teacher training is one of the key factors for incorporating DT in pedagogical practices. This aspect takes on greater relevance in ITT, as they could enter the education system with an adequate level of TDC. In this way, future teachers would be able to enrich the learning environments through DT and incorporate them naturally into their future professional practice (Castañeda, Esteve, & Adell, 2018). ITT in Latin America has been incorporating DT in the study plans with little or no guidance and support from the ministries of education. In fact, the policy has focused on delivering infrastructure and training to teachers in the educational system, without offering support and guidance to teacher-training institutions. It is necessary to systematize and share experiences involving the inclusion of DT in the ITT curriculum (Brun, 2011), in alignment with international standards (Brushed & Prada, 2012).

In Chile, given the autonomy of institutions that train teachers and the shortage of policies and guidelines for including DT in ITT, there are a variety of specific subjects on DT distributed along different semesters of the syllabus. However, they are more focused on digital literacy, than on teaching with DT (Rodriguez & Silva, 2006). This fact has not hindered the development of particular initiatives created by some institutions, in line with guiding the development of the TDC. They use some national standards and, at the same time, integrate elements of other international frameworks (Cerda, Huete, Molina, Ruminot & Saiz, 2017). In this context, the level of self-perception of students with regard to TDC (MINEDUC-Enlaces, 2011). It has been observed that the level of TDC development of ITT students is based on technical and ethical aspects, rather than those related to teaching and knowledge management (Badilla,

Jiménez, & Careaga, 2013; Ascencio, Garay, & Seguic, 2016). In the case of Uruguay, because there is an entity that controls teacher training, there are two ITT subjects: "Information and education" and "integrating digital technologies," which include education in TDC of future teachers (Rombys, 2012). In both countries, no specific cross-sectional formulations are observed to guide the integration of DT in other subjects. Their work is subjected to the competencies and skills of the teaching staff itself (Silva & al., 2017).

1.2. Evaluation of TDC

Evaluating TDC in ITT presents important challenges that relate to the complexity of evaluating competencies and the assessment system used. Objective assessment tools are required, that are not based only on the perception of the user but measure the level of TDC by solving situations or problems in line with the indicators to be evaluated (Villar & Poblete, 2011: 150). Currently, there are TDC self-assessment tools that are based on self-perception (Redecker & Punie, 2017; Tourón, Martín, Navarro, Pradas & Íñigo, 2018). INTEF (2017) presents a proposal that uses a technological solution and also incorporates the use of a portfolio for evaluation. In our view, the challenge is to use an objective, reliable and valid TDC evaluation test that measures the knowledge of the future teacher. For this purpose, this study sets forth to analyze the development level of TDC in a sample of senior students of ITT in Chile and Uruguay, through a previously validated instrument (see section 2.2), which allows us to make an assessment aligned to TDC, using the indicators and dimensions proposed by Lázaro and Gisbert (2015) (Figure 1). At the same time, through the data obtained, research will also examine the relationship of the TDC level with other key variables.

Figure 1. Dimensions of TDC
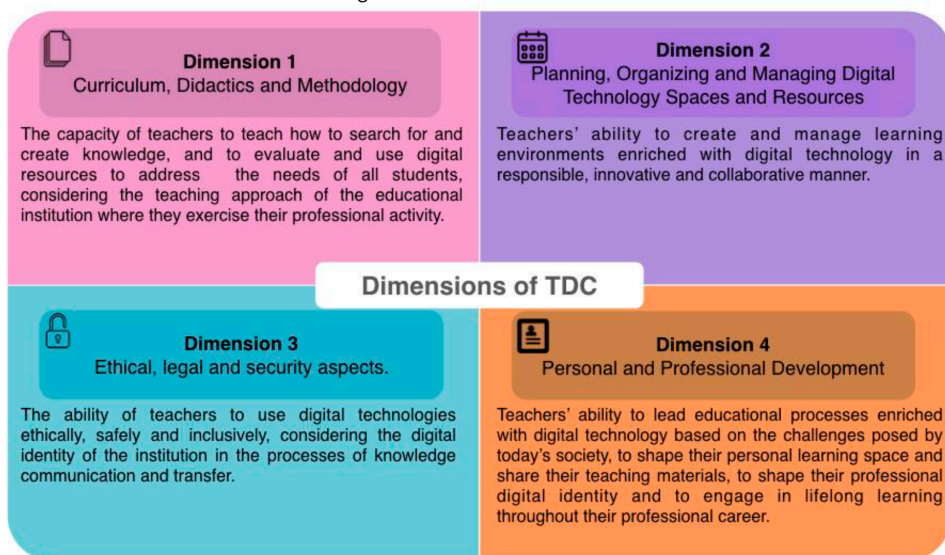
1.3. Objectives and research questions

In order to determine the development level of TDC of the ITT senior students in Chile and Uruguay, the study will present and discuss the results for a representative sample in both countries, through quantitative analysis of the data obtained using the described instruments, and also with regard to the variables of gender and educational level. Specifically:

- O1. Assess the level of TDC in a sample of students from Chile and Uruguay.
- O2. Study the relationship between the level of TDC and the factors of gender and educational level.

The following research questions are established to guide the process and will be used to present and discuss the results:

- Q1. What is the distribution in the four dimensions of TDC of the sample studied?
- Q2. Are there significant differences for TDC in terms of gender?
- Q3. Are there differences in TDC among future teachers of primary and secondary education?

2. Material and methods

2.1. Sample

With the aim of studying the TDC of senior students of ITT in Chile and Uruguay, we chose a representative stratified sample composed of 568 students of both countries. We performed a stratified random sampling with p=5%. The sample was drawn from a population of 2,467 students for Uruguay and an estimated population of 12,928 in Chile, considering the public universities that provide ITT. To perform the stratified sample, the relative weight of the population was taken into account, of the various ITT institutions Uruguay and different public universities in Chile, considering each institution as a stratum.

In the case of Uruguay (there are two institutions —with a center for each stratum— in the capital city of the country, and the remaining 2 institutions with 28 centers scattered throughout the rest of the territory), in 2 of the 4 strata, a multistage sample was conducted, in which the centers were chosen first, and then, the students within these centers. Eleven centers participated of a total of 30. First, the sample was divided by strata, according to the number of students present in each center. Then, depending on feasibility decisions, students were drawn in the institutions of the capital and the centers of the rest of the country. Within these centers, students to be surveyed were drawn by an assigned number in the student lists. To select the individuals of the samples, another 10% was drawn for substitution, respecting the relative weight of each subsample.

Table 1. Detail of the sample							
Chile				**Uruguay**			
Institution	Universe	Sample	%	Institution	Universe	Sample	%
Institution 1	370	38	10.3%	Institution 1	436	63	14.4%
Institution 2	298	30	10.1%	Institution 2	972	132	13.6%
Institution 3	251	38	15.1%	Institution 3	724	60	8.3%
Institution 4	341	49	14.4%	Institution 4	335	40	11.9%
Institution 5	386	58	15%				
Institution 6	141	17	12.1%				
Institution 7	133	43	32.3%				
Total	1920	273	14.4%	Total	2467	295	12%

In the Chilean case, after dividing the sample in strata —by number of students present in each one of them— there was one drawing per university, while the instrument was applied by full classroom, with the participation of seven universities, of a total of 16. The universe and the samples are shown on Table 1. Table 2 characterizes the sample of 568 students who participated in the study. It is made up of 273 Chilean students (48.1%) and 295 Uruguayan students (51.9%).

Table 2. Sample frequency							
		Consolidated Basis		**Chile**		**Uruguay**	
		N	%	N	%	N	%
Gender	Male	140	24.6%	96	35.2%	44	14.9%
	Female	428	75.4%	177	64.8%	251	85.1%
Level of education	Primary	222	39.1%	58	21.2%	164	55.6%
	Secondary	304	53.5%	181	66.3%	123	41.7%
	Other	42	7.4%	34	12.5%	8	2.7%

2.2. Instruments and procedure

To study the TDC of the sample, a test-type assessment instrument was used to present problem situations that novel teachers may encounter during their professional practice. This instrument is

composed of closed questions with hierarchical or weighted responses, with several answer options. The responses were scored according to their level of precision: 1, 0.75, 0.5, 0.25 points. This differentiation is explained because, faced with the same problem situation, there may be several correct answers, but with different levels of precision, depending on the situation. This was constructed from an array of indicators to assess TDC in ITT in the Chilean-Uruguayan context (Silva, Miranda, Gisbert, Moral, & Oneto, 2016) based primarily on ICT standards in ITT from MINEDUC-Enlaces (2008) and the proposed TDC rubric by Lázaro & Gisbert (2015).

The specifications table was reviewed by a panel of experts, both in Chile and Uruguay. This is a proposal of TDC contextualized to ITT, which is based on different international standards (Fraser, Atkins & Richard, 2013; INTEF, 2014; ISTE, 2008 and UNESCO, 2008), to ensure the construct validity of the instrument. In order to ensure content validity in the evaluation questionnaire, the 56 initial questions were validated through expert judgment which included nine experts in the field of Higher Education linked to ITT in Uruguay, Chile and Spain (3 per country). This process was carried out through validation matrices, where each expert individually answered yes or no to the conditions of validity of each question.

Of the 56 questions, 51 obtained a quality assessment of over 75%, while only six questions were evaluated with scores under 75%, making them unsuitable for the final evaluation instrument. The assessment instrument was made up of the four top rated questions by experts for each of the 10 indicators. In this way, the final instrument was composed of 40 questions, distributed in four dimensions: D1. Curriculum, Didactics and Methodology: 16 questions; D2. Planning, Organizing and Managing Digital Technology Spaces and Resources: eight questions; D3. Ethical, legal and security aspects: eight questions and D4. Personal and Professional Development: eight questions. Meanwhile, each correct answer was assigned one point and the instrument awarded 40 points maximum.

Below is an example of an item or question: "If you want your students to perform a CIICT (curricular integration of information and communication technologies) activity, which of the following digital technologies do you or would you use: (a) Educational Video (0.50); (b) Blog with curricular topic (0.75); (c) Specific software for the subject (1.00); (d) Presentation with curricular contents (0.25). The internal consistency of the instrument was studied (Silva & al., 2017), and interpreted on the basis of the criterion cited by Cohen, Manion and Morrison (2007). In our case, $\alpha=0.60$, which indicates "good" internal reliability for scales between 0.6 and 0.8 points.

The process of administering the test took two months. The instrument was administered to the sample of students in the last year of pedagogy in Chile and Uruguay (see Section 2.1) online, from any place and device (tablet, cell phone, computer). Data from the test was downloaded and saved to a Microsoft Excel (2007) spreadsheet, taking into account the ethical aspects relating to anonymity and conformity of data transfer.

2.3. Statistical tests

To analyze the implementation results of the instrument and to respond to the research questions, a descriptive data analysis of the assessment instrument for TDC at the level of dimensions and indicators, was performed. Later, different statistical tests were administered. In particular, to perform the analysis, the creation of "Indicators of Teacher's Digital Competences (ITDC)" was proposed to categorize students in initial teacher training by level of TDC, into: basic, intermediate and advanced, for the dimensions, by crossing of variables: sex and educational level, with the purpose of identifying statistically significant differences with the chi-square ($\chi2$) test and the comparison of distributions (Z test). Data were analyzed with SPSS for Windows, Version 24.

For the construction of each indicator, all the scores obtained for each item were added. The results of this sum of scores were categorized (recoded) according to a theoretical estimate that considers the actual distribution of the scores obtained: minimum score obtained. Analysis, maximum score obtained and the scores in the position 33 and 66 if the scores are sorted in ascending order. Considering the scores for each indicator that make up the dimensions mentioned above, the TDC indicator of classification was created, as described below in Table 3.

Table 3. Dimensions and scores for levels of ITDC		
Dimension	**Level**	**ITDC Classification Score**
D1	Basic	From 4,50000 to 8,5000 points
	Intermediate	From 8,5001 to 10,0000 points
	Advanced	From 10,0001 to 14,2500 points
D2	Basic	From 2,0000 to 4,2500 points
	Intermediate	From 4,2501 to 5,2500 points
	Advanced	From 5,2501 to 7,5000 points
D3	Basic	From 2,0000 to 4,2500 points
	Intermediate	From 4,2501 to 5,2500 points
	Advanced	From 5,2501 to 7,5000 points
D4	Basic	From 1,7500 to 3,7500 points
	Intermediate	From 3,7501 to 4,5000 points
	Advanced	From 4,5001 to 7,5000 points

3. Results

First, we estimated the overall results of the sample by dimension of TDC. The mean of the four dimensions is between 2.0 and 2.3 points, which is equivalent to 51% to 59% of the total points available. These values have standard deviations between 0.3 and 0.6. For all dimensions, it should be noted that relatively similar scores between mean, median and mode enable us to see we are dealing with a normal distribution of data, which was verified through statistical tests. In particular, the results were compared using the Levene test to confirm the normal distribution for each dimension in the total sample. We present the results sorted by research question:

• Q1. What is the distribution in the four dimensions of TDC for the sample studied?

The results of the distribution in our sample by TDC dimension showed that for the four dimensions, students in the sample are mostly at the basic level (Figure 2), although 1 of every three subjects is at the advanced level.

Figure 2. Percentages of students tested in Basic, Intermediate and Advanced, corresponding to each dimension of TDC
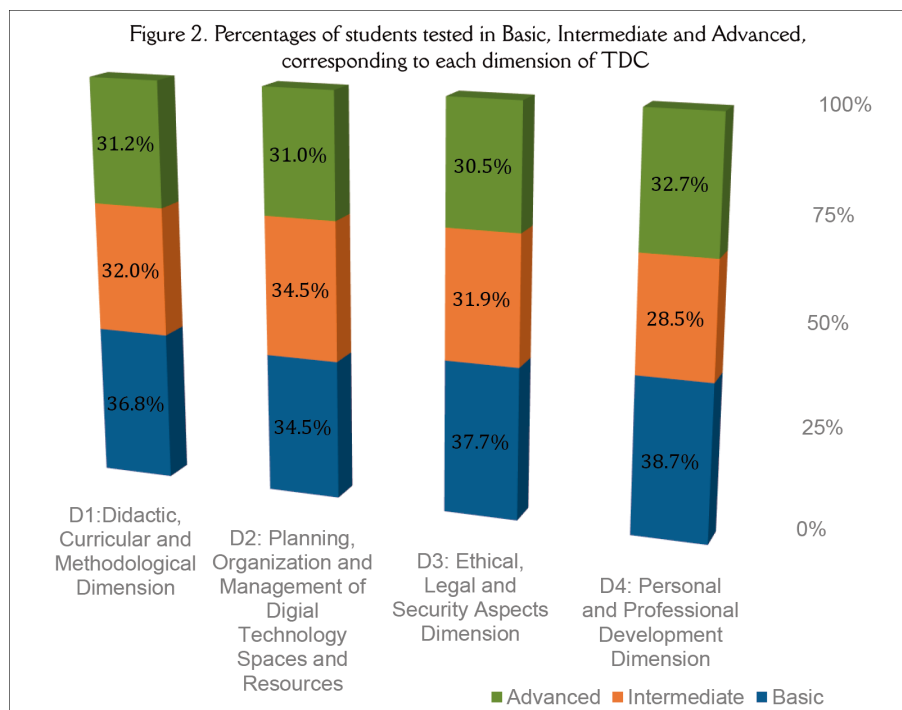
Only differences that could be statistically significant in D4 are found: "Personal and Professional Development" (Figure 2). To calculate if the differences observed are significant among students with

intermediate TDC (28.5%), and basic TDC (38.7%), a Chi-square test was applied to compare the different levels ($\chi^2(2) = 10.8$ with p<0.01). This result indicates that we must reject the null hypothesis and therefore we can state that there is a statistical difference between these two groups of students. In other words, the distribution of students with low level of D4 is significantly higher than that of students with intermediate competency. Once the dimensions of TDC evaluated in our sample of students is studied, we detail the results for each of the questions that correlate their TDC with the variables of interest:

- P2. "Are there significant differences for TDC in terms of gender?" was first measured through the descriptive statistical study of the percentages of distribution (Table 4).

Table 4. Percentage of students distributed by gender, evaluated as Basic, Intermediate and Advanced, corresponding to each dimension of TDC

Dimensions	Male			Female		
	Basic	Intermediate	Advanced	Basic	Intermediate	Advanced
D1	40.7%	32.1%	27.1%	35.5%	32%	32.5%
D2	29.3%	31.4%	39.3%	36.2%	35.5%	28.3%
D3	42.1%	25.7%	32.1%	36.2%	33.9%	29.9%
D4	37.1%	30%	32.9%	39.3%	28%	32.7%

The results show that no significant differences were observed with regard to gender in the four dimensions studied. Even so, the percentage of male students that reach advanced digital competences is noteworthy in D2: "Planning, Organization and Management" (39.3%), compared to female students at that same level (28.3%). To evaluate this difference quantitatively, a Chi-square test was applied, which only showed a statistically significant value between these two groups ($\chi^2(1) = 6.61$, with p=0.047, <.05). We can say that there is a statistical difference between these two groups of male and female students for D2. In particular, the distribution of male students with an advanced level in this dimension is significantly higher than that of women. In reference to the third research question Q3: Are there differences of TDC among teachers of secondary and primary education? We can see in Table 5 the following percentages of distribution for each group, separated by levels of TDC development.

Table 5. Percentages of students distributed by level of education, evaluated as Basic, Intermediate and Advanced, corresponding to each dimension of TDC

Dimensions	Primary Level			Secondary Level			Other Educational Levels		
	Basic	Interm.	Adv.	Basic	Interm.	Adv.	Basic	Interm.	Adv.
D1	35.6%	33.3%	31.1%	37.8%	33.3%	29.6%	35.7%	21.4%	42.9%
D2	45.5%	32.4%	22.1%	28%	34.9%	37.2%	23.8%	42.9%	33.3%
D3	36%	35.6%	28.4%	40.1%	28%	31.9%	28.6%	40.5%	31%
D4	35.1%	25.7%	39.2%	39.8%	25.7%	39.2%	50%	31%	19%

Percentage differences are observed for D1: "Didactic, Curricular and Methodological Dimension", in which students from educational levels other than Primary and Secondary were mostly advanced TDC (42.9%). The situation is reversed in D2: "Planning, organization and management of spaces and digital technology resources", where the percentage of Primary Education students with basic TDC development is noteworthy (45.5%). For D3. "Ethical, Legal and Security Aspects" 40.1% of students in Secondary Education has basic TDC development and 40.5% Basic students from other disciplines display intermediate development of TDC. Finally, dimension D4. "Personal and Professional Development" presents high values for students of Primary and Secondary Education at advanced levels (39.2%), but not for other disciplines, in which half of their students have a basic level of TDC development (50%).

To evaluate these differences, once again a Chi-square test was performed, which shows a significant value between groups in the D2 dimension ($\chi^2(2) = 14.28$ with p<.01). Specifically, the Z-test indicates that the proportion of Primary Education students with basic development of TDC is significantly higher than that of Secondary and other levels of studies. In turn, the proportion of students of Secondary Education with advanced development of TDC is significantly higher than that of students at the Primary Level. Finally, for Dimension 4 there are no statistically significant differences (p=0.056).

4. Discussion and conclusions

The first general objective of this research was to assess the level of TDC of students in their last year of ITT, for a representative sample in Chile and Uruguay. We proceeded to discuss the results found in the previous section according to the proposed research questions. In particular, starting from the first question, our intention was to analyze the level of TDC in terms of the four dimensions defined, and study the possible differences between levels of development of this competency. The data on the differences between competence groups have shown a low level of development in general, with a significant difference in dimension D4. "Personal and Professional Development". In particular, in our sample there are more students with low level in this item.

The results for the level of TDC in the sample studied differ from those obtained in studies of perception of this competence in ITT. Here, the level of development appears noticeably higher in the different levels, since students perceive a greater command of DT in relation to the actual level they reach (Badilla, Jiménez, & Careaga, 2013; Prendes, Castañeda, & Gutiérrez. 2010; Banister & Reinhart, 2014; Touron & al., 2018; Gutierrez & Serrano, 2016, Ascencio, Garay, & Seguic, 2016). However, the results are consistent with research that evaluates TDC in pedagogy students, from the results of a test, administered by the Ministry of Education that used simulated environments. This test assesses the technological skills of future teachers of primary education and preschool education, shows that only 58% of the graduates had an acceptable level of DT, 59% in primary education and 55% in preschool education (Canales & Hain, 2017). These data confirm the validity of our assessment instrument, in terms of criterion, which added to the previous study of construct validity and content (Silva & al., 2017), make this an applicable instrument for the evaluation of TDC in students of ITT in Latin American samples. A study of perception by MINEDUC with 3,425 teachers who participated in their formative plans in ICT, in relation to the integration of the pedagogical use of ICT in the classroom and in their own professional development, showed that 0.47% are at an initial level; 21% are at an elementary level; 77% obtained a higher level; and 0.23% are at an advanced level. The results are more optimistic than those observed in this study (MINEDUC, 2016).

The second general objective was to study the correlations between the level of TDC and the gender and educational level factors. This study allows us to analyze the possible personal factors or variables that may influence the development of TDC. Significant differences have appeared in both variables (gender and educational level). In particular, there is a high percentage of male students that reach advanced digital competences in D2: "Planning, Organization and Management" compared to female students. This differs from other studies in Chile with students of pedagogy of the humanities, which indicate that there are no significant differences between the groups compared and that students show homogeneous characteristics when it comes to their approach toward technology (Ayale & Joo, 2019). However, previous studies (Björk, Gudmundsdottir, & Hatlevik, 2018) found, in a sample of teachers in Malta, that men claimed to have more confidence in the use of technology in the classroom than women. Additionally, the study of Ming Te Wang and Degol (2017) among professionals in the technology sector shows that gender stereotypes are socio-cultural factors that may affect cognitive factors, including the perception of competence. Similarly, greater experience in the classroom with the use of technologies, more positive attitudes and self-confidence are generated in the specific case of women (Teo, 2008: 420) and better assessment of their TDC.

In the light of the observed results, it is both a need and a challenge to strengthen the development of TDC in general, and the didactic-pedagogical aspects, in particular, during ITT. To this end, teacher training institutions require guidance that will enable them to achieve improvements in the short, medium and long term, in various areas of ITT, such as the educational system, training and teaching, in order to make progress in the level of development of TDC. These must come from results arising from research, which should feed the diagnosis, evaluation, and accompaniment in developing TDC in ITT.

This study provides evidence that students of initial training, at one step of completing their teacher training, do not possess the TDC required to effectively use DT in their future exercise as teachers. This aspect is of concern because teachers who are not digitally competent will have difficulties in effectively using TDC in their daily practice and in teaching digital competence to their students. This

low competence on the part of teachers is one of the main barriers for the use of DT in their teaching work and for their own professional development (UNESCO, 2013). We emphasize, in addition, that there is a positive correlation between the quality of the pedagogical practices and the use of DT in teaching (INTEF, 2016).

Finally, it is considered that the instrument is a good starting point to assess the TDC in students of ITT, because it puts together a set of questions that must be put into play in context, and it is applicable to the local scope of both countries. As proposals for the future, we consider interesting to:

- Undertake, in future studies, to improve the instrument, extending the battery of questions for each indicator and incorporating questions for indicators of the original matrix validated by experts that were not addressed in this study. Only 10 of the 14 originally approved were considered.
- Try the assessment instrument in other contexts and teachers in training of other educational levels, such as preschool or special needs education that exist in Latin America.
- Perform comparative studies between Latin American and European countries, since both contexts, despite differences in education plans, share the same problems with regard to the insertion of DC in ITT.
- It is also interesting within the same country or in comparison with other countries, to assess the differences, if any, between the training of teachers in public and in private institutions.

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References

Ascencio, P., Garay, M., & Seguic, E. (2016). Formación Inicial Docente (FID) y Tecnologías de la Información y Comunicación (TIC) en la Universidad de Magallanes – Patagonia Chilena. *Digital Education Review*, 30, 123-134. https://bit.ly/2YBYWoS

Ayale-Pérez, T., & Joo-Nagata, J. (2019). The digital culture of students of Pedagogy specialising in the humanities in Santiago de Chile. *Computers & Education*, 133, 1-12. https://doi.org/10.1016/j.compedu.2019.01.002

Badilla, M., L., J., & Careaga, M. (2013). Competencias TIC en formación inicial docente: Estudio de caso de seis especialidades en la Universidad Católica de la Santísima Concepción. *Aloma*, 31(1), 89-97. https://bit.ly/2Vn3CwG

Banister, S., & Reinhart, R. (2014). Assessing NETS-T performance in teacher candidates: Exploring the Wayfind teacher assessment. *Journal of Digital Learning in Teacher Education*, 29(2), 59-65. https://doi.org/10.1080/21532974.2012.10784705

Björk-Gudmundsdottir, G., & Hatlevik, O.E. (2018). Newly qualified teachers' professional digital competence: Implications for teacher education. *European Journal of Teacher Education*, 41(2), 214-231. https://doi.org/10.1080/02619768.2017.1416085

Brun, M. (2011). Las tecnologías de la información y las comunicaciones en la formación inicial docente de América Latina. Comisión Económica para América Latina y el Caribe (CEPAL), División de Desarrollo Social, Serie Políticas Sociales. http://bit.ly/2WQMtNm

Canales, R., & Hain, A. (2017). Política de informática educativa en Chile: Uso, apropiación y desafíos a nivel investigativo. In *Contribuciones al estudio de procesos de apropiación de tecnologías*Buenos Aires: . GatoGris.

Castañeda, L., Esteve, F., & Adell, J. (2018). ¿Por qué es necesario repensar la competencia docente para el mundo digital? *Revista de Educación a Distancia*, 56, 1-20. https://doi.org/10.6018/red/56/6

Cerda, C., Huete-Nahuel, J., Molina-Sandoval, D., Ruminot-Martel, E., & Saiz, J. (2017). Uso de tecnologías digitales y logro académico en estudiantes de Pedagogía chilenos. *Estudios Pedagógicos*, 54(3), 119-133. https://doi.org/10.4067/s0718-07052017000300007

Cohen, L., Manion, L., & Morrison, K. (2007). Research methods in educationLondon: . Routledge. https://doi.org/10.4324/9780203224342

Escudero, J.M., Martínez-Domínguez, B., & Nieto, J.M. (2018). Las TIC en la formación continua del profesorado en el contexto español. *Revista de Educación*, 382, 57-78. https://doi.org/10.4438/1988-592X-RE-2018-382-392

European Commission (Ed.) (2015). Marco estratégico: Educación y formación, 2020. https://bit.ly/2VzQRDO

European Commission (Ed.) (2018). Proposal for a council recommendation on key competences for lifelong learning. https://bit.ly/2YsyGNz

Fraser, J., Atkins, L., & Richard, H. (2013). DigiLit leicester. Supporting teachers, promoting digital literacy, transforming learning. Leicester City Council. https://bit.ly/2LDzSMw

Gutiérrez, I., & Serrano, J. (2016). Evaluación y desarrollo de la competencia digital de futuros maestros en la Universidad de Murcia. *New Approaches in Educational Research*, 5, 53-59. https://doi.org/10.7821/naer.2016.1.152

INTEF (Ed.) (2014). *Marco Común de Competencia Digital Docente*. Madrid: Instituto Nacional de Tecnologías Educativas y de Formación del Profesorado. https://bit.ly/1IqyLdh

INTEF (Ed.) (2016). Resumen Informe. Competencias para un mundo digital. https://bit.ly/2Jh7C06

INTEF (Ed.) (2017). Marco Común de Competencia Digital Docente. https://bit.ly/1Y88rd6

ISTE (Ed.) (2008). *National educational technology standards for teachers*. Washington DC: International Society for Technology in Education. https://bit.ly/2UaLExK

Lázaro-Cantabrana, J., Usart-Rodríguez, M., & Gisbert-Cervera, M. (2019). Assessing teacher digital competence: The construction of an instrument for measuring the knowledge of pre-service teachers. *Journal of New Approaches in Educational Research*, *8*(1), 73-78. https://doi.org/10.7821/naer.2019.1.370

Lázaro-Cantabrana, J.L., & Gisbert-Cervera, M. (2015). Elaboración de una rúbrica para evaluar la competencia digital del docente. *Universitas Tarraconensis*, *1*(1), 48-63. https://doi.org/10.17345/ute.2015.1.648

Mineduc (Ed.) (2008). *Estándares TIC para la formación inicial docente: Una propuesta en el contexto chileno*. Santiago de Chile: Ministerio de Educación. https://bit.ly/2YunboZ

Mineduc (Ed.) (2011). *Actualización de competencias y estándares TIC en la profesión docente*. Santiago de Chile: Ministerio de Educación. https://bit.ly/2Q0zmqm

Mineduc (Ed.) (2016). *Docentes en Chile: Conocimiento y uso de las TIC 2014*, volume 32. Santiago de Chile: MINEDUC, Serie Evidencias. https://bit.ly/2VB8jIs

Ministerio de Educación Nacional (Ed.) (2013). Competencias TIC para el desarrollo profesional docente. https://bit.ly/2JddreY

Papanikolaou, K., Makri, K., & Roussos, P. (2017). Learning design as a vehicle for developing TPACK in blended teacher training on technology enhanced learning. *International Journal of Educational Technology in Higher Education*, *14*(1), 34-41. https://doi.org/10.1186/s41239-017-0072-z

Prendes, M., Castañeda, L., & Gutiérrez, I. (2010). ICT competences of future teachers. [Competencias para el uso de TIC de los futuros maestros]. *Comunicar*, *18*(35), 175-182. https://doi.org/10.3916/C35-2010-03-11

Redecker, C., & Punie, Y. (2017). *European framework for the digital competence of educators: DigCompEdu*. Luxembourg: Publications Office of the European Union. https://doi.org/10.2760/159770

Rodríguez, J., & Silva, J. (2006). Incorporación de las tecnologías de la información y la comunicación en la formación inicial docente el caso chileno. *Innovación Educativa*, *6*(32), 19-35. https://bit.ly/2VLB6K7

Rombys, D. (2012). Integración de las TIC para una buena enseñanza: Opiniones, actitudes y creencias de los docentes en un Instituto de Formación de Formadores. *Tesis de Maestría*, *Instituto de Educación*. Universidad ORT Uruguay. http://bit.ly/2IgNIRo

Rozo, A., & Prada, M. (2012). Panorama de la formación inicial docente y TIC en la región Andina. *Educación y Pedagogía*, *24*(62), 191-204. https://bit.ly/2eZntSt

Silva, J., J., L., Miranda, P., & R, C. (2018). El desarrollo de la competencia digital docente durante la formación del profesorado. *Opción*, *34*(86), 423-449. https://doi.org/10.5565/rev/educar.725

Silva, J., Miranda, P., Gisbert, M., Morales, M., & Onetto, A. (2016). Indicadores para evaluar la competencia digital docente en la formación inicial en el contexto chileno-uruguayo. *Revista Latinoamericana de Tecnología Educativa*, *15*(3), 55-68. https://doi.org/10.17398/1695-288X.15.3.55

Silva, J., Rivoir, A., Oneto, A., Morales, M., Miranda, P., Gisbert, M., & Salinas, J. (2017). Informe de investigación. Estudio comparado de las competencias digitales para aprender y enseñar en docentes en formación de Uruguay y Chile. https://bit.ly/2YkYmLO

Teo, T. (2008). Pre-service teachers attitudes towards computer use: A Singapore survey. *Australasian Journal of Educational Technology*, *24*(4), 413-424. https://doi.org/10.14742/ajet.1201

Tourón, J., Martín, D., Navarro, E., Pradas, S., & Íñigo, V. (2018). Validación de constructo de un instrumento para medir la competencia digital docente de los profesores. *Revista Española de Pedagogía*, *76*(269), 25-54. https://doi.org/10.22550/REP76-1-2018-02

UNESCO (Ed.) (2008). Estándares de competencia en TIC para docentes. https://bit.ly/2JJMFdV

UNESCO (Ed.) (2015). Educación 2030: Declaración de Incheon y Marco de Acción para la realización del Objetivo de Desarrollo. https://bit.ly/2MNieD5

UNESCO (Ed.) (2018). ICT competency framework for teachers. https://bit.ly/2WD5kLH

Villa-Sánchez, A., & Poblete-Ruiz, M. (2011). Evaluación de competencias genéricas: Principios, oportunidades y limitaciones. *Bordón*, *63*(1), 147-170. https://bit.ly/2VkTZyV

Wang, M.T., & Degol, J.L. (2017). Gender gap in science, technology, engineering, and mathematics (STEM): Current knowledge, implications for practice, policy, and future directions. *Educational Psychology Review*, *29*(1), 119-140. https://doi.org/10.1007/s10648-015-9355-x

Digital resources and didactic methodology in the initial training of History teachers

Recursos digitales y metodología didáctica en la formación inicial de docentes de Historia

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ABSTRACT

This paper analyzes the links that exist between the perceptions of teachers-in-training regarding the use of digital resources in the Secondary Education classroom and their own methodological and epistemological conceptions. Shulman's theories continue to largely guide current research on teacher knowledge. However, the impact caused by the new technologies has inspired new approaches like T-PACK, which put the focus on the teachers' digital competence. In order to address this goal, information has been collected by means of a questionnaire implemented in 22 universities, 13 Spanish (344 participants) and 9 British (162 participants). The analysis of data was conducted along three phases: a) examination of the structure of assessments regarding the usefulness of digital resources by analyzing latent classes; b) estimation of confirmatory factor models for variable evaluation processes, History as a formative subject and historical competencies; c) estimation of interclass differences by using confirmatory factor models. The results showed four types of response regarding the use of digital resources in the classroom that were polarized about two items: comics and video games. Important interclass differences have likewise been found regarding methodological issues (traditional and innovative practices), as well as less important differences concerning epistemological conceptions and views on the development of historical competencies in the classroom.

RESUMEN

El objetivo de este trabajo es analizar los vínculos entre las percepciones del profesorado en formación sobre el uso de los recursos digitales en el aula de Secundaria, y sus concepciones metodológicas y epistemológicas. Las teorías de Shulman siguen orientando en gran medida las investigaciones sobre el conocimiento del profesorado. Sin embargo, el impacto de las nuevas tecnologías ha impulsado nuevos enfoques, como el T-PACK, que incide en la competencia digital docente. Para abordar este objetivo se ha recogido información de un cuestionario implementado en 22 universidades, 13 españolas (344 participantes) y 9 inglesas (162 participantes). Los análisis de datos se realizaron en tres fases: a) exploración de la estructura de las valoraciones sobre la utilidad de los recursos digitales mediante análisis de clases latentes; b) estimación de los modelos factoriales confirmatorios para las variables procesos de evaluación, Historia como materia formativa, y competencias históricas; c) estimación de las diferencias entre clases. Los resultados mostraron cuatro perfiles de respuesta en función de la opinión sobre el uso de los recursos en el aula, y polarizadas en torno a dos ítems: cómics y videojuegos. También se ha podido comprobar importantes diferencias entre clases en cuestiones metodológicas (prácticas tradicionales e innovadoras); y diferencias menos importantes sobre percepciones epistemológicas y de desarrollo de competencias históricas en el aula.

1. Introduction and state of the question

1.1. Teacher training and pedagogical content knowledge

Over the last few decades the initial training and the continuous professional development of teachers has become a mainstream issue (González & Skultety, 2018). International studies insist on the need to renew teacher training programs in order to upgrade the teaching-learning processes in compulsory education (Barnes, Fives, & Dacey, 2017). A large number of authors argue that it is necessary to conduct more comparative research and to transfer its findings into classroom practice (König, Ligtvoet, Klemenz, & Rothlandb, 2017). In the context of current research lines in teacher training, the analysis of the knowledge and conceptions of teachers has come to play a fundamental part in the approach that should be adopted by investigations on initial training programs (Darling-Hammond, 2006; Fives & Buehl, 2012). Outstanding among this body of research are studies aimed at calibrating the several types of professional knowledge possessed by teachers and emphasizing the command of regular classroom tasks (Oliveira, Lopes & Spear-Swerling, 2019).

The proposals by Shulman (1987) have had a broad influence on the definition of such categories as are designed for the purpose of researching teachers' knowledge. Particularly when teaching skills are evaluated, researchers tend to draw distinctions between content knowledge (CK), pedagogical content knowledge (PCK) and general pedagogical knowledge (GPK) (Kleickmann, Richter, Kunter, Elsner, Besser, Krauss, & Baumert, 2012). While CK consists in the knowledge of a specific subject and is related to the contents that teachers are expected to explain, GPK is general pedagogical knowledge and involves broad principles and strategies for classroom management and organization (Blömeke, Busse, Kaiser, König, & Sühl, 2016). PCK includes knowledge that relates the specific subject contents to the purposes of teaching (Monte-Sano, 2011): it is a kind of knowledge that delves deep into the social representations that students have with regard to a specific subject matter as well as into the way students understand that knowledge, the methods and resources that are needed in order to teach that discipline and the selection and organization of specific contents so as to adapt them to the reality of the classroom (Meschede, Fiebranz, Möller, & Steffensky, 2017).

1.2. T-PACK, teacher digital competence and didactic methodology

Digital resources are having a great impact on the new ways of classifying teacher competencies. While it is true that both teachers and students are immersed in media experiences in their everyday lives, the transfer of such an experience into the teaching-learning process has not yet been fully developed (Ramírez & González, 2016). There are still some reservations about their use that have a strong bearing on teacher training. In fact, teacher training constitutes the variable that exerts the greatest influence on the level of digital competence of teachers, according to studies like the one by González, Gozálvez and Ramírez (2015).

One of the most robust research proposals for the integration of digital resources in teacher training programs is the methodological model known as Technological Pedagogical Content Knowledge (T-PACK) developed by Koehler and Mishra (2008). This model supports a teacher training approach that incorporates digital resources from a threefold perspective: the teacher's acceptance of technology and technological competence, the use of pedagogical models and the didactic application of such technologies (Koh & Divaharan, 2011). In other words, the T-PACK model is based on the interrelatedness of three types of knowledge: pedagogical content knowledge, technological content knowledge regarding how technology can be useful in generating new types of content, and technological pedagogical knowledge, which is the whole body of knowledge related to the use of technology in teaching methodologies. This model has proven relatively successful, so that in the last five years we have seen a proliferation of studies about its impact in teacher training (Gisbert, González, & Esteve, 2016), which trace the teachers' perceptions regarding the significance of digital literacy skills (García-Martín & García-Sánchez, 2017) or measure the teachers' ability to develop digital information among their students and promote their communicative skills in this regard (Claro & al., 2018).

Other relevant studies focus on the integration of professional digital skills into teacher training (Instefjord & Munthe, 2017) and the characterization of such factors as account for digital inclusion

(Hatlevik & Christophersen, 2013) or the proposal of basic criteria for the teaching of digital skills both in schools and in teacher training programs (Engen, Giæver, & Mifsud, 2015).However, research work on the training of teachers in the domains of History and other Social Sciences that involves comprehensive, systematic and comparative studies is still scarce. There are some proposals that have produced a model in order to align evaluation with learning skills and activities (Guerrero-Roldán & Noguera, 2018). Other studies, like the one by Cózar and Sáez (2016), focus on play-based learning or gamification in the initial training of Social Science teachers; or on the digital skills of prospective Social Science teachers as defined by the TPACK model (Colomer, Sáiz & Bel, 2018). All together, they have opened up an avenue of research that needs to be further pursued.

1.3. Research problems

Our main goal is to analyze the existing relationships between the views and perceptions of teachers-in-training regarding the use of digital resources and their own appraisal of History as a formative subject, as well as the didactic strategies that they are expected to implement in the classroom. This general goal, in turn, gives rise to four distinct research problems:

> The T-PACK model is based on the interrelatedness of three types of knowledge: pedagogical content knowledge, technological content knowledge regarding how technology can be useful in generating new types of content, and technological pedagogical knowledge, which is the whole body of knowledge related to the use of technology in teaching methodologies.

- Q1. What is the response profile of teachers-in-training concerning the use of digital resources in the teaching of History? Are there differences between the answers provided by Spanish and British respondents?
- Q2. What is the relationship between the opinions of teachers-in-training about the use of digital resources and their perception of evaluation processes?
- Q3. What is the relationship between the opinions of teachers-in-training about the use of digital resources and the value they attach to History as a formative subject?
- Q4. What is the relationship between the opinions of teachers-in-training about the use of digital resources and the value they attach to the development of historical skills in the classroom?

2. Material and methods

2.1. Participants

The context in which this research took place is the professional postgraduate degree that provides graduates with the required qualification to become Secondary Education teachers of History both in Spain and in Britain. 506 teachers-in-training were recruited all of whom were enrolled in either Spain's Master's degree in secondary education, History and Geography specialty (344), or Britain's Postgraduate Certificate in Education courses or Teach First programs (162) by the end of academic year 2015-2016. 22 universities joined the study, 13 from Spain and 9 from Britain. Even though the number of British participants was lower, the sample representativeness was similar for both countries.

According to official data, and following consultation with a British expert in teacher training, its is estimated that a population of 1,200 students in Spain and 800 in Britain are enrolled in these professionally-geared degrees. The choice of these two countries is due to their different traditions in History education —in the case of Britain focused on the development of historical skills by contrast with Spain's emphasis on conceptual contents and transversal competencies.

2.2. Research approach

The design chosen for the purpose of the present study was quantitative and non-experimental, involving the use of a Likert scale questionnaire (1-5). Survey-based designs are quite common in the field of education, since they are applicable to multiple problems and make it possible to collect information on a high number of variables (Sapsford & Jupp, 2006).

2.3. Data collection instrument

The data used are part of a questionnaire named "Views and perceptions of teachers receiving initial training on History learning and the evaluation of historical competencies". The questionnaire was validated by four experts from different areas and universities in Spain who had extensive experience in Secondary Education. It was constructed around the pertinence and clarity of each of the items: only items scoring three on average were eventually included. The first part of the questionnaire deals with identification details and includes information about the university, gender, age and training background of respondents. The second one consists of three thematic blocks. The first block, titled "Views and perceptions about evaluation and its role in the teaching-learning process" focuses on teaching practices in relation to traditional and innovative profiles, following studies like those authored by Alonso-Tapia and Garrido (2017) or Stufflebeam and Shinkfield (2007).

The second block, "Views and perceptions about History as a formative subject, methods, sources and teaching resources" deals with the opinions of respondents with regard to the epistemology of History and its function as a subject in education. This section draws upon the Beliefs History Questionnaire used by VanSledright and Reddy (2014). The third block, "Views and perceptions about the evaluation of historical competencies in Secondary Education: use of sources, causal reasoning and historical empathy", is mainly based on the three basic principles of historical thinking: causal explanation, sources and evidences, and empathy or historical perspective (Martínez-Hita & Gómez, 2018).

Once the questionnaire was validated by the experts, it was translated into English and submitted for further validation to the ethics committee of the University College of London's Institute of Education, which provided its approval. For the purpose of collecting the information we previously contacted teachers in both countries. Completed questionnaires were collected in paper format from the universities of Murcia, Alicante, Valencia, Barcelona, La Rioja, Zaragoza, Oviedo, Cantabria, Valladolid, Burgos, Madrid (Universidad Autónoma), Málaga and Jaén. In Britain, questionnaires were collected, both on line and in format paper from the following universities: IoE-UCL, Exeter, Edge Hill, Metropolitan Manchester, York, Leeds, East-Anglia, Birmingham and Christ Church of Canterbury.

2.4. Procedure and data analysis

Data analysis was performed along three stages: a) Exploration of the structure of assessments on the usefulness of digital resources through latent class analysis; b) Estimation of confirmatory factor models for all three questionnaire blocks; c) Estimation of the differences across classes as regards the variables modeled under point b. All the analyses were performed by using Mplus 7.0 (Muthén & Muthén, 2015).

2.4.1. Latent class analysis

In the first place, modeling was performed on the assessments provided by students regarding the importance of using the several modalities of digital resources (Internet, digital and printed press, films and documentaries on historical topics, video games and comics). To this end we used latent class analysis (LCA). LCA constitutes a useful method in order to statistically identify internally homogenous groups on the basis of continuous or categorical multivariate data. LCA uses probabilistic models for non-observable group membership unlike other clustering methods based on the detection of conglomerates by means of arbitrary or theoretical distance measurements (Hagenaars & McCutcheon, 2002). The number of classes was determined by using fit indices: entropy, the Akaike Information Criterion (AIC), the Bayesian Information Criterion (BIC), the sample-size ajusted BIC (ssaBIC) and the Lo-Mendell-Rubin test (LMR). Lower values for AIC, BIC and saaBIC suggest a better fit of the current model with respect to the more parsimonious previous one. Entropy is an index of the accuracy with which the model classifies individuals (values above .70 suggest a substantial accuracy). The LMR tests the null hypothesis that the solution with

k+1 classes is no better than the solution with k classes. Significant LMR values (p<.05) suggest that the solution involving the higher number of classes represents more closely the structure of the data (Lo, Mendell, & Rubin, 2001).

2.4.2. Estimation of factor models

Prior to estimating interclass differences concerning the variables under examination, confirmatory factor analyses were conducted in order to ensure measurement quality. We first assessed the dimensionality of each scale by means of an optimized parallel analysis (Timmerman & Lorenzo-Seva, 2011). Next, we estimated the confirmatory models according to the number of factors suggested by the parallel analysis.

In order to evaluate the goodness-of-fit of factor models, we estimated the root mean square error of approximation (RMSEA), the comparative fit index (CFI) and the Tucker-Lewis index (TLI). RMSEA values lower than .05 or .08, and CFI and TLI higher than .95 and .90 respectively suggest a good or acceptable fit of the data in the model (Hu & Bentler, 1999). Additionally, we traced the presence of local misfits by using the modification indices (MI) and the standardized expected parameter change (SPEC) for each model. MI values higher than 10 and SEPC values higher than .20 suggest the presence of local sources of misfit that should be investigated before selecting the definitive model (Saris, Satorra & Van der Veld, 2009). In order to estimate all factor models, we used means and variance adjusted weighted least squares (WLSMV), given the ordinal nature of the input data.

2.4.3. Class comparison

Classes were compared by using the standardized factor scores obtained for each of the scales. A t-test was performed on every pair of classes. A significance level of .01 was used in order to decrease the probability of classifying as significant differences that are substantially irrelevant. For every significant contrast, we estimated the effect size (Cohen, 1988).

3. Results

3.1. Latent class analysis

Table 1 contains the results of our latent class analysis. We estimated models of a maximum of five classes (the six-class solution could not be correctly estimated due to a non-positive definite derivative matrix). The one-class solution, equivalent to a unidimensional factor model, obtained the worst fit of all consulted indices.

Table 1. Results of the latent class analysis						
Classes	fp	AIC	BIC	ABIC	Entropy	LMR test
1	16	11472	11540	11489	1	-
2	25	10823	10928	10849	.81	.0017
3	34	10664	10808	10700	.75	.015
4	43	10524	10706	10569	.76	.0027
5	52	10483	10703	10560	.76	.679

Note. fp=free parameters; AIC=Akaike Information Criterion; BIC=Bayesian Information Criterion; VLRM=Lo-Mendell-Rubin likelihood ratio test.

AIC, BIC and saaBIC showed improved values as far as the five-class solution was concerned. However, the BIC and saaBIC improvement in the five-class model with regard to the four-class model could not be taken as strong evidence in favor of the model with more parameters (ΔBIC=3 and ΔsaaBIC=9 were in both cases lower than a Bayes factor of 150; Raftery, 1995). The LMR test suggested the inclusion of more classes until reaching the five-class model, where LMR turned out to be non-significant (p=.679), thus suggesting that the four-class model should be retained. Entropy was adequate in all cases. Given these results, we chose to retain the more parsimonious four-class solution.

The response profile of the several classes is shown in figure 1. The lines represent the average score for each item per class (the higher the score, the more importance is attached to the items within digital resources).

Figure 1. Response profile of latent classes
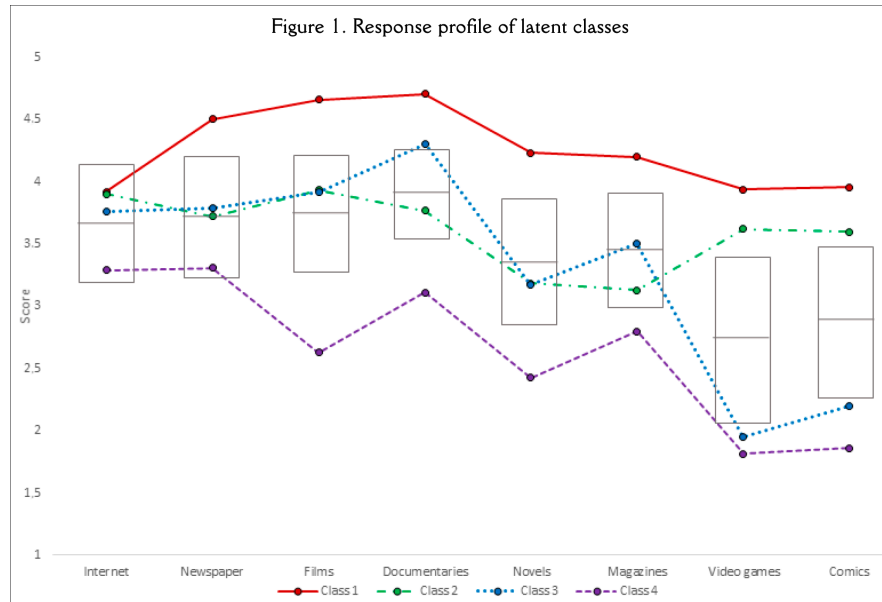
The rectangles represent a standard deviation around the mean (horizontal line) estimated on the basis of the data from the full sample. Class 1 (21.2% of the sample) assigned high values to all items in digital resources. Class 2 (25.7%) assigned moderately high values to all items, with the exception of those with a larger written content (popularizing magazines and historical novels), which obtained somewhat lower values.

Figure 2. Results of the parallel analysis for each scale
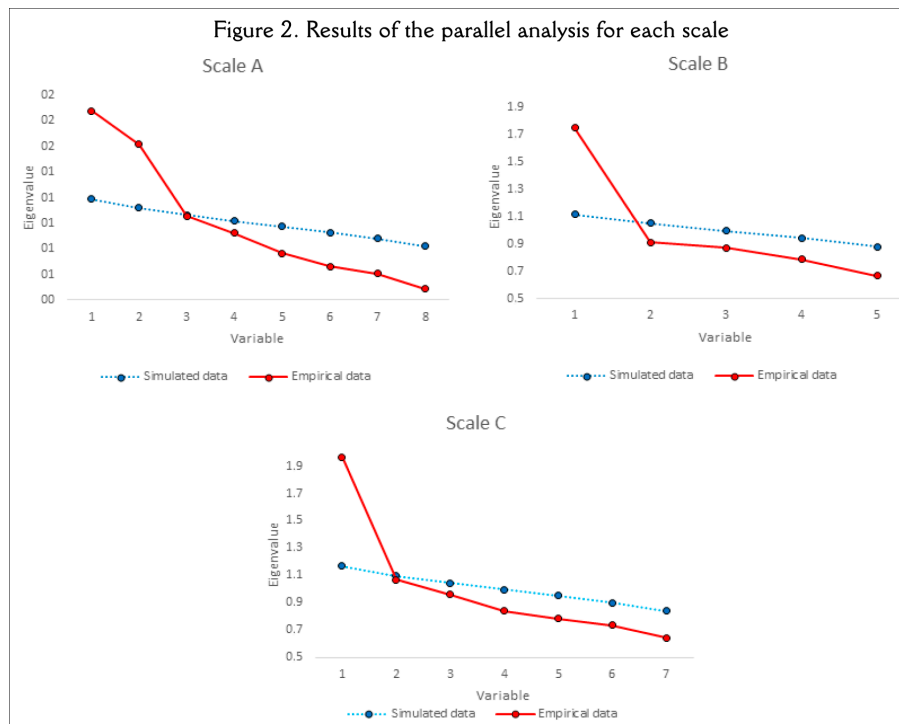
Class 3 (30.1%) showed a very similar profile to class 2, except for the items "documentaries", which received slightly higher values, and "video games" and "comics", where values were substantially low (unlike in class 2). Lastly, class 4 (22.9%) was assigned intermediate (Internet, digital and printed press,

documentaries), low (film, novels and popularizing magazines) or very low values (comics and video games). The distribution of individuals across classes was significantly different in Spain and Britain ($\chi^2(3)=28.96$, p.=.001), but hardly relevant in any case (Cramer's V=.21).

3.2. Factor analysis

Figure 2 (panels a, b and c) shows the results of the parallel analysis for each scale. The analysis suggested a two-factor structure for scale A and a one-factor structure for scales B and C, since only one of the empirical eigenvalues was higher than the simulated eigenvalues (1,000 matrices).

Items on scale A underwent an exploratory factor analysis (weighted least squares for categorical variables implemented on FACTOR 10.9; Lorenzo-Seva & Ferrando, 2006). The two-factor correlated solution produced a clear structure where one factor clustered items referring to the preference for traditional evaluation procedures, and another one clustered those other items related to innovative evaluation procedures.

Traditional evaluation procedures clustered by factor A1 were: a) evaluation is a positive element; b) it must rely on curricular precepts; c) qualitative techniques must have a lower impact; and d) the examination is an objective procedure. The more innovative procedures clustered by factor A2 were: a) conceptual concepts must have a lower impact; b) traditional evaluation procedures hamper innovation; and c) traditional innovation procedures are related to school failure. Inter-factor correlation was negative and low (-.31), suggesting that the preference for innovative methods does not necessarily imply the rejection of traditional methods (and vice versa). Factor B clustered items related to conceptions of history as a formative subject from a traditional perspective: a) History is simply knowledge of the past; b) the disagreement among historians is only due to problems about sources; c) historical contents must be based on the origin of the nation; d) sound reading and memory skills are enough to interpret sources; e) it is complicated to use methods of inquiry. Factor C included items that were least inclined to the development and evaluation of historical skills in the classroom, save for the use of sources: a) it is essential to memorize dates; b) items supporting the use of sources; c) items against causal explanation; d) items against the use of historical empathy.

Table 2 contains the fit indices of confirmatory factor models. In the case of variable A, the two-factor correlated model achieved a sufficient goodness-of-fit according to RMSEA and CFI, but a suboptimal one according to TLI.

Table 2. Fit indices for confirmatory factor models						
Model	fp	RMSEA	CFI	TLI	CSq(df)	CSq/df
A	36	0.08	0.921	0.872	54(13)	4.15
A(cus)	37	0.066	0.951	0.912	38(12)	3.17
B	25	0.045	0.975	0.95	10(5)	2.00
C	34	0.061	0.913	0.869	40(14)	2.86
C(cus)	36	0.037	0.972	0.95	20(12)	1.67

Note. pl = free paramaters; RMSEA = Root mean square error of approximation; CFI = Comparative fit index; TLI = Tucker-Lewis index; df = degrees of freedom.

We can observe that the correlation between residuals for two items specifically referred to content evaluation obtained MI and SEPC values respectively higher than 10 and .20. Since it is to be expected that pairs of items referring to very specific aspects of content should exhibit moderate correlations beyond those explained by the factor itself (Brown, 2006), we chose to dispense with that correlation. The resulting model displayed a sufficient goodness-of-fit (RMSEA=.06, CFI=.951, TLI=.912). The unidimensional model for variable B obtained a close fit (RMSEA=.04, CFI=.97, TLI=.95) without further model specifications being needed. The unidimensional model for variable C obtained a sufficient goodness-of-fit on RMSEA and CFI, but not on TLI (.86). The main sources of misfit in this case were two correlations between residuals. Such specific shared variance was modelled by dispensing with both correlations, which resulted in a substantially better fit (RMSEA=.03, CFI=.97, TLI=.95).

3.3. Interclass comparison

For the purpose of interclass comparison, we use the standardized factor scores (M=0, DT=1) estimated by means of the factor models described above. Table 3 contains the results of the t tests.

Table 3. Results of t tests			
Factor	Class	Size effect	sig.
FA 1	1 vs. 2	.76	.000
	1 vs. 3	.54	.000
	1 vs. 4	.46	.000
	2 vs. 3	.23	.055
	2 vs. 4	.70	.000
	3 vs. 4	.92	.000
FA 2	1 vs. 2	.02	.835
	1 vs. 3	1.7	.000
	1 vs. 4	1.4	.000
	2 vs. 3	1.7	.000
	2 vs. 4	1.4	.000
	3 vs. 4	.34	.000
FB	1 vs. 2	.46	.000
	1 vs. 3	.23	.034
	1 vs. 4	.93	.000
	2 vs. 3	.22	.095
	2 vs. 4	.47	.001
	3 vs. 4	.69	.000
FC	1 vs. 2	.06	.657
	1 vs. 3	.25	.030
	1 vs. 4	.31	.011
	2 vs. 3	.34	.013
	2 vs. 4	.28	.050
	3 vs. 4	.59	.000

The main differences across classes were observed in factors A1 and A2, where ten out of twelve contrasts turned out to be significant with effect size ranging from very low (.34) to very high (1,77). Factor B showed significant differences in four out of six contrasts, with effect sizes ranging from moderate (.47) to high (.93). Finally, factor C only presented one significant difference with a moderate size effect (.59).

In order to facilitate the interpretation of results, figure 3 shows the mean standardized factor scores by class and factor. Regarding variable A1, class 4 showed substantially more favorable appraisals of traditional methods than the remaining classes: classes 2 and 3 showed intermediate ratings and class 1 expressed very unfavorable ones. Regarding variable A2, the most favorable views on innovative procedures were presented by classes 1 and 2, with very large differences (as many as 1.7 standard deviations) compared to classes 3 and 4, which showed moderately unfavourable assessments of innovative procedures. Regarding variable B, the main differences were observed in class 1, which produced a substantially negative appraisal of traditional perceptions of History; and in class 4, which showed moderately positive appraisals. In the case of variable C, the single relevant difference was observed between classes 3 (slightly negative appraisals) and 4 (slightly positive appraisals).

4. Discussion and conclusions

The results of the latent class analysis and the interclass comparison performed by using the factor model for each of the questionnaire blocks enable us to answer all four research problems.

P1. Taken as a whole, the classes reflect two issues: a) In the first six analyzed items, the classes are virtually arranged like a continuum ranging from high (class 1) to moderate ratings (classes 2 and 3), and from moderate to low (class 4); b) The previous arrangement changes in the case of comics and video games, where classes are organized around two opposite extremes resulting in a highly polarized bimodal distribution involving two substantially favourable classes (1 and 2) and two highly unfavourable ones (3 and 4). Differences in class size, on the other hand, are not very relevant, since all range between 21 and

30% of the sample. As for the differences between the results for Spain and Britain, these are scarce from a statistical point of view and basically concern the sizes of individual classes.

P2. There is no single bipolar continuum of traditional-innovative processes. The preference for innovative or traditional procedures operates as a binomial of two different and scarcely dependent factors, so that one can find individuals who prefer innovative processes without necessarily rejecting traditional ones. The traditional process factor is clearly class-related in the sense that the higher the rating assigned to the usefulness of digital resources, the lower the preference for the use of traditional procedures (this relation is clearly seen in classes 1 and 4). In the innovative process factor, groups are polarized in a similar fashion to what happened with the ratings of comics and videogames. Thus, classes 1 and 2 (positive assessments of comics and video games) are quite in favor of using innovative strategies. In comparison, classes 3 and 4 (low value attached to comics and video games) express a lower preference for innovative processes. The results show a clear correlation between the value assigned to innovative methodologies, on the one hand, and to the usefulness of comics and video games in the History classroom on the other. A clear example of this correlation can be found in class 3, which assigned very similar values to those attached by class 2 to the first six items within digital resources, while expressing a more negative assessment of comics and video games. Class 3 presents assessments of innovative procedures that are radically different from those of class 2. International studies on gamification have shown the close connection between the use of video games in the classroom and the increase in motivation and support of innovation in teacher training (Landers & Amstrong, 2017; Özdener, 2018). Although to a smaller extent, research and innovation experiences have also been published with regard to the use of comics in specific topics in the social sciences and its impact on motivation (Delgado-Algarra, 2017). Teachers-in-training see both resources as two important elements for innovation in the History classroom that are closely tied to motivation.

P3. The result for factor A1 (traditional evaluation procedures) is now repeated, but differences are much slighter in this case. In other words, the higher the ratings for the items under the digital resources category, the lower the values assigned to items presenting history as a formative subject from a traditional perspective. These results are in line with the findings in the study by García-Martín and García-Sánchez (2016), which relates the implementation of active methodologies (together with the use of innovative strategies, styles and approaches) to the acquisition and development of digital skills. In this case, again classes 1 and 4 (which express opposite views regarding the value of digital resources) represent the largest rating differences (.93). Classes 2 and 3 (representing opposite views as regards the rating of comics and video games) assign similar scores to this factor. We can observe that this polarization of classes 2 and 3 is rather related to the views on the value of innovative methodological procedures than to the open rejection of traditional methods. Moreover, since for factor B there is a mixture of methodological and epistemological elements, no differences in the views expressed by both classes (2 and 3) can be attested.

P4. There is only one difference and it qualifies as moderate. A tendency is perceived for factor B. The larger presence of items related to the discipline's epistemology explains the fewer discrepancies across classes. In the case of factor C, the items are mainly related to the development and evaluation of historical competencies. The differences in the teachers' ratings of the use of digital resources were mainly linked to their conception (rather traditional or innovative) of teaching methodologies. Yet such differences did not exhibit the same intensity as regards their epistemological conceptions of history: a mismatch that was already pointed at by Kirschner a decade ago (2009).

In view of the results obtained, we believe it necessary to strengthen digital competencies in teacher training programs that go beyond the mere acquaintance with ICT tools. The T-PACK model provides an alternative where the use of technology is seen from a didactic perspective targeted at teaching contents (Claro & al., 2018). If we implement this model in the training of History teachers, the use of digital resources should encourage the prospective teachers' ability to propose activities where the historian's procedures play a major part. Moreover, such activities should be developed on the basis of questions that enable students to solve problems by applying methods of inquiry. Research on History education over the last few decades has espoused these proposals in the face of traditional approaches and on the basis of a more competency-based epistemological view (Van-Drie & Van-Boxtel, 2008). Until these methodological

perspectives are not brought together, digital resources will play a merely playful and motivational role, and will not develop a truly critical approach that instils in students the ability to evaluate digital information (Hatlevik & Hatlevik, 2018) and solve historical questions. It is necessary to adopt measures within teacher training so as to achieve a competency-based form of History education that resorts to more active learning methods (Gómez & Miralles, 2016) and foregrounds a direct relationship between the implementation of active methodologies (involving the use of innovative strategies and approaches), a shift in the epistemological model of historical knowledge and the development of digital competencies (García-Martín & García-Sánchez, 2016).

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References

Alonso-Tapia, J., & Garrido, H. (2017). Evaluar para el aprendizaje. Evaluación de la comprensión de textos no escritos. *Electronic Journal of Research in Educational Psychology*, *15*(1), 164-184. https://doi.org/10.14204/ejrep.41.16020

Barnes, N., Fives, H., & Dacey, C. (2017). U.S. teachers' conceptions of the purposes of assessment. *Teaching and Teacher Education*, *65*, 107-116. https://doi.org/10.1016/j.tate.2017.02.017

Blömeke, S., Busse, A., Kaiser, G., König, J., & Sühl, U. (2016). The relation between content-specific and general teacher knowledge and skills. *Teaching and Teacher Education*, *56*, 35-46. https://doi.org/10.1016/j.tate.2016.02.003

Brown, T.A. (2006). *Confirmatory factor analysis for applied research*. New York: Guilford Publications. https://bit.ly/2Qe7mzI

Claro, M., Salinas, A., Cabello-Hutt, T., San-Martín, E., Preiss, D.D., Valenzuela, S., & Jara, I. (2018). Teaching in a Digital Environment (TIDE): Defining and measuring teachers' capacity to develop students' digital information and communication skills. *Computers & Education*, *121*, 162-174. https://doi.org/10.1016/j.compedu.2018.03.001

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Hillsdale, NJ: Erlbaum. https://doi.org/10.1016/c2013-0-10517-x

Colomer, J.C., Sáiz, J., & Bel, J.C. (2018). Competencia digital en futuros docentes de Ciencias Sociales en Educación Primaria: Análisis desde el modelo TPACK. *Educatio Siglo XXI*, *36*(1), 107-128. https://doi.org/10.6018/j/324191

Cózar, R., & Sáez, J.M. (2016). Game-based learning and gamification in initial teacher training in the social sciences: An experiment with MinecraftEdu. *International Journal of Educational Technology in Higher Education*, *13*(2), 1-11. https://doi.org/10.1186/s41239-016-0003-4

Darling-Hammond, L. (2006). Assessing teacher education. The usefulness of multiple measures for assessing program outcomes. *Journal of Teacher Education*, *57*(2), 120-138. https://doi.org/10.1177/0022487105283796

Delgado-Algarra, E.J. (2017). Comics as an educational resource in the teaching of social science: Socio-historical commitment and values in Tezuka's manga. *Culture & Education*, *4*, 848-862. https://doi.org/10.1080/11356405.2017.1370819

Engen, B.K., Giæver, T.H., & Mifsud, L. (2015). Guidelines and regulations for teaching digital competence in schools and teacher education: A weak link? *Nordic Journal of Digital Literacy*, *10*(2). https://bit.ly/2WcRDGl

Fives, H., & Buehl, M.M. (2014). Exploring differences in practicing teachers' valuing of pedagogical knowledge based on teaching ability beliefs. *Journal of Teacher Education*, *65*(5), 435-448. https://doi.org/10.1177/0022487114541813

García-Martín, J., & García-Sánchez, J.N. (2017). Pre-service teachers' perceptions of the competence dimensions of digital literacy and of psychological and educational measures. *Computers & Education*, *107*, 54-67. https://doi.org/10.1016/j.compedu.2016.12.010

Gisbert, M., González, J., & Esteve, F. (2016). Competencia digital y competencia digital docente: Una panorámica sobre el estado de la cuestión. *RIITE. Revista Interuniversitaria de Investigación en Tecnología Educativa*, *0*, 74-83. https://doi.org/10.6018/riite/2016/257631

Gómez, C.J., & Miralles, P. (2016). Historical skills in compulsory education: Assessment, inquiry based strategies and students' argumentation. *Journal of New Approaches in Educational Research*, *5*(2), 130-136. https://doi.org/10.7821/naer.2016.7.172

González, G., & Skultety, L. (2018). Teacher learning in a combined professional development intervention. *Teaching and Teacher Education*, *71*, 341-354. https://doi.org/10.1016/j.tate.2018.02.003

González-Fernández, N., Gozálvez-Pérez, V., & Ramírez-García, A. (2015). La competencia mediática en el profesorado no universitario. Diagnóstico y propuestas formativas. *Revista de Educación*, *367*, 117-146. https://doi.org/10.4438/1988-592X-RE-2015-367-284

Guerrero-Roldán, A.E., & Noguera, I. (2018). A model for aligning assessment with competences and learning activities in online courses. *The Internet and Higher Education*, *38*, 36-46. https://doi.org/10.1016/j.iheduc.2018.04.005

Hagenaars, J., & McCutcheon, A. (2002). *Applied latent class analysis*. Cambridge: Cambridge University Press. https://doi.org/10.1017/CBO9780511499531

Hatlevik, I.K.R., & Hatlevik, O.E. (2018). Students' evaluation of digital information: The role teachers play and factors that influence variability in teacher behavior. *Computers in Human Behavior*, *83*, 56-63. https://doi.org/10.1016/j.chb.2018.01.022

Hatlevik, O.E., & Christophersen, K.A. (2013). Digital competence at the beginning of upper secondary school: Identifying factors explaining digital inclusion. *Computers & Education*, *63*, 240-247. https://doi.org/10.1016/j.compedu.2012.11.015

Hu, L.T., & Bentler, P.M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, *6*(1), 1-55. https://doi.org/10.1080/10705519909540118

Instefjord, E.J., & Munthe, E. (2017). Educating digitally competent teachers: A study of integration of professional digital competence in teacher education. *Teaching and Teacher Education*, *67*, 37-45. https://doi.org/10.1016/j.tate.2017.05.016

Kirschner, P.A. (2009). Epistemology or pedagogy, that is the question. In Tobias, S., & Duffy, T.M. (Eds.), *Constructivist Instruction: Success or Failure?* London-New York: Routledge. https://doi.org/10.4324/9780203878842

Kleickmann, T., Richter, D., Kunter, M., Elsner, J., Besser, M., Krauss, S., & Baumert, J. (2012). Teachers´content knowledge and pedagogical content knowledge: The role of structural differences in teacher education. *Journal of Teacher Education*, *1*(17), 10-1177. https://doi.org/10.4324/9780203878842

Koehler, J., & Mishra, P. (2008). Introducing technological pedagogical knowledge. In AACTE (Ed.), *The handbook of technological pedagogical content knowledge for educators* (pp. 3-28). New York: Routledge. http://bit.ly/2MORJk9

Koh, J.H.L., & Divaharan, H. (2011). Developing pre-service teachers' technology integration expertise through the tpack-developing instructional model. *Journal of Educational Computing Research*, *44*(1), 35-58. https://doi.org/10.2190/ec.44.1.c

König, J., Ligtvoet, R., Klemenz, S., & Rothlandb, M. (2017). Effects of opportunities to learn in teacher preparation on future teachers' general pedagogical knowledge: Analyzing program characteristics and outcomes. *Studies in Educational Evaluation*, *53*, 122-133. https://doi.org/10.1016/j.stueduc.2017.03.001

Landers, R.M., & Amstrong, M.B. (2017). Enhancing instructional outcomes with gamification: An empirical test of the Technology-Enhanced training effectiveness model. *Computers in Human Behavior*, *71*, 499-507. https://doi.org/10.1016/j.chb.2015.07.031

Lo, Y., Mendell, N.R., & Rubin, D.B. (2001). Testing the number of components in a normal mixture. *Biometrika*, *88*(3), 767-778. https://doi.org/10.1093/biomet/88.3.767

Lorenzo-Seva, U., & Ferrando, P.J. (2006). Factor: A computer program to fit the exploratory factor analysis model. *Behavior Research Methods*, *38*(1), 88-91. https://doi.org/10.3758/BF03192753

Martínez-Hita, M., & Gómez, C.J. (2018). Nivel cognitivo y competencias de pensamiento histórico en los libros de texto de Historia de España e Inglaterra. Un estudio comparativo. *Revista de Educación*, *379*, 145-169. https://doi.org/10.4438/1988-592X-RE-2017-379-364

Meschede, N., Fiebranz, A., Möller, K., & Steffensky, M. (2017). Teachers' professional vision, pedagogical content knowledge and beliefs: On its relation and differences between pre-service and in-service teacher. *Teaching and Teacher Education*, *66*, 158-170. https://doi.org/10.1016/j.tate.2017.04.010

Monte-Sano, C. (2011). Learning to open up history for students: Preservice teachers' emerging pedagogical content knowledge. *Journal of Teacher Education*, *62*(3), 260-272. https://doi.org/10.1177/0022487110397842

Muthén, L.K., & Muthén, B. (2015). *Mplus. The comprehensive modelling program for applied researchers: User's guide.* Los Angeles: Muthén & Muthén. https://bit.ly/2whpKPb

Oliveira, C., Lopez, J., & Spear-Swerling, L. (2019). Teachers' academic training for literacy instruction. *European Journal of Teacher Education*, *43*, 315-334. https://doi.org/10.1080/02619768.2019.1576627

Özdener, N. (2018). Gamification for enhancing Web 2.0 based educational activities: The case of pre-service grade school teachers using educational Wiki pages. *Telematics and Informatics*, *35*, 564-578. https://doi.org/10.1016/j.tele.2017.04.003

Raftery, A.E. (1995). Bayesian model selection in social research. *Sociological Methodology*, *25*, 111-163. https://doi.org/10.2307/271063

Ramírez-García, A., & González-Fernández, N. (2016). Media competence of teachers and students of compulsory education in Spain. [Competencia mediática del profesorado y del alumnado de educación obligatoria en España]. *Comunicar*, *24*(49), 49-58. https://doi.org/10.3916/C49-2016-05

Sapsford, R., & Jupp, V. (2006). *Data collection and analysis*. London: Sage. https://doi.org/10.4135/9781849208802

Saris, W.E., Satorra, A., & der Veld, W.M.V. (2009). Testing structural equation models or detection of misspecifications? *Structural Equation Modeling*, *16*(4), 561-582. https://doi.org/10.1080/10705510903203433

Shulman, L. (1987). Knowledge and teaching: Foundations of the New Reform. *Harvard Educational Review*, *57*(1), 1-23. https://doi.org/10.17763/haer.57.1.j463w79r56455411

Stufflebeam, D.L., & Shinkfield, A.J. (2007). *Evaluation theory, models, and applications*. San Francisco: Jossey-Bass. http://bit.ly/2XQQ0fq

Timmerman, M.E., & Lorenzo-Seva, U. (2011). Dimensionality assessment of ordered polytomous items with parallel analysis. *Psychological methods*, *16*(2), 209-220. https://doi.org/10.1037/a0023353

Van-Drie, J., & Van-Boxtel, C. (2008). Historical reasoning: Towards a framework for analyzing student's reasoning about the past. *Educational Psychology Review*, *20*, 87-110. https://doi.org/10.1007/s10648-007-9056-1

VanSledright, B.A., & Reddy, K. (2014). Changing Epistemic Beliefs? An exploratory study of cognition among prospective history teacher. *Tempo e Argumento*, *6*(11), 28-68. https://doi.org/10.5965/2175180306112014028

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Competence of future teachers in the digital security area

Competencia de futuros docentes en el área de seguridad digital

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ABSTRACT

The use of technologies and the Internet poses problems and risks related to digital security. This article presents the results of a study on the evaluation of the digital competence of future teachers in the DigCompEdu European framework. 317 undergraduate students from Spain and Portugal answered a questionnaire with 59 items, validated by experts, in order to assess the level and predominant competence profile in initial training (including knowledge, uses and interactions and attitudinal patterns). The results show that 47% of the participants belong to the profile of teachers at medium digital risk, evidencing habitual practices that involve risks such as sharing information and digital content inappropriately, not using strong passwords, and ignoring concepts such as identity, digital "footprint" and digital reputation. The average valuations of each item in the seven categories show that future teachers have an average competence in the area of digital security. They have good attitudes toward security but less knowledge and fewer skills and practices related to the safe and responsible use of the Internet. Future lines of work are proposed, aimed at responding to the demand for a better prepared and more digitally competent citizenry. The demand for education in security, privacy and digital identity is becoming increasingly important, and these elements form an essential part of initial training.

RESUMEN

El uso de las tecnologías e Internet plantea problemas y riesgos relacionados con la seguridad digital. Este artículo presenta los resultados de un estudio sobre la evaluación de la competencia digital de futuros docentes en el marco europeo DigCompEdu. Participan 317 estudiantes de Grado de España y Portugal. Se aplica un cuestionario con 59 ítems validado por expertos con el objeto de conocer el nivel y perfil competencial predominante en la formación inicial (incluyendo conocimientos, usos e interacciones y patrones actitudinales). Los resultados muestran que el 47% de los participantes pertenecen al perfil de docentes en riesgo digital medio, evidenciando prácticas habituales que conllevan riesgos tales como compartir información y contenidos digitales de forma inapropiada, no utilizar contraseñas seguras, y desconocer conceptos como identidad, huella o reputación digital. Las valoraciones medias de cada ítem en las siete categorías evidencian que los futuros docentes poseen una competencia media en el área de seguridad digital. Tienen buenas actitudes hacia la seguridad, pero menos conocimientos, habilidades y prácticas relacionadas con el uso seguro y responsable de Internet. Se plantean futuras líneas de trabajo enfocadas a dar respuesta a la exigencia de una ciudadanía mejor preparada y más competente digitalmente. La demanda de formación en seguridad, privacidad e identidad digital está siendo cada vez más importante, reconociéndose que es muy necesaria en la formación inicial.

KEYWORDS | PALABRAS CLAVE

Digital competence, teacher education, privacy, cyber security, Internet, teachers, university, initial training.
Competencia digital, formación del profesorado, privacidad, seguridad cibernética, Internet, docentes, universidad, formación inicial.

1. Introduction

Digital competence takes the form of cognitive, attitudinal, and technical skills that help to mitigate numerous problems and challenges in the knowledge society. Dynamic and transversal, digital competence is considered as a key competence in developing a digital citizenry and as a crucial element in lifelong learning processes (Janssen, Stoyanov, Ferrari, Punie, Pannekeet, & Sloep, 2013).

Digital competence is the ability to use technologies critically and safely for work, leisure, and communication. It involves using them to recover, evaluate, store, produce, present, and exchange information, as well as to communicate and participate in collaboration networks through Internet (Parliament & European Council, 2006). Digital competence includes issues related to technology, information, multimedia, and communication that encourage critical, responsible, creative use of technology—issues fundamental to learning processes and participation in the 21st century (Esteve, Gisbert, & Lázaro, 2016; Napal, Peñalva-Vélez, & Mendióroz, 2018).

The framework for development of digital competence in Europe (DigComp) provides the structure for understanding and evaluating digital competence. This framework is consolidated and disseminated internationally through the European Framework for the Digital Competence of Educators (DigCompEdu) (Redecker, 2017). In Portugal and Spain, it is used to evaluate users' digital competence using different levels: basic (level A), intermediate or independent (level B), and advanced or competent (level C), based on the user's knowledge, abilities, and skills.

In Latin America, it is adopted to search for, choose, and process information critically; communicate using various formats; act responsibly; and take advantage of technology to learn and to solve problems (Lueg, 2014). Digital teaching competence (DTC) is the comprehensive set of personal characteristics, knowledge, abilities, and attitudes required to act effectively in various teaching contexts (Tigelaar, Dolmans, Wolfhagen, & Van-der-Vleuten, 2004). It mobilizes abilities and skills related to use of ICT to generate knowledge (Flores-Lueng & Roig, 2016), stimulating more conscious and positive use of these media in education (Pedro & Chacon, 2017).

DTC involves knowing how to use technologies to teach and learn with didactic and pedagogical criteria and moral and ethical sense (Krumsvik, 2009). It is crucial to understand DTC from a holistic perspective—that is, both to integrate ICT properly into the curriculum and classroom and to ensure development of the student's digital competence (Álvarez & Gisbert, 2015; Fernández-Cruz & Fernández-Díaz, 2016; Prendes, Castañeda, & Gutiérrez, 2010).

1.1. Safety in DTC

Safety in DTC involves protection of users' information and communication against the problems generated by ICT use (Barrow & Heywood-Everett, 2006). It is related to the privacy, integrity, and efficiency of Internet technology and information (Anderson, 2003). Safety refers to teachers' knowledge, abilities, and attitudes to design and develop learning experiences that promote, model, and train students as digitally responsible citizens.

People who teach play a special leading role in fostering acquisition of digital competence, since the teacher is a model and guide who cares for, orients, and trains others about responsible use of navigation, communication, and collaboration, as well as sharing information through Internet. This role can cause problems, however, due to a mistaken conception, that teachers teach about safety as if students only understood and had a single concept of Internet (Edwards & al., 2018).

DigComp (2016) and DigCompEdu (2017) have provided the foundation for developing a framework for digital competence of educators (MCCDD, 2017). They include competences concerning digital safety, such as protection of personal data and privacy, protection of health, and proper management of digital identity. The framework stresses responsible use, respect for the principles of online privacy that apply to oneself and others, and care for the environment.

In the area of safety, the competent user can "review the safety configuration of systems and applications, react if his/her computer equipment is infected with a virus, configure and/or modify the firewall and safety parameters of his/her electronic devices, encrypt emails and archives, and apply filters to avoid email spam" (http://bit.ly/30qMppL).

Research on digital safety (e-safety, digital safety, Internet safety, or Internet safety) is undertaken in different disciplines, such as Psychology, Education, and Law, and research has proliferated in the past decade (Jones, Mitchell, & Finkelhor, 2013; Shin, 2015; Šimandl & Vanícek, 2017; Chou & Peng, 2011; Napal, Peñalva-Vélez, & Mendióroz, 2018). Yet both in- and preservice teachers show low mastery of topics related to digital safety (De-Waal & Grösser, 2014).

Various reports, studies, and strategic plans attempt to help construct a climate of trust to mitigate or prevent the effects safety -related problems, especially in vulnerable groups, through actions such as incorporation of content on safety and responsible Internet use; design of itineraries to prevent, sensitize, raise awareness of, and improve trust and communication in Internet use; and foster the digital competence of parents and teachers, stressing social and emotional abilities to support and understand children's use of ICT and the problems that can be avoided, among other issues.

1.2. Training of preservice teachers in digital safety

Education systems recognize the importance of training teachers in mastery of ICT, particularly concerning safety, but initial training teacher programs usually treat digital competence transversely (Napal, Peñalva-Vélez, & Mendióroz, 2018).

Study programs show a clear dispersion of required subjects on educational technologies, with differing presence across universities, polytechnics, and other institutions of higher education. There is no doubt that the preservice teacher needs knowledge (pedagogical

> Initial training with a coherent approach is necessary, where safety should be taught as a matter of high priority in the educational field, especially in training programs within a common digital competence framework.

and content-related), abilities (social and technical), and attitudes concerning digital safety and how to teach it. We expect teachers to assume responsibilities in teaching digital safety and orient their students to the rules for Internet behavior, but teachers often lack sufficient preparation to understand risks and unethical behavior (Chou & Peng, 2011). The educator can serve as a model to help improve students' behavior when using technology, have conversations about risks and damage, and influence students significantly through his/her action (Chou & Chou, 2016; Šimandl, 2015; Shin, 2015).

In sum, initial training should be responsive to society's current needs so that professionals adapt to innovation processes and can compete in and for use of technology on the labor market (Tejada & Pozos, 2018). Our new digital culture demands teachers who are useful, practical, and oriented to training critical, responsible citizens. Various studies indicate the pressing need for educational institutions centers to adopt coherent focus that guarantees training to promote safety as a high-priority question in education, especially in teacher training programs (Barrow & Heywood-Everett, 2006; Woollard, Wickens, Powell, & Rusell, 2009; Chou & Peng, 2011; Engen, Giæver, & Mifsud, 2015; Shin, 2015).

Work is being done internationally to improve safety in Asian and European organisms through education and training. In Taiwan, the TAIS program (2006-2010) identified four aspects for the training of competent teachers: safety and protection of communications, suitability of information, online safety and own use of technological devices.

In the EU, organisms such as the British Educational Communications and Technology Agency (BECTA) and various studies in Nordic countries and the Czech Republic stress training teachers and conclude that prior experiences, knowledge, practices, opinions, and perceptions determine how teachers should teach, resolve, and attend to digital safety problems (Engen, Giæver, & Mifsud, 2015; Šimandl & Vanícek, 2017). At global level, UNICEF proposes the importance of consolidating actions and educational measures for and from educational institutions, the shared responsibility of parents and teachers, and the need to dedicate educational resources to education and prevention programs that help

to avoid threats and protect against the dangers of the digital world (United Nations Children's Fund (UNICEF), 2017).

The goals of our study are:

1) To identify preservice teachers' level of digital competence in safety.

2) To describe the competence profile of preservice teachers in different areas of safety (interaction through technologies, sharing of digital information and contents, protection of personal data, protection of health, netiquette, digital identity, and cyberbullying on social networks and Internet).

3) To explore differences by sex, gender, and age at which one begins using social networks in each of the different areas in order to determine training needs to improve preservice teachers' digital competence in safety.

4) To provide pedagogical activities in safety appropriate to preservice teachers' strengths and weaknesses.

2. Material and methods

We perform a descriptive, transversal study of 317 undergraduates 18-43 years old (M=22.2; DT=4.8). The students are from four Spanish and one Portuguese university; 248 (78.2%) are women and 69 (21.8%) men.

Figure 1. Categories of questionnaire on safety
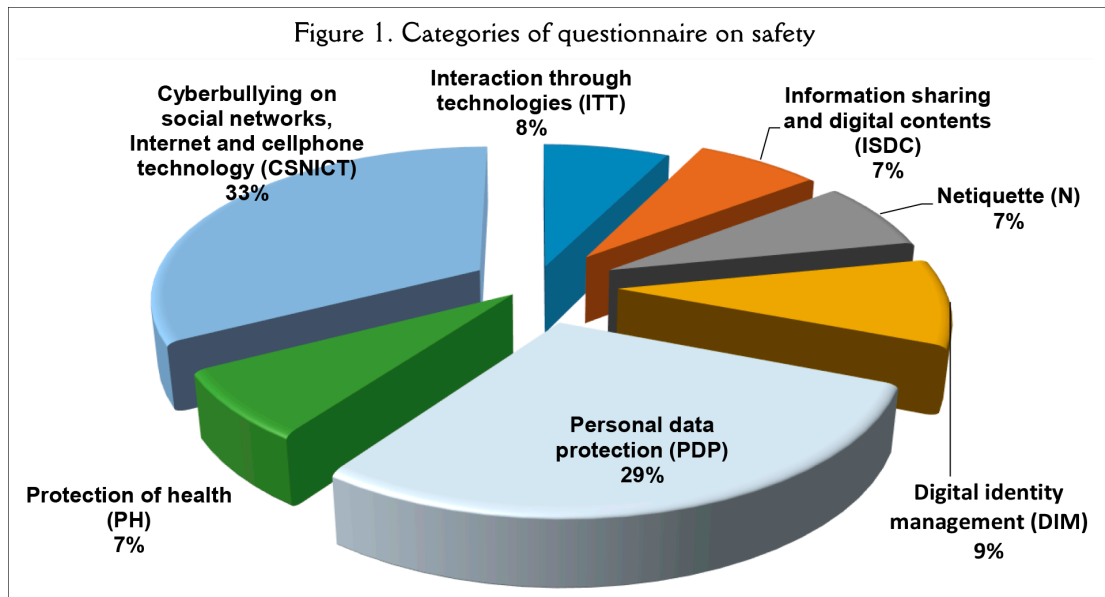
The survey instrument is an ad hoc questionnaire for preservice teachers designed based on areas of safety from DigComp 2.0, DigCompEdu, the common framework for DTC (INTEF, 2017), the NETS*S project (ISTE, 2007), and a tool for self-diagnosis of digital competences from the Andalusian Regional Government (http://bit.ly/2YnNixx).

The questionnaire has 59 items divided into seven categories (Figure 1) and was validated by eight experts from Spanish and Portuguese universities with teaching and research experience in educational technologies. We obtain an Alpha Cronbach of $\alpha=.923$, as well as values for the criteria of clarity (.916), relevance (.914), and importance (.946). The items are divided into knowledge (K=24 items), abilities and practices (A&P=23 items), and attitudes (A=10 items). Table 1 groups the items under these dimensions. The statistical analysis was performed with SPSS 24.0. Using a two-stage cluster procedure, we classified the participants according to competence levels, with a three-category solution (significance level 5%). We also performed univariate descriptive analysis, calculating the mean and confidence interval at 95%, as well as the standard deviation. For the qualitative variables, we calculated frequency and percentage, and analyzed the relationship among them using the Chi-square test. With the nonparametric

Spearman's rho correlation coefficient, we analyzed the association among the numerical variables. To study the relationship between numerical and dichotomous variables, we applied the nonparametric Mann-Whitney test, calculating the effect size. The relationship between the categorical and numerical variables was analyzed using the nonparametric Kruskal-Wallis test. For the tests with statistically significant results, we used the Mann-Whitney test to compare the categories by pairs.

Table 1. Dimensions of digital safety questionnaire	
Knowledge (K)	Technical knowledge to tag information with other people (ISDC2). Technical knowledge to share information with others (ITTISDCI). Concept of digital identity (DIM1). Concept of digital reputation (DIM4). Knowledge of rules for online communication and behavior (N1). Creation of strong passwords (PDP1). Risks of wrongful appropriation of usernames and passwords (PDP3). Digital fingerprint and safety of browsers to prevent saving of passwords and browsing data (PDP10). Importance of data protection (PDP15). Physical and mental health risks of Internet (PSI). Measures or protocols to protect physical and mental health (PS2). Application of action patterns to avoid risks, abuses, scams, or other problems(PS4). Cases of bullying and abuse of social networks (CSNICT1). Inappropriate use of social networks (CSNICT4). Preventive measures to avoid problems of inappropriate technology use (cyberbullying) (CSNICT5). How to act in case of cyberbullying or other safety problems (CSNICT7). Identifying situations related to network abuses and cyberbullying (CSNICT9). Serious risks and relationship to cyberbullying (CSNICT13). Situations of risk due to technologies and Internet (CSNICT14). Most common social networks at high risk of bullying (CSNICT15). Social effects of cyberbullying and other network problems (CSNICT16). Causes of risks and cyberbullying through Internet, social networks, or technological devices (CSNICT17). Areas of DTC that help to prevent situations of bullying (CSNICT18).
Attitudes (A)	Care for one's image on social networks (DIM2). Peer group promotion of digital image protection and care (GID3). Respectful language when writing on different social networks (N2). Care in writing on social networks (N3). Not giving personal information to strangers (PDP7). Bad feeling and rejection on learning of cases of bullying or abuse on social networks (CSNICT2). Having positive attitudes to avoid problems related to Internet use that affect physical or mental health (CSNICT6). Responsibility as a future educator for implementing educational and preventive actions involving safety (CSNICT10). Importance of knowing, practicing, and modelling behavior that encourages responsible Internet use (CSNICT11).
Abilities and practices (A&P)	Introduction to social networks (IP3). Places to access Internet (IP4). Use of specific technological devices/tools (ITT1). Number of email accounts used (IMT2). Active participation in social networks (ITT3). Disseminating and resending information easily (ISDC3). Disseminating and resending information without others' consent (ISDC4). Searching for information and updating matters such as identity and data management (DIM5). Use of communication rules and behavior based on social network or email use (N4). Frequent change of passwords (PDP2). Sharing usernames and passwords (PDP4). Use of different passwords to prevent theft (PDP5). Use of unblocking patterns and passwords (PDP6). Use of strong passwords (PDP8). Deactivating options for saving passwords on devices (PDP9). Blocking devices when leaving them or when leaving devices in the presence of others (PDP11). Covering phone and computer cameras when not in use(PDP12). Publishing information that can harm digital image, identity, or reputation (PDP13). Recommending that contacts be careful with their digital identity and reputation (PDP14). Searching for information on data protection and digital reputation (PDP16). Applying measures or protocols to care for physical and mental health (PH3). Sharing information with peer groups or family on problems of bullying and online safety (CSNICT3). Attending training activities (CSNICT8). When to learn appropriate use of ICT? (CSNICT12).

3. Results

3.1. Levels of competence in digital safety

The analysis performed enabled us to identify three groups of digital competences in safety, with high, medium, and low levels, respectively. We compare the mean values for each category on the

questionnaire (Figure 2).

In 34% of cases, we find "digitally secure teachers". These participants use few technological devices, email accounts, and social networks (ITT); share information with the consent of third persons (ISDC); and know, apply, and respect the rules of communication and behavior (N). As to digital identity and reputation, they avoid publishing personal information that could affect their digital image (DIM), and use different passwords, which they change often. They know and use blocking patterns on their devices, avoid having their passwords recorded on devices that are not their own (PDP), and are aware of the importance of not letting Internet abuse affect their health (PH).

The medium level, "teachers at medium digital risk", accounts for 47% of the cases. These participants are able to upload and share information on social networks (ISDC), know communication rules but do not always follow them (N), and care for their image on social networks. They may, however, have some personal data on Internet that does not correspond to reality (DIM). They avoid sharing their passwords and personal information on social networks and have information about account protection (PDP). They also have information about the risks Internet or excessive use that social networks pose to physical and mental health and know measures and protocols for protection, although they do not always follow these protocols (PH).

Figure 2. Levels of competence in safety
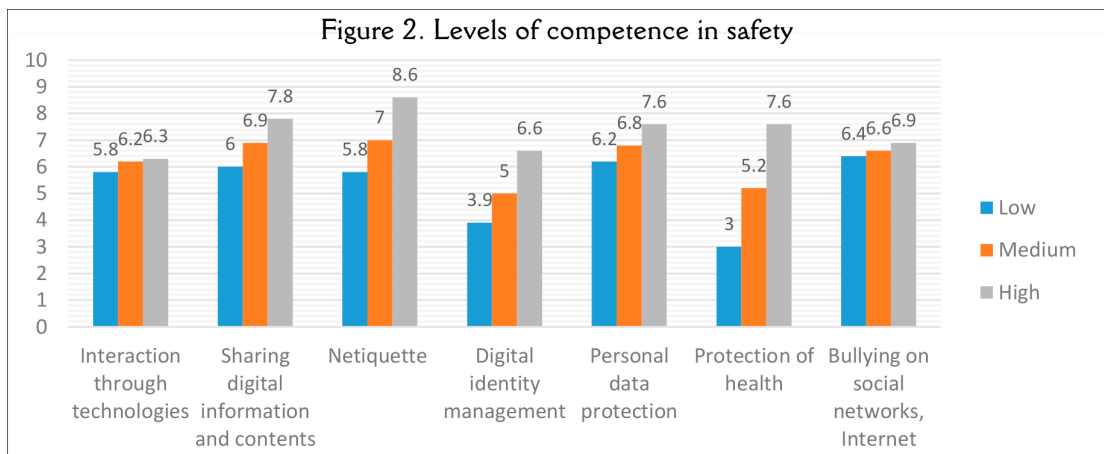
Among the preservice teachers, 18% showed a low level and are thus considered as "teachers at digital risk". These participants are always connected to Internet, have more than five devices, and use different email accounts and more than five social networks (ITT). They are able to upload and share photos and generally do not have difficulty managing social networks (ISDC). They do not know, and thus do not follow, rules for communication and behavior (N). Independently of the group to which they belong, only 7% of survey respondents had participated in some training activity on topics related to digital safety.

3.2. Profiles of competence in safety by age, gender, age at which one began social network use, and places of access to Internet

The age group 20-24 years old constitutes the largest number of participants (50%) in all three levels of safety competence. Students over 24 represent 17%. We can identify "digitally secure preservice teachers", who show greater competence in netiquette (8.62), sharing digital information and content (7.76), personal data protection (7.64), and protection of health (7.64). This group shows lower values for bullying on social networks, Internet, and cellphones (6.87); digital identity management (6.59); and interaction through technologies (6.27).

Figure 3 illustrates this trend. The "preservice teachers at medium digital risk" show high values in the same categories, although the averages are lower: netiquette (6.97); sharing digital information and content (6.88); personal data protection and protection of health (6.76); bullying on social networks, Internet, and cellphones (6.64); and interaction through technologies (6.20). The categories for protection of health (5.24) and digital identity management (4.99) are even lower. The "preservice teachers at digital risk" show

greater competence concerning bullying on social networks, Internet, and cellphones (6.40); personal data protection (6.20); sharing digital information and content (5.94); and netiquette (5.79). They show lower levels of competence, however, in digital identity management (3.93) and protection of health (3.04).

Figure 3. Competence levels by age group
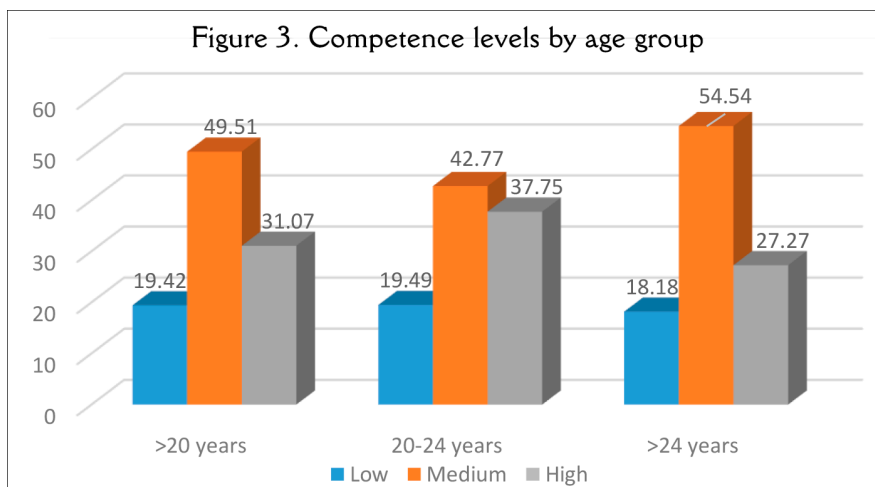
By gender, for all three competence groups, the highest percentage of women show medium-level competence (38% of cases), followed by those with a high level (23%) and a low level (15%). Of the total sample, 9% of men show a high level of competence, 8.5% a medium, and 4.4% a low level. For age at which respondents began to use social networks, individuals who started to use these networks before the age of 12 are significantly related to medium and high levels of competence. Those who started use between 12 and 14 years of age also show medium-level competence. The relationship between level of overall competence and low level of the three groups according to starting age is less significant. Competence level is significantly related to place(s) of access. Most individuals with a low competence level are always connected; groups with intermediate and high competence are connected a smaller percentage of the time. In the group with medium competence, nearly half of participants are connected from one specific place, while a similar percentage is always connected. Participants with high competence are connected more frequently from one place, although nearly half are always connected.

3.3. Differences in knowledge, attitude, ability, and practice

The results differ according to the dimensions of the questionnaire. First, knowledge (K) of digital safety had 24 items, with values ranging from 10 (CSNICT14 and 18) to 1.9 (CSNICT17), and an average of 6.7 (Table 2). The participants had the most knowledge on topics on preventing risky situations, personal data protection, and technical knowledge on sharing information with others. They had less knowledge of the rules of online communication and behavior, the effects of cyberbullying, measures or protocols for protection of physical and mental health, and concepts such as digital identity or digital reputation. The average point-values for the dimension attitudes (A) of the preservice teachers toward problems and risks associated with safety range from 10 (CSNICT10) to 6.24 (CSNICT6), with an average of 8.77. These items include the responsibility the teachers perceive when implementing educational and preventive measures related to safety; the need to acquire knowledge, practice, and model behavior that encourages responsible use; and feelings of discomfort and rejection when they learn of cases of abuse on social networks or other problems. Other attitudes involve not giving personal information to strangers, peer group promotion of protecting and caring for one's virtual image, and having positive attitudes to avoid problems related to Internet use that affect physical or mental health.

On the dimension of secure Abilities and Practices (A&P), with 23 items, the averages ranged from 10 (CSNICT1 and CSNICT8) to 2.2 (CSNICT8), with the lowest average as 6.03. These items evaluate secure practices, including care in publishing information that can harm digital image, identity, or reputation; not sharing usernames and passwords; and using different passwords to avoid theft and

blocking devices. Among the least secure practices were applying measures or protocols to care for physical and mental health, using technological devices and tools, disseminating and resending information easily, changing passwords infrequently, applying safety protocols in browsing and personal data protection, and participating in training activities related to safety.

3.4. Correlations among study variables

Table 2 (https://doi.org/10.6084/m9.figshare.8150516) displays the nonparametric correlations among the numerical variables in the study. We see that age is positively related to the age at which one began to use social networks and interaction through technologies. These last two variables are also positively related to each other. Interaction through technological is negatively associated with digital identity management and protection of health, and positively associated with overall competence. Sharing digital information and content is positively associated with netiquette; digital identity management; personal data protection; protection of health; bullying on social networks, Internet, and cellphones; and overall competence. Netiquette is positively associated with digital identity management; personal data protection; protection of health; bullying on social networks, Internet, and cellphones; and overall competence. Digital identity management is positively related to personal data protection; protection of health; bullying on social networks, Internet, and cellphones; and overall competence. Personal data protection is also positively associated with protection of health and overall competence. Protection of heath is directly associated with bullying on social networks, Internet, and cellphones; and overall competence. These last two variables are also related to each other.

Analysis of the relationship of sex to age, age at which one began to use social networks, and competence in social networks shows that men start using social networks earlier than women (13.46 years vs. 13.76 years old). Competence in sharing digital information and content is greater among women (7.10) than among men (6.59). Competence in managing digital identity is greater in men (5.72) than in women (5.21). Finally, competence in protecting health is also greater in men (6.27) than in women (5.45). Participants' age is only related to the age at which they began using social networks. The nonparametric Mann-Whitney tests indicate that starting age is lowest in the group under 20 years of age, followed by the group ages 20-24, and finally by those over 24. The age at which one began using social networks is significantly related to interaction through technologies. Participants who began before age 12 have less competence in this dimension than those who started at age 12-14 or later.

4. Discussion and conclusions

This study attempts to identify the levels and profiles of preservice teachers in digital safety in order to detect educational needs and propose activities for initial training at the university. To achieve this goal, we designed an instrument to demonstrate content validity and reliability, with a high Alpha Cronbach (Panayides, 2013).

Goal 1: To identify preservice teachers' level of digital competence in safety, we performed a cluster analysis that enabled us to identify three levels of competence, corresponding to the categories of digital safety in the questionnaire. In evaluating the level of digital competence, 36.85% of the preservice teachers scored at medium level, a result similar to that obtained by Fernández-Cruz & Fernández-Díaz (2016) with preservice teachers from so-called "Generation Z" and Napal, Peñalva-Vélez, & Mendióroz (2018) with secondary school preservice teachers.

Goal 2: We describe the competence profile of preservice teachers by differentiating between "digitally secure teachers" (high level), "teachers at medium digital risk" (medium level), and "teachers at digital risk" (low level). In general, women 20-24 years old form the majority and share the common characteristic that 93% have received no training in this area, even if they attempt to use secure practices. Self-taught learning about safety was acquired outside formal education, but we find evidence of the need for formal training (Engen, Giæver, & Mifsud, 2015). The results show little difference by gender on the questionnaire categories (6.49 for men and 6.42 for women), although men have a slightly higher average in ISDC, N, PDP, and CSNCT. As to age, those under 20 are more competent in ISDC and PDP. The high-risk behavior profile is that of the individual who is always connected to Internet (Yan, 2009; Fernández-

Montalvo, Peñalva, & Irazabal, 2015). The results by dimensions of knowledge (6.7), attitude (8.7), and abilities and practices (6.03) indicate greater willingness toward safety but less knowledge and practice related to secure, responsible use of Internet.

Goal 3: Exploring differences enables us to see the need to improve digital competence in safety (in the form of training activities) and prevention and education programs for secure, responsible Internet use (Chou & Peng, 2011; Fernández-Montalvo, Peñalva, & Irazabal, 2015). Such activities can enable the establishment of guidelines to improve secure, healthy abilities, and behavior through the network (Chou & Chou, 2016) —one of the dimensions that still presents considerable difficulties when evaluating digital competence (Napal, Peñalva-Vélez, & Mendióroz, 2018).

Why safety training? Although a significant body of research on digital competence focuses on evaluating technology or information literacy, hardly any studies focus specifically on areas of safety at university or on preservice teachers. We thus agree with Yan (2009) and Shin (2015) that preservice teachers do not receive sufficient training in this area. Our results show minimal training on questions of Internet safety.

Goal 4: This study proposes that safety is a determining factor in the acquisition of digital competence. Guaranteeing responsible, appropriate use of technology is the responsibility of courses in the area of Educational Technology for initial teacher training. Although institutions such as UNESCO, UNICEF, and the OECD, well as DigCompEdu in Europe, INTEF in Spain, and INCoDe.2030 in Portugal recognize digital safety in all areas as a difficult challenge, we understand both its importance in professionalizing educators to be digitally competent, secure, and responsible (Tejada & Pozos, 2018) and the value of information on the daily impact of technology on consumption and the environment for digital citizenship. This study has methodological limitations. The preservice teachers were drawn only from the fields of early childhood and primary education, and their participation in completing the online questionnaire was voluntary. The first of these conditions prevents generalizing the results to other levels of education. The second influenced the sample size.

What topics are crucial for training the future professional? The results of this study enable us to propose the following topics: rules for online communication and behavior (netiquette), measures and protocols to prevent risks on Internet and to care for physical and mental health, concepts related to digital safety (reputation, identity, digital divide and fingerprint), personal data protection in the field of education, and secure protection of devices and password creation.

Despite the limitation that there are few studies specifically on digital safety, we provide empirical evidence of the importance of initial training. This study shows the need for in-depth research on teaching digital safety, as well as for the promotion and inclusion of content on safety in university curricula — a measure already in place in other stages of education, along the lines of the PIES model (Šimandl & Vanícek, 2017), the CIPA program (Yan, 2009), and the TAIS project (Chou & Peng, 2011). Among future lines of research, we propose developing deeper knowledge of curricular inequalities across different university study programs (not only those that train teachers); researching the impact of training on matters of safety for external practices, initial training, and professional practice; and establishing how to teach and evaluate this area of competence beyond the preservice teacher's mere self-perception. Evaluation can be advanced through interdisciplinary studies in Education, Psychology, Medicine, Economics, Law, and Engineering — areas with a close relationship to subcompetences related to safety.

References

Álvarez, J., & Gisbert, M. (2015). Information literacy grade of secondary school teachers in Spain - Beliefs and self-perceptions. [Grado de alfabetización informacional del profesorado de secundaria en España: Creencias y autopercepciones]. *Comunicar, 45,* 187-194. https://doi.org/10.3916/C45-2015-20

Anderson, J.M. (2003). Why we need a new definition of information security. *Computers & Security, 22*(4), 308-313.

https://doi.org/10.1016/S0167-4048

Barrow, C., & Heywood-Everett, G. (2006). The experience of English educational establishments: Summary and recommendations [online]. British Educational Communications and Technology Agency (BECTA). https://bit.ly/2Gz6aoD

Chou, C., & Peng, H. (2011). Promoting awareness of Internet safety in Taiwan in-service teacher education: A ten-year experience. *The Internet and Higher Education*, *14*(1), 44-53. https://doi.org/10.1016/j.iheduc.2010.03.006

Chou, H.L., & Chou, C. (2016). An analysis of multiple factors relating to teachers' problematic information security behavior. *Computers in Human Behavior*, *65*, 334-345. https://doi.org/10.1016/j.chb.2016.08.034

De-Waal, E., & Grösser, M. (2014). On safety and security in education: Pedagogical needs and fundamental rights of learners. *Educar*, *50*(2), 339-361. https://doi.org/10.5565/rev/educar.44

Edwards, S., Nolan, A., Henderson, M., Mantilla, A., Plowman, L., & Skouteris, H. (2018). Young children's everyday concepts of the internet: A platform for cyber-safety education in the early years. *British Journal of Educational Technology*, *49*(1), 45-55. https://doi.org/10.1111/bjet.12529

Engen, B.K., Giæver, T.H., & Mifsud, L. (2015). Guidelines and regulations for teaching digital competence In schools and teacher education: a weak link? *Nordic Journal of Digital Literacy*, *10*, 172-186. https://bit.ly/2SNLcZM

Esteve, F.M., Gisbert, M., & Lázaro, J.L. (2016). La competencia digital de los futuros docentes: ¿Cómo se ven los actuales estudiantes de educación? *Perspectiva Educacional*, *55*(2), 38-54. https://doi.org/10.4151/07189729-Vol.55-Iss.2-Art.412

Fernández-Cruz, F.J., & Fernández-Díaz, M.J. (2016). Generation Z's teachers and their digital skills. [Los docentes de la Generación Z y sus competencias digitales]. *Comunicar*, *46*, 97-105. https://doi.org/10.3916/C46-2016-10

Fernández-Montalvo, J., Peñalva, A., & Irazabal, I. (2015). Hábitos de uso y conductas de riesgo en Internet en la preadolescencia. [Internet use habits and risk behaviours in preadolescence]. *Comunicar*, *44*, 113-121. https://doi.org/10.3916/C44-2015-12

Flores-Lueg, C., & Roig-Vila, R. (2016). Percepción de estudiantes de Pedagogía sobre el desarrollo de su competencia digital a lo largo de su proceso formativo. *Estudios Pedagógicos*, *42*(3), 129-148. https://doi.org/10.4067/S0718-07052016000400007

Fondo de las Naciones Unidas para la Infancia (Ed.) (2017). Niños en un mundo digital. Estado mundial de la Infancia 2017. https://uni.cf/2FUq60R

Instituto Nacional de Tecnologías Educativas y Formación del Profesorado (Ed.) (2017). *Common digital competence framework for teachers*. Madrid: INTEF. https://bit.ly/1Y88rd6

Janssen, J., Stoyanov, S., Ferrari, A., Punie, Y., Pannekeet, K., & Sloep, P. (2013). Experts' views on digital competence: Commonalities and differences. *Computers & Education*, *68*, 473-481. https://doi.org/10.1016/j.compedu.2013.06.008

Jones, L.M., Mitchell, K.J., & Finkelhor, D. (2013). Online harassment in context: Trends from three youth internet safety surveys. *Psychology of Violence*, *3*(1), 53-69. https://doi.org/10.1037/a0030309

Krumsvik, R. (2009). Situated learning in the network society and the digitised school. *European Journal of Teacher Education*, *32*(2), 167-185. https://doi.org/10.1080/02619760802457224

Lueg, C. (2014). Competencia digital docente: Desempeños didácticos en la formación inicial del profesorado. *Hachetetepé*, *9*, 55-70. https://bit.ly/2Iq3Odu

Napal, M., Peñalva-Vélez, A., & Mendióroz, A. (2018). Development of digital competence in secondary education teachers' training. *Education Sciences*, *8*, 104. https://doi.org/10.3390/educsci8030104

Panayides, P. (2013). Coefficient Alpha: Interpret with caution. *Europe's Journal of Psychology*, *9*(4), 687-696. https://doi.org/10.5964/ejop.v9i4.653

Parlamento y Consejo Europeo (Ed.) (2006). Recomendación 2006/962/CE, de 18 de diciembre de 2006, sobre las competencias clave para el aprendizaje permanente. Diario Oficial L 394 de 30 de diciembre de 2006. https://bit.ly/2PQgYCV

Pedro, K.M., & Chacon, M.C.M. (2017). Pesquisas na internet: Uma análise das competências digitais de estudantes precoces e/ou com comportamento dotado. *Educar em Revista*, *33*(66), 227-240. https://doi.org/10.1590/0104-4060.50335

Prendes, M.P., Castañeda, L., & Gutiérrez, I. (2010). Competencias para el uso de TIC de los futuros maestros. [ICT competences of future teachers]. *Comunicar*, *35*, 175-182. https://doi.org/10.3916/C35-2010-03-11

Redecker, C. (2017). European framework for the digital competence of educators: DigCompEdu. In Punie, Y. (Ed.), *Publications office of the European Union*. https://doi.org/10.2760/159770, https://doi.org/10.2760/159770

Shin, S.K. (2015). Teaching critical, ethical, and safe use of ICT in pre-service teacher education. *Language Learning & Technology*, *19*(1), 181-197. https://doi.org/10.10125/44408

Simandl, V. (2015). ICT teachers and technical e-safety: Knowledge and routines. *International Journal of Information and Communication Technologies in Education*, *4*(2), 50-65.

Simandl, V., & Vaníek, J. (2017). Influences on ICT teachers' knowledge and routines in a technical e-safety context. *Telematics and Informatics*, *34*(8), 1488-1502. https://doi.org/10.1016/j.tele.2017.06.012

Tejada, J., & Pozos, K.V. (2018). Nuevos escenarios y competencias digitales docentes: Hacia la profesionalización docente con TIC. *Profesorado*, *22*(1), 41-67. https://bit.ly/2GQmv7H

Tigelaar, D.E., Dolmans, D.H., Wolfhagen, I.H., & Van-Der-Vleuten, C.P. (2004). The development and validation of a framework for teaching competencies in higher education. *Higher Education*, *48*(2), 253-268. https://doi.org/10.1023/B:HIGH.0000034318.74275.e4

Woollard, J., Wickens, C., Powell, K., & Russell, T. (2009). Evaluation of e-safety materials for initial teacher training: Can Jenny's Story' make a difference? *Technology, Pedagogy and Education*, *18*(2), 187-200. https://doi.org/10.1080/14759390902992659

Yan, Z. (2009). Differences in high school and college students' basic knowledge and perceived education of Internet safety: Do high school students really benefit from the Children's Internet Protection Act? *Journal of Applied Developmental Psychology*, *30*(3), 209-217. https://doi.org/10.1016/j.appdev.2008.10.007

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Application of the ubiquitous game with augmented reality in Primary Education

Aplicación del juego ubicuo con realidad aumentada en Educación Primaria

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ABSTRACT

Augmented reality (AR) immersion enables virtual objects and real environments to coexist and encourage experimentation with phenomena that are not possible in the real world. Augmented reality is generating new opportunities for the development of ubiquity within educational environments. The objective of this study was to analyze the impact that the integration of ubiquitous game approaches with augmented reality has on learning. A quasi-experimental study was carried out with 91 sixth-grade primary school students; the learning scenario was designed and the augmented reality application "WallaMe" was selected for use in five sessions of a didactic unit in Art Education. Through pretest and postest procedures, academic performance and information search skills were evaluated, and, a Likert scale analyzed the motivation and collaboration variables among the students. The results showed that the experimental group obtained statistically significant improvements in the academic performance of the subject, motivation, in the search for, and analysis of, information, level of fun and collaboration. The conclusion is that the dynamic activities managed in the intervention, which made use of augmented reality and localization, benefit teaching-learning processes, and encourage innovation and improvement through educational technology.

RESUMEN

La inmersión de la realidad aumentada (RA) propicia la coexistencia de objetos virtuales y entornos reales que permiten la experimentación con fenómenos que no son posibles en el mundo real. La realidad aumentada está generando una nueva oportunidad de crecimiento de la ubicuidad en los entornos educativos. El objetivo de este estudio es analizar el impacto que tiene sobre el aprendizaje la integración educativa de los enfoques de juego ubicuo con realidad aumentada. Se realizó un estudio cuasi experimental con 91 alumnos de sexto curso de Educación Primaria, se diseñó el escenario de aprendizaje y se seleccionó la aplicación de realidad aumentada «WallaMe», que fue utilizada en cinco sesiones de una unidad didáctica del área de Educación Artística. Mediante el procedimiento de pretest y postest se evaluaron el rendimiento académico y las habilidades de búsqueda de información, y una escala Likert analizó las variables motivación y colaboración entre los estudiantes. Los resultados mostraron que el grupo experimental obtiene mejoras estadísticamente significativas en la motivación hacia el aprendizaje, el rendimiento académico de la materia y en la competencia digital. En definitiva, se concluye que las actividades dinámicas manejadas en la intervención, que hacen uso de realidad aumentada y localización, aportan beneficios en los procesos de enseñanza aprendizaje, y propician una innovación y mejora educativa con el uso de la tecnología educativa.

1. Introduction

The use of game-based learning (Squire, Giovanetto, Devane, & Durga, 2005) as an educational enhancer has grown in recent years, and numerous studies have demonstrated the success of these practices in fomenting the capacity to reason (Bottino, Ferlino, Ott, & Tavella, 2007), leadership skills, collaboration (Zhao & Linaza, 2015) and motivation to learn in primary education. However, the results from using the game-based augmented reality (AR) application in classroom contexts has not been researched as widely, even though the link between AR and the classroom is a hot topic in educational science literature. There are few theoretical or conceptual works that explain the complex relation between the characteristics of rapid technological, and occasionally, revolutionary evolution, its potential for education and learning, and its integration in teaching activities (Cabero & Marín, 2018). We believe the research presented here is a novel and singular contribution. In line with Knaus (2017:64), teachers need to understand the potential of digital media, software and algorithms in order to use them in a rational, didactic way, seeing them as resources and not merely ends in themselves. Some researchers and teaching professionals (Cantillo, Roura, & Sánchez, 2012; Brazuelo, Gallego, & Cacheiro, 2017) have questioned the use of virtual games in the concept and practice of education through mobile and ubiquitous devices. All the studies consulted here state that the use of games and AR can only be justified if their application is didactic, and if it promotes creativity, collaboration and reflection. Creativity is the key dimension highlighted for years by researchers such as Perez-Rodriguez, & Delgado-Ponce (2012: 33). Other researchers (Koring, 2016) conclude that children learn a lot from playing games with other children, thus ideally, digital media should be used by children to play in groups, so that they can engage in, and reflect on, the play they generate.

From this educational perspective, AR-based apps can be used to initiate didactic interactions in towns and cities, and in settings such as museums and places of cultural interest for situated educational activities that motivate users. These developments drive the relocation of teaching away from the school center and move the student away from reality towards immersive scenarios (Dunleavy, Dede, & Mitchell, 2009; Bronack, 2011).

1.1. Game-based Digital Learning

Klopfer, Osterweil, & Salen (2009: 21) define digital learning games as those aimed at acquiring knowledge and fostering mental habits and understanding that can be useful in the academic context. The mechanics of these games are essential for their effectiveness as bearers of intrinsic motivation and fun (Perrotta, Featherstone, Aston, & Houghton, 2013). The use of GPS-based games is evidently interesting because they change the players' paradigm: users must step outside to achieve their goals and walk around to reach objects and fulfil the objectives that allow them to progress in the game. This is also a good way to combat the sedentary habits that are so prevalent among gamers. Games can promote a higher level of thought, and, positive proof in various studies (Dondlinger, 2007; Steinkuehler, & Duncan, 2008) urges designers of educational games to focus on player/student participation in an environment in which they can experiment with the relations between all objects, resolve a set of problems, actively learn a new literacy and develop critical learning (Gee, 2004).

Several studies insist on the advantages of game-based learning as an environment that stimulates motivation and commitment in students (Blunt, 2007; Greenfield, 2010; Slova ek, Zovki , & Cekovi , 2014), and our research is based on verifying this notion. These practices mean that motivation is an integral part of the pedagogical processes (Aguaded, 2012; Eseryel, Law, Ifenthaler, Ge, & Miller, 2014; Katja, 2012; Liao, 2015). The findings in educational research help determine whether to adopt certain objectives and encourage learning activities that are significant and motivational for the students.

1.2. Exploring augmented reality

Klopfer & Squire (2008: 205) broadly define AR as a situation in which a coherent localization or virtual information is superimposed dynamically on a real-world situation. Cabero & Barroso (2016, 44) describe AR as the combination in real time of digital and physical information using a range of technological devices. The integration of the real and virtual worlds through AR creates an enriching scenario (Bronack,

2011; Cabero & García, 2016; Fombona, Pascual, & Madeira, 2012; Fombona, 2013 Rico & Agudo, 2016; Squire & Klopfer, 2007). Cabero & Barroso (2016) emphasize that any physical space can become a stimulating educational scenario, and that AR reinforces ubiquitous learning through an inspiring learning environment in which the student interacts with objects and manages information.

Some successful experiences in which students have to use portable devices to carry out research, interpret unique location data and provide solutions within an AR-based game environment are: "Environmental Detectives" (Squire & Klopfer, 2007), a game in which students assume the role of environmental engineers and have to solve problems in a real setting. A similar experience is "Mad City Mystery" (Squire & Jan, 2007), in which players have to solve a crime by searching for information in their environment; another is "Frequency 1550", developed by The Waag Society to help students discover medieval Amsterdam (Akkerman, Admiraal, & Huizenga, 2009).

The advantages of AR enable detection of locations, monitoring of student status and issuing of task reminders. This dynamic offers alternatives for re-focusing student attention. AR technology is easy to incorporate into education as it allows students to use their own devices without the need for extra technologies. Fombona & Vázquez

> Ubiquitous learning implies the break between formal and informal learning and facilitates a more social way of learning; it presumes that learning "based on the curriculum" gives way to learning "based on problem-solving", now with the student as framework of reference.

(2017: 335) state that primary school students already own devices that can be used for AR-based activities, since 80% of devices nowadays use the Android operating system and 60% have GPS, which lets students perform geolocation tasks. Barroso & Cabero (2016:165) carried out a detailed study that concluded that AR objects aroused considerable interest in students, technically and aesthetically, as well as for ease of use. This system allows users to work in real time by exchanging comments and provides information that heightens participants' sensation of immediacy. All the AR-related media mentioned so far enable the user to experience interactions with a sense of immersion, which is "the subjective impression that you are involved in a global and realistic experience" (Dede, 2009: 66). All this occurs within a ubiquitous learning scenario expanded by digital mobile media that allow the user to construct and exchange knowledge between the virtual and the physical (Díez & Díaz, 2018). Ubiquitous learning implies the break between formal and informal learning and facilitates a more social way of learning; it presumes that learning "based on the curriculum" gives way to learning "based on problem-solving", now with the student as framework of reference (Burbules, 2014). The various subsets of AR including mobile AR, gameable AR, and multiplayer AR, offer a range of possibilities to support the implementation of these perspectives. Considering the most important characteristics of these AR types, we can classify the educational approach in three categories: Approaches that emphasize student participation via "roles", student interactions with physical locations (ubiquity, collaboration, situated learning, informal learning) and the design of learning tasks (learning in 3D, visualizing the invisible). This study focuses on an intervention that emphasizes learning tasks, ubiquity, collaboration and situated learning, with the use of location and programs such as "WallaMe".

2. Method

2.1. Research design

We based our study on a quasi-experimental design on both a control and an experimental group, including a pretest and postest. The main objective was to analyze the impact on learning of ubiquitous AR game approaches in education; the variables analyzed were: academic performance, student skills in searching for, and analyzing, information, level of fun and collaboration established among the students.

The hypotheses were: The use of AR in ubiquitous settings improves academic performance (H1); the use of AR improves searching and information analysis skills (H2); the use of AR increases motivation and level of fun (H3); the use of AR and ubiquity fosters collaboration (H4). The research was structured around the following dimensions, with the indicators and instruments described for each dimension (Table 1).

Table 1. Dimensions, indicators and instruments			
Dimensions	**Indicators**	**Instruments**	**Analysis**
Dimension 1: Search for, selection and analysis of, information	Academic performance	Tests	Descriptive analysis Wilcoxon test Mann-Whitney U test
	Search for information		
	Analysis of information		
	Level of fun		
	Collaboration		
Dimension 2: Educational use of "WallaMe"	Academic results		
	Motivation		
	Level of fun		
	Search for information		
	Collaboration		

2.2. Participants

This research was developed in a public Primary Education school in the Autonomous Community of Madrid, and it was applied to all the students in sixth grade (91 students) who attended Art Education classes. The experimental group consisted of 69 students, who searched for information using technological devices (Dimension 1) with the "WallaMe" app during five sessions that were part of a didactic unit on "Art in Europe" (Dimension 2).

Figure 1. Research design
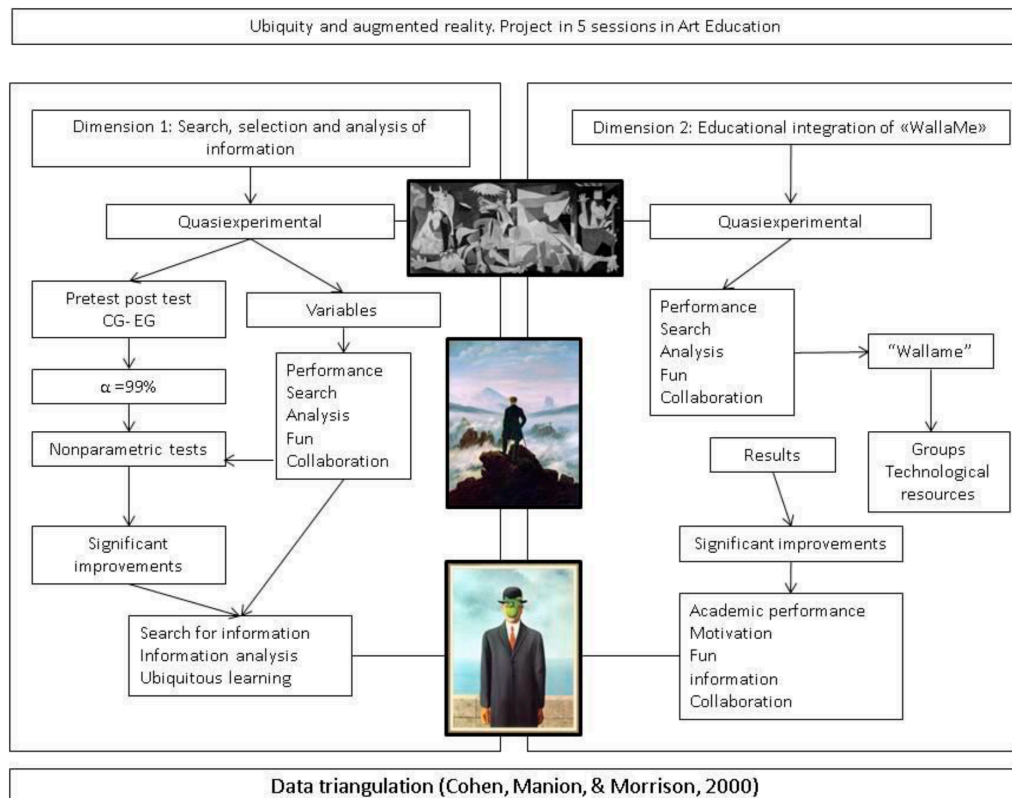
The control group was formed of 22 students in a class that studied the same unit but using a textbook and "traditional" forms of teaching, with an expositional approach and teacher-centered focus. The sampling was non-probabilistic and intentional. The experimental group had 34 girls and 35 boys; the control group had 13 girls and 9 boys. The pretest control for knowledge of "Art in Europe" in the two groups showed that both sets of students had the same level of knowledge.

2.3. Intervention process

Based on the conceptual definition described in the theoretical section of this article (Mathews, 2010; Rosenbaum, Klopfer, & Perry, 2007; Squire & Jan, 2007; Squire & Klopfer, 2007), the analysis of the tools and intervention centered on the application of game- and situation-based learning. The categories that framed the analysis and application were:

- Approaches that emphasize student interactions with physical locations.
- Approaches that emphasize the design of learning tasks.

In dimension 1, the analysis centered on the students' ability to search for, select and analyze information using their mobile phones, thus, ubiquitous learning. The 5 sessions in Art Education were aimed at learning about works of art in Europe. The students were organized individually and later in groups, to carry out searches for information relating to the paintings in different countries, analyzing artistic styles, historical context, the artists, and social and cultural repercussions (Figure 1). Dimension 2 consisted of an intervention in the 5 sessions of the "Art in Europe" unit. Here the students had to download the free "WallaMe" app to their phones (Figure 2).

Figure 2. Use of «WallaMe» for works of art. Mobile phone version
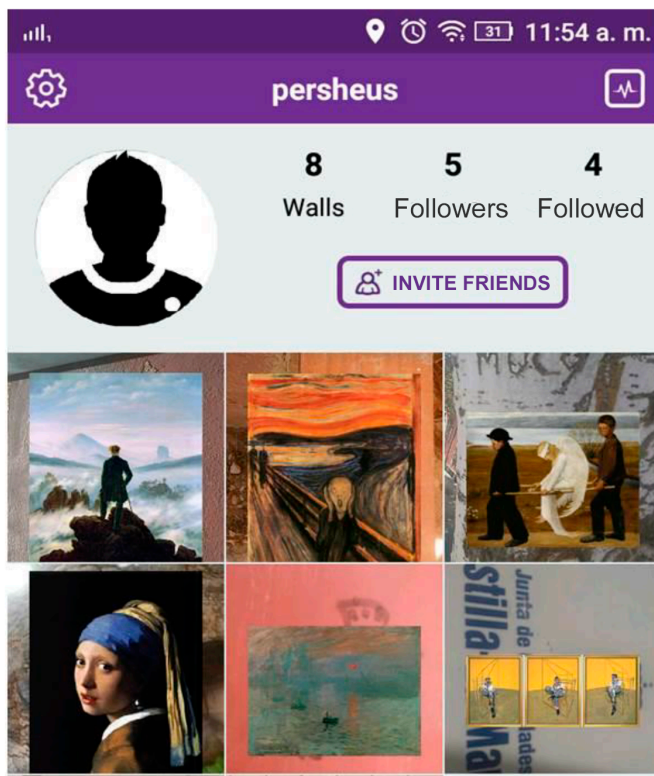
Then, in groups, they went to the school playground to locate images of some of the most important paintings in European art history. Once they had captured the images, the students had to work in groups to find the following data: title of each painting, name of the artist, country of origin, historical and social context, style of painting used, description of the style and interpretation of the work. Instructions and

materials were provided to help students structure their work and carry out the tasks on computers with an Internet connection in the classroom. Once completed, the final session consisted of a discussion to check the answers (name of painting, artist, style). We worked with interesting historical and artistic concepts while also learning about the geography of Europe, and we developed digital competences in a task that required continuous information searching.

When both groups had concluded the 5 sessions, a postest was carried out to evaluate academic performance in relation to the content imparted in the didactic unit. A questionnaire was also distributed to both groups, with a 1-5 Likert scale, to analyze the variables of motivation, commitment, level of fun and collaboration.

In both dimensions, the students searched for, and analyzed, information relating to the artistic content in the unit. The curricular structure complied with current education legislation: Content, assessment criteria and learning standards. Content is designed to foment the creative process: purpose of the painting, search for information (bibliographical and internet). Planning, work to be developed by analyzing works of art from various countries. The assessment criteria included: 1) Being able to distinguish the fundamental differences between fixed images and images in motion, classifying them according to the patterns learnt; 2) Ability to approach reading, analysis and interpretation of art and images that are fixed and in motion, in their historical and cultural contexts, understanding their meaning and social function in a critical way, and being able to produce new visual compositions based on the knowledge acquired; 3) Responsible use of information and communication technologies to search for, create and disseminate images that are fixed and in motion.

The following learning standards were established: Classification of fixed and moving images according to a range of criteria; Critical assessment of messages transmitted by the images; Development of good habits for ordering, correct usage and careful maintenance of the material and instruments used in their artistic creations; Demonstration of creativity and initiative in their artistic productions; Active participation in group tasks; Assessment of the compositions produced; Handling simple computing programs for sound and treatment of digital images (size, brightness, color, contrast…) that contribute to the development of the creative process.

2.4. Analysis and results

2.5. 3.1. Dimension 1: Search for, and analysis of, information and works of art

A comparison of the data for the control and experimental groups yielded the results for the students who carried out searches for information using a conventional approach based on the textbook, and for those who used electronic devices and mobile phones with AR.

2.5.1. Pretest and postest. Wilcoxon test and sign test

Given that both sets of students had the same initial level of competence in the subject, the analysis of the postest is of particular interest as it presents a significant difference in the scores according to the treatment used. The results from the Wilcoxon test and the sign test, with a significance of 0.01, indicate a statistically significant improvement in various factors, thus, the research hypothesis regarding better academic performance, improved information search and analysis skills, level of fun and collaboration, is proven correct (Table 2).

Table 2. Wilcoxon test and sign test. Experimental group samples						
	Mean		Wilcoxon		Sign test	
	Pretest	Postest	Z	Sig.	Z	Sig.
Academic performance	3.05	3.91	-5.513	.000	-5.215	.000
Information search	3.33	4.25	-5.575	.000	-6.086	.000
Information analysis	3.26	3.85	-4.248	.000	-3.276	.001
Level of fun	3.35	3.87	-4.144	.000	-3.528	.000
Collaboration	3.37	3.81	-3.472	.001	-2.969	.003

2.5.2. Control group and experimental group

The scores showed a statistically significant improvement in the experimental group over the control group following treatment assignment. The students who performed the activity using electronic devices and ubiquitous learning scored higher in the variables analyzed than the control group that worked with the textbook (Table 3).

Table 3. Mann-Whitney U test. Independent samples				
	Mean		Mann-Whitney	
	Control	Experimental	U	Sig.
Academic performance	3.27	3.91	348.5	.000
Information search	3.68	4.25	388.5	.000
Information analysis	3.14	3.85	356	.000
Level of fun	3.23	3.87	402	.000
Collaboration	3.23	3.81	425	.001

2.6. Dimension 2: Using "WallaMe" in an educational context: a case in primary education

In this dimension, we analyzed the intervention with the "WallaMe" app in Art Education. A quasi-experimental design was constructed since it was impossible to work with a random sample due to ethical or logistical considerations. A pretest was carried with the experimental group (O1), a program (X) and a postest (O2). The control group had a pretest (O1) and a postest (O2).

This design ensures control over the majority of sources and is more accessible in educational settings. In short, a pretest and postest were carried out, and there was also a control group, so, various non-parametric tests were run due to this being a cautious research proposal. The experimental group consisted of 69 students at three centers that had uploaded "WallaBe" to their mobile phones for 5 sessions of a didactic unit called "Art in Europe". There was also a control group of 22 students who studied the same unit but used a textbook and a "traditional" form of teaching. The sampling was non-probabilistic and intentional, hence the quasi-experimental design. Although it was assumed that the number of students in the experimental group was sufficient to render it normal, a conservative approach was favored, with the running of non-parametric tests (Wilcoxon test and Mann-Whitney U test), with a significance level (α) of 0.01.

2.6.1. Pretest and postest: Wilcoxon test and sign test

An exploratory analysis of the data was performed; the low values in the preliminary test suggested that the students in both groups had the same initial levels. It was in the postest that scores varied, to indicate significant differences in the values according to the treatment applied. The Wilcoxon and sign tests values, with a significance of 0.01, indicate a statistically significant improvement, thus the research hypothesis is proven in terms of better academic results, greater motivation, level of fun, stronger information search skills and collaboration (Table 4).

Table 4. Wilcoxon test and sign test. Experimental group samples						
	Mean		Wilcoxon		Sign test	
	Pretest	Postest	Z	Sig.	Z	Sig
Academic results	3.39	4.01	-4.015	.000	-3.776	.000
Motivation	3.30	4.48	-6.240	.000	-6.326	.000
Level of fun	3.13	4.14	-5.449	.000	-4.576	.000
Information search	3.41	4.09	-4.433	.000	-3.946	.000
Collaboration	3.25	4.07	-4.140	.000	-4.166	.000

2.6.2. Control group and experimental group

As well as the data that established that there was a variation, with an increase in student scores following application of the treatments assigned, the experimental groups showed a statistically significant improvement in relation to the control group.

Table 5. Mann-Whitney U test. Independent samples				
	Mean		Mann-Whitney	
	Control	Experimental	U	Sig.
Academic results	3.59	4.01	532	.000
Motivation	3.68	4.48	367.5	.000
Level of fun	3.23	4.14	362.5	.000
Information search	3.41	4.09	464.5	.004
Collaboration	3.36	4.07	440	.002

The students who carried out the activity with "WallaMe" got better results for the variables analyzed than the control group that worked with textbook and via direct teacher instruction (Table 5).

There was a statistically significant improvement in the dependent variables analyzed, with greater incidence of motivation and level of fun, which emphasizes the active nature of the intervention applied (Figure 3).

The improvement in academic performance indicated in the test of the didactic unit on Art Education is appreciated in the control group values of 3.32 in the pretest and 3.59 in the postest, against 3.39 in the experimental group's pretest (similar to the GC) and 4.01 in the postest (an improvement on the GC postest score). Both groups begin with similar scores in the pretest, but the learning processes lead to an improvement in the postest score for the experimental group, which exceeds 4 points. Based on the data from this statistical analysis, the trend and improvement are statistically significant when the intervention that is the object of this study was applied.

Figure 3. Results from the control group (GC) and experimental group (GE) in dimension 2

	Performance	Motivation	Fun	Information	Collaboration
GC	3.59	3.68	3.23	3.41	3.36
GE	4.01	4.48	4.14	4.09	4.07
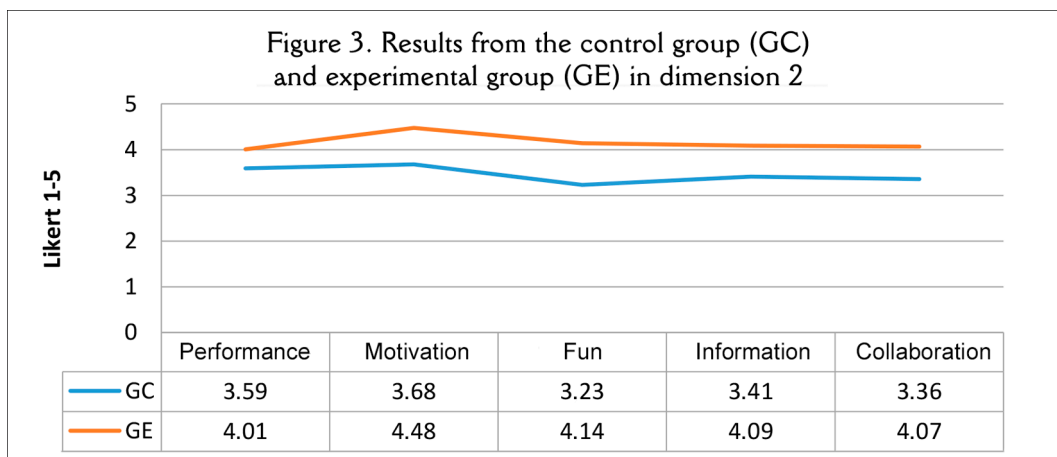
3. Discussion

The results analysis enables us to compare our data with those of other authors, in relation to the impact of the approach proposed in our study regarding location and AR in educational settings. These resources can involve the students much more and can support learning in specific contexts. In line with the results of this research, other studies state that learning with localization and AR offers benefits for, and improvements in, learning processes (Bronack, 2011; Mathews, 2010; Rosenbaum, Klopfer, & Perry, 2007; Squire & Jan, 2007; Squire & Klopfer, 2007), and fosters student motivation (Bressler & Bodzin 2013; Cózar-de-Moya, Hernández, & Hernández, 2015; Han, Jo, Hyun, & So, 2015). A range of studies have evaluated ubiquity together with technological elements and AR within different contexts and areas (Huang, Sun, & Li, 2016; Kim & Han, 2014: Pendit, Zaibon, & Abubakar, 2015), and they emphasize the advantages they provide for interaction and motivation, which reflects the results in our study.

Other experiences in primary education highlight interaction, the creation of local, significant materials for students (Diego-Obregon, 2014), with curricular content and collaborative work (Ramirez

& Cassinerio, 2014), and with works and projects centered on an environment-focused education (Kamarainen, Metcalf, Grotzer, Browne, Mazzuca, Tutwiler, & Dede, 2013). These studies and experiences from other countries present significant evidence that the use of AR and ubiquity in educational settings yields substantial improvements, as do the findings of our research.

This study is in line with other authors, in that AR-related learning activities often lead to innovative approaches that involve participative simulations (Wu, Lee, Chang, & Liang, 2013). Our study shows that the nature of these educational approaches differs considerably from the teacher-centered approach (Kerawalla, Luckin, Seljeflot, & Woolard, 2006; Squire & Jan, 2007). This study corroborates the coherence of the approach proposed by Klopfer & Squire (2008: 203-228) that emphasizes the need to balance competitive impulses and facilitate the decentralized flow of information in educational activities. The results in our study demonstrate the advantages of collaboration and the importance of technology and information management as essential skills (Kerawalla & al., 2006; Klopfer & Squire, 2008; Squire & Jan, 2007).

4. Conclusions

Although there are numerous theoretical studies on the potential for, and design of, AR apps, there is less research on the effects of AR-based game scenario design on improvements in learning, in other words, how this can be used in everyday classroom contexts.

Overall, it is considered that the resources and approaches analyzed are beneficial for pedagogical practice, and there are enough suitable projects and media available to design and develop educational activities. By triangulation of the data (Cohen, Manion, & Morrison, 2000) and the results in the two dimensions analyzed, we can conclude that:

1) The use of mobile devices and ubiquity in the search for information relevant to Art Education improved academic achievement and competence in information search and analysis (Dimension 1, Table 2, Table 3).

2) The approaches based on ubiquitous learning, AR and information search contributed to an increase in the level of fun and the potential for collaboration between students (Dimension 1, Table 2; Table 3).

3) There are statistically significant improvements in academic performance when activities are applied in the school setting, as in the case detailed in dimension 2 (Table 4, Table 5; Figure 3).

4) There are statistically significant improvements in motivation, level of fun, information search skills and collaboration. The pedagogical use of ubiquitous AR in a project on European painting was successful as a case study, and the results present numerous advantages (Table 4; Table 5).

It is evident that an incorporation of this type requires resources, infrastructure and good internet connection, and adequately trained teachers for this pedagogical design to be integrated. However, as this study shows, when these are all in place, the evidence and advantages are clear. The apps currently on the market that use location and AR are clearly designed for gaming and entertainment, yet with some exceptions, and by well-planned design, they can be used to develop activities and projects that offer considerable advantages, as various studies have described and which our own study verifies.

In the case explored here, we emphasize the values that show statistically significant improvements in educational performance, motivation, level of fun, information search skills and student collaboration. This case has shown that game-based, dynamic activities that use localization and AR offer pedagogical benefits and represent an opportunity for success in enabling innovation in education through the application of emerging technologies.

References

Aguaded, I. (2012). Media proficiency, an educational initiative that cannot wait. [La competencia mediática, una acción educativa inaplazable]. *Comunicar, 39*, 07-08. https://doi.org/10.3916/C39-2012-01-01

Akkerman, S., Admiraal, W., & Huizenga, J. (2009). Storification in history education: A mobile game in and about medieval. *Computers & Education*, *52*(2), 449-459. https://doi.org/10.1016/j.compedu.2008.09.014

Barroso, J., & Cabero, J. (2016). Evaluación de objetos de aprendizaje en realidad aumentada: Estudio piloto en el Grado de Medicina. *Enseñanza & Teaching*, *34*(2), 149-167. https://doi.org/http://doi.org./10.14201/et2016342149167

Blunt, R. (2007). Does game-based learning work? Results from three recent studies. In *Interservice/Industry Training, Simulation & Education Conference (I/ITSEC)* (pp. 1-11). Florida, USA: NTSA.

Bottino, R.M., Ferlino, L., Ott, M., & Tavella, M. (2007). Developing strategic and reasoning abilities with computer games at primary school level. *Computers & Education*, *49*(4), 1272-1286. https://doi.org/10.1016/j.compedu.2006.02.003

Brazuelo, F., Gallego, D., & Cacheiro, M.L. (2017). Los docentes ante la integración educativa del teléfono móvil en el aula. *Revista de Educación a Distancia*, *52*, 1-22. https://doi.org/10.6018/red/52/6

Bressler, D.M., & Bodzin, A.M. (2013). A mixed methods assessment of students' flow experiences during mobile augmented reality science game. *Journal of Computer Assisted Learning*, *29*(6), 505-517. https://doi.org/10.1111/jcal.12008

Bronack, S.C. (2011). The role of immersive media in online education. *Journal of Continuing Higher Education*, *59*(2), 113-117. https://doi.org/10.1080/07377363.2011.583186

Burbules, N. (2014). El aprendizaje ubicuo: Nuevos contextos, nuevos procesos. *Entramados*, *1*, 131-133. https://bit.ly/2SOhHah

Cabero, J., & Barroso, J. (2016). The educational possibilities of augmented reality. *Journal of New Approaches in Educational Research*, *5*(1), 44-50. https://doi.org/10.7821/naer.2016.1.140

Cabero, J., & García, F. (2016). *Realidad aumentada*. Madrid: Síntesis.

Cabero, J., & Marín, V. (2018). Blended learning y realidad aumentada: Experiencias de diseño docente. *RIED*, *21*(1), 57-74. https://doi.org/10.5944/ried.21.1.18719, https://doi.org/10.5944/ried.21.1.18719

Cantillo, C., Roura, M., & Sánchez, A. (2012). Tendencias actuales en el uso de dispositivos móviles en educación. *La Educ@ción Digital Magazine*, *147*, 1-21. https://bit.ly/2znGXZy

Cohen, L., Manion, L., & Morrison, K. (2000). *Research methods in education*. New York: Routledge. https://bit.ly/2BdCnOz

Cózar, R., De-Moya, M., Hernández, J., & Hernández, J. (2015). Tecnologías emergentes para la enseñanza de las ciencias sociales. Una experiencia con el uso de realidad aumentada en la formación inicial de maestros. *Digital Education Review*, *27*, 138-153. https://bit.ly/2V4Ford

Dede, C. (2009). Immersive interfaces for engagement and learning. *Science*, *323*(5910), 66-69. https://doi.org/10.1126/science.1167311

Diego-Obregon, R. (2014). Realidad aumentada en documentos e imágenes. *Aula de Innovación Educativa*, *230*, 65-66. http://bit.ly/2Q1fCTw

Díez, E., & Díaz, J.M. (2018). Ubiquitous learning ecologies for a critical cyber-citizenship. [Ecologías de aprendizaje ubicuo para la ciberciudadanía crítica]. *Comunicar*, *54*, 93-103. https://doi.org/10.3916/C54-2018-05

Dondlinger, M.J. (2007). Educational video games design: A review of the literature. *Journal of Applied Educational Technology*, *4*(1), 21-31. https://bit.ly/2BzU9M3

Dunleavy, M., Dede, C., & Mitchell, R. (2009). Affordances and limitations of immersive participatory augmented reality simulations for teaching and learning. *Journal of Science Education and Technology*, *18*(1), 7-22. https://doi.org/10.1007/s10956-008-9119-1

Eseryel, D., Law, V., Ifenthaler, D., Ge, X., & Miller, R. (2014). An investigation of the interrelationships between motivation, engagement, and complex problem solving in game-based learning. *Educational Technology & Society*, *17*(1), 42-53. https://bit.ly/2FK8jhI

Fombona, J. (2013). La interactividad de los dispositivos móviles geolocalizados, una nueva relación entre personas y cosas. *Revista Historia y Comunicación Social*, *18*, 777-788. https://doi.org/10.5209/rev_HICS.2013.v18.44007

Fombona, J., Pascual, M.J., & Madeira, M.F. (2012). Realidad aumentada, una evolución de las aplicaciones de los dispositivos móviles. *Píxel-Bit*, *41*, 197-210. https://bit.ly/2rpWSTS

Fombona, J., & Vázquez-Cano, E. (2017). Posibilidades de utilización de la geolocalización y realidad aumentada en el ámbito educativo. *Educación*, *1*(20), 319-342. https://doi.org/10.5944/educxx1.19046

Gee, J.P. (2004). *Lo que nos enseñan los videojuegos sobre el aprendizaje y el alfabetismo*. Málaga: Aljibe. https://bit.ly/2BJioqw

Greenfield, P.M. (2010). Video games revisited. In Van-Eck, R. (Ed.), *Gaming and cognition: Theories and practice from the learning sciences* (pp. 1-21). Hershey, PA: IGI Global. https://doi.org/10.4018/978-1-61520-717-6.ch001

Han, J., Jo, M., Hyun, E., & So, H.J. (2015). Examining young children's perception toward augmented reality-infused dramatic play. *Educational Technology Research and Development*, *63*(3), 455-474. https://doi.org/10.1007/s11423-015-9374-9

Huang, C.S.J., Yang, S.J.H., Chiang, T.H.C., & Su, A.Y.S. (2016). Effects of situated mobile learning approach on learning motivation and performance of EFL students. *Journal of Educational Technology & Society*, *19*(1), 263-276. http://bit.ly/2Q0oNDT

Kamarainen, A.M., Metcalf, S., Grotzer, T., Browne, A., Mazzuca, D., Tutwiler, M.S., & Dede, C. (2013). EcoMOBILE: Integrating augmented reality and probeware with environmental education field trips. *Computers & Education*, *68*, 545-556. https://doi.org/10.1016/j.compedu.2013.02.018

Katja, F. (2012). Mobiles Lernen in der Schule. In Laufer., J., & Röllecke, R. (Eds.), *Chancen digitaler Medien für Kinder und Jugenlichen* (pp. 53-59). München: Koepadverlag.

Kerawalla, L., Luckin, R., Seljeflot, S., & Woolard, A. (2006). 'Making it real': Exploring the potential of augmented reality for teaching primary school science. *Virtual Reality*, *10*(3), 16-174. https://doi.org/10.1007/s10055-006-0036-4

Kim, H., & Han, S. (2014). A framework for the automatic 3D city modeling using the panoramic image from mobile mapping system and digital maps. 2014 ieee virtual reality (vr). https://doi.org/10.1109/VR.2014.6802087

Klopfer, E., Osterweil, S., & Salen, K. (2009). *Moving learning games forward*. Cambridge, MA: The Education Arcade. https://bit.ly/2XbN90z

Klopfer, E., & Squire, K. (2008). Environmental detectives: The development of an augmented reality platform for environmental simulations. *Educational Technology Research and Development*, *56*(2), 203-228. https://doi.org/10.1007/s11423-007-9037-6

Knaus, T. (2017). Pädagogik des digitale: Phänomene, Potentiale, Perspektiven. In Eder, S., Mikat, C., & Tillmann, A. (Eds.), *Software takes command* (pp. 40-68). München: Kopaed. https://bit.ly/2Gxjr0L

Liao, T. (2015). Augmented or admented reality? The influence of marketing on augmented reality tecnologies. *Information Communication & Society*, *18*(3), 310-326. https://doi.org/10.1080/1369118X.2014.989252

Mathews, J.M. (2010). Using a studio-based pedagogy to engage students in the design of mobile-based media. *English eaching: Practice and Critique*, *9*(1), 87-102. https://bit.ly/2TXdSf5

Pendit, U.C., Zaibon, S.B., & Abubakar, J.A. (2015). Digital interpretive media usage in cultural heritage sites at yogyakarta. *Jurnal Teknologi*, *75*(4), 71-77. https://doi.org/10.11113/jt.v75.5069

Pérez-Rodríguez, M.A., & Delgado-Ponce, A. (2012). From digital and audiovisual competence to media competence: Dimensions and indicators. [De la competencia digital y audiovisual a la competencia mediática: Dimensiones e indicadores]. *Comunicar*, *39*, 25-35. https://doi.org/10.3916/C39-2012-02-02

Perrota, C., Featherstone, G., Aston, H., & Houghton, E. (2013). Game-based learning: Latest evidence and future directions. https://bit.ly/2GQlRHh

Ramírez, V., & Cassinerio, S. (2014). *Realidad aumentada-trabajo cooperativo; nivel inicial*. Buenos Aires: Innovación y Educación. http://bit.ly/2JD3ua4

Rico, M.M., & Agudo, J.E. (2016). Aprendizaje móvil de inglés mediante juegos de espías en Educación Secundaria. *RIED*, *19*(1), 121-139. https://doi.org/10.5944/ried.19.1.14893

Rodewald, E.M. (2017). Profilklasse, 'Smart Gaming'. In Gross, F., & Röllecke, R. (Eds.), *MedienPädagogik der Vielfalt-Integration und Inklusion*München: . Kopaed. https://amzn.to/2tunWki

Rosenbaum, E., Klopfer, E., & Perry, J. (2007). On location learning: Authentic applied science with networked augmented realities. *Journal of Science Education and Technology*, *16*(1), 31-45. https://doi.org/10.1007/s10956-006-9036-0

Slovacek, K.A., Zovki ,N., & Cekovi A. (2014). A Language games in early school age as a precondition for the development of good communicative skills. *Croatian Journal of Education*, *16*(1), 11-23. https://bit.ly/2Nc4uBM

Squire, K., Giovanetto, L., Devane, B., & Durga, S. (2005). From users to designers: Building a self-organizing game-basedlearning environment. *TechTrends*, *49*(5), 34-42. https://doi.org/10.1007/BF02763688

Squire, K., & Jan, M. (2007). Mad city mystery: Developing scientific argumentation skills with a place-based augmented reality game on handheld computers. *Journal of Science Education and Technology*, *16*(1), 5-29. https://doi.org/10.1007/s10956-006-9037-z

Squire, K., & Klopfer, E. (2007). Augmented reality simulations on handheld computers. *Journal of the Learning Sciences*, *16*(3), 371-413. https://doi.org/10.1080/10508400701413435

Steinkuehler, C., & Duncan, S. (2008). Scientific habits of mind in virtual worlds. *Journal of Science Education and Technology*, *17*, 530-543. https://doi.org/10.1007/s10956-008-9120-8

Wu, H.K., Lee, S.W.Y., Chang, H.Y., & Liang, J.C. (2013). Current status, opportunities and challenges of augmented reality in education. *Computers & Education*, *62*, 41-49. https://doi.org/10.1016/j.compedu.2012.10.024

Zamora-Manzano, J.L., & Bello-Rodríguez, S. (2017). Dispositivos móviles como herramienta de aprendizaje en el mundo del Derecho. In Pérez-Fera, M., & Rodríguez-Pulido, J. (Eds.), *Buenas prácticas docentes del profesorado universitario* (pp. 139-152). Barcelona: Octaedro.

Zhao, Z., & Linaza, J.L. (2015). La importancia de los videojuegos en el aprendizaje y el desarrollo de niños de temprana edad. *Electronic Journal of Research in Educational Psychology*, *13*(2), 301-318. https://doi.org/10.14204/ejrep.36.14108

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Online political participation of young people in Mexico, Spain and Chile

La participación política online de los jóvenes en México, España y Chile

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ABSTRACT

Digital media are present in all areas of society, even configured as a new space for political socialization. This is especially applicable in the case of young people due to their high use of new technologies, as they are also trained with the necessary skills to do so. In this context, social networks have prompted the emergence of a new type of political participation: which takes place online. Therefore, this study delves into the relationship between the socialization that occurs in the network, digital skills and political participation online and offline. A quantitative survey-based methodology was used with university students from three Ibero-American countries: Mexico, Spain and Chile. The fieldwork was conducted between the months of December 2017 and June 2018. The results obtained show that young people consume mainly digital media, which does not prevent them from being critical with the quality they deserve. In this sense, the political participation actions in which they are involved are mostly developed in the network, thus participating to a lesser extent offline. Therefore, young people enter the world of politics through the consumption of information on the Internet, which favors a subsequent online political participation.

RESUMEN

Los medios digitales están presentes en todos los ámbitos de la sociedad, configurándose incluso como un nuevo espacio para la socialización política. Ello es especialmente aplicable en el caso de los jóvenes debido al elevado uso que realizan de las nuevas tecnologías, al estar capacitados también con las habilidades necesarias para ello. En este contexto, las redes sociales han propiciado el surgimiento de un nuevo tipo de participación política: la que tiene lugar de forma online. Por tanto, esta investigación indaga sobre la relación existente entre la socialización que se produce en la red, las habilidades digitales y la participación política en línea y fuera de línea. Se utiliza una metodología cuantitativa a partir de la realización de encuestas a jóvenes universitarios de México, España y Chile. El trabajo de campo se desarrolló entre los meses de diciembre de 2017 y junio de 2018. Los resultados obtenidos muestran que los jóvenes consumen principalmente medios digitales, lo cual no impide que sean críticos con la calidad que merecen los mismos. En relación con ello, las acciones de participación política en las que se implican se desarrollan en su mayoría en la red, participando así en menor medida fuera de línea. Por tanto, los jóvenes se introducen en el mundo de la política a través de Internet mediante el consumo de información, lo que favorece una posterior participación política online.

1. Introduction

1.1. Digital media and political participation

In the last few years, beginning with the surge of social media, there is a new form of participation that takes place within cyberspace (Vesnic-Alujevic 2012). Political participation is understood as the set of actions and attitudes of citizens aimed at influencing the political system (Pasquino, 1996). In academia, the main topics of discussion in this respect are focused on the influence of traditional communication media on the discussion that occurs in social networks (Sveningsson, 2014; Gualda, Borrero, & Cañada 2015; Zaheer, 2016), as well as the capacity of social media to promote political participation, either online or offline (Bosetta, Dotceac, & Trenz, 2018). In this context, digital media are being configured as a new space for socialization (Resina, 2010), through which the individuals learn how to manage in this new online world (García-Peñalvo, 2016). Youth will be especially enveloped in this dynamic, as they are digital natives still in the process of shaping themselves.

In this respect, one of the most important learning activities in which youth are involved consists on learning how to be citizens. In agreement with this, digital media, as a new environment for political socialization, could contribute in the empowerment of youth to acquire the necessary abilities for participating in public life, as well as to develop new forms of activism (Hernández & al., 2013).

Therefore, new technologies are being shaped as the new stage for political participation. This could facilitate the implication of citizens in public life in a context of disaffection (Dalton, 2004), by contributing with overcoming the existing obstacles for offline participation (Grossman, 1995). In any case, this new form of political activism through the Internet would not substitute the traditional political participation offline, but it could be a complementary activity. As previous works have shown in the Mexican case, there is a strong relationship between both types of participation, online and offline (De-la-Garza & Barredo, 2017).

However, the concept of the internet as a facilitator of political activism has generated diverse objections from the academic field due to the existence of a digital divide which is based, in part, to the economic inequalities of access (Norris, 2001; DiMaggio & Hargittai 2001), and on the other hand, the inequality related to the digital skills needed for political participation online (Van-Dijk & Hacker, 2003; Hargittai 2002). In this scenario, age would condition access to new technologies, as well as the possession of digital skills needed for becoming politically involved through the internet (Albrecht 2006; Min 2010), as has been previously shown for the case of Spain (Recuero, 2016). In this sense, a prior interest in politics is required from the users in order to participate either online or offline (Casteltrione, 2016). Thus, many research studies mention that social networks such as Facebook re-enforce the civil commitment of politically-active users (Vromen, Loader, Xenos, & Bailo, 2016; Mascheroni, 2017), aside from favoring their move towards political action either online or offline (Min & Wohn, 2018).

Therefore, an interconnection would be produced between the three elements: socialization, digital skills and online/offline political participation. Thus, firstly, youth's socialization in new technologies enables them to acquire new digital skills needed for utilizing the internet from every angle. These skills are the ones that subsequently facilitate the political socialization of youth, as they tend to introduce themselves into public life through new technologies. Therefore, young people can start to learn how to be citizens through the internet by politically participating online. This could favor the acquisition of new skills and competences that are political in character and that facilitate involvement in other types of offline participation. With the aim of recognizing how this phenomenon behaves in today's youth, who began their process of socialization with these digital tools (Crovi, 2013), a comparative study was conducted between youth from the following Ibero-American countries: Mexico, Spain and Chile.

1.2. Youth in Mexico, Spain and Chile

In the last few years, youth have protagonized diverse activities of political participation that have been linked to their origin and/or their development with digital media. Experiences of this type can be identified in the three countries analyzed in the present research work. In Chile, the Chilean Student Winter was able to place the subject of public education in the political agenda (Aguilera, 2012; Zepeda, 2014), with the use of social media emerging as important. In this context, Vierner, Cárcamo and Scheihing (2018)

posited that as the young Chileans showed an interest in politics, they had a greater tendency of adopting a critical posture against the massive communication media. Nevertheless, there was a high degree of political disaffection in Chile in young people (Mardones, 2014; Manríquez & Augusti, 2015).

As for Mexico, according to Morales (2002), youth's mobilization has been fundamental for provoking institutional changes. With social movements after the emergence of #YoSoy132, a more participative citizenry has been strengthened with a clear commitment to diverse matters that concern this country (Portillo, 2015). It should be highlighted that the emergence of the active political participation in social media took place mainly after the birth of #YoSoy132 (Quiñónez, 2014). In the case of Spain, the new generations have more distrust towards the traditional media than social networks (Fernández, 2015).

In agreement with this, Spanish youth have provided signs of their activism through the new technologies. In sometimes occasions, this online political participation has even been transferred to the traditional public space through offline political participation (García & al., 2014). The 15M movement and the Movement for Decent Housing are examples of this (Hernández & al., 2013; Haro & Sampedro 2011).

> One of the most important learning activities in which youth are involved consists on learning how to be citizens. In agreement with this, digital media, as a new environment for political socialization, could contribute in the empowerment of youth to acquire the necessary abilities for participating in public life, as well as to develop new forms of activism.

2. Material and methods

2.1. Objectives

The main objective of this study is to analyze the existing relationship between socialization on the Internet, the acquisition of digital skills and the political participations in both of its aspects, online and offline. In previous research, it has been shown that youth have a greater degree of activism online, as age is a variable that conditions online political participation (Norris, 2001; DiMaggio & Hargittai, 2001). Nevertheless, it is necessary to have a more in-depth understanding of the characteristics and constraints of this type of participation conducted by young people. In this respect, it has also been shown that the level of studies is a relevant variable (Albrecht, 2006; Recuero 2016), so that the combination of being young and having a high level of education would foster a greater digital activism. Therefore, the present study is focused on examining university students from Mexico, Spain and Chile, as they can fully participate politically, as legal adults. The analysis of this collective will allow us to verify whether digital media are shaped as a space for political participation in which youth learn how to become citizens.

2.2. Research design

In this study, a quantitative methodology is utilized starting with the design, application and analysis of a questionnaire given to young university students from Mexico, Spain and Chile. In the design of the questionnaire, two large sets of questions were formulated, which allowed for the comparison between countries.

In first place, we find those related with media consumption, which are aimed at identifying the digital socialization of youth, and which therefore mirror their related skills. In second place, we find the questions related to the political participation online as well as offline. In the formulation of the questions, the items proposed by previous research studies were taken into account. Thus, the reliability of the indicators utilized is guaranteed, as well as its comparability with other studies. Therefore, with respect to the consumption of media, the indicators proposed by Gómez and others (2013) in their study on political culture in the context of the presidential election in 2012 in Mexico, were taken into account.

With respect to the questions on online political participation, the items proposed by two research studies were included. Thus, a few of the elements utilized by Gil-de-Zúñiga and others (2010) were selected, such as the online signing of petitions about collective matters with which the students were in agreement. From the contribution by Vesnic-Alujevic (2012), the following activities were recovered: search for information on politics, read humorous content related to politics, watch a political video, share political information with others, participate or read discussions about politics, post information about politics in their profile, and post a "like" on a comment or a message from another user.

As for offline political participation, sometimes of the questions applied by Oser and others (2013) were included, such as contacting a politician about a public interest matter, contributing with an organization that seeks to influence public policies and others. Starting with the data collected with the use of the questionnaire, a descriptive analysis was conducted on the consumption of media as well as online and offline political participation of Mexican, Spanish and Chilean university students.

2.3. Sample

The size of the sample obtained in the study was composed of 1,239 interviews in the Mexican case, 627 interviews in the Spanish case, and 1,058 in the Chilean case. These interviews were given to Mexican, Spanish and Chilean students from public and private universities enrolled in different degrees. A non-probabilistic, convenience sampling was conducted, with the field work conducted between the second semester of 2017, and the first semester of 2018. The poll was applied through the Internet using the Google Forms platform. For the student's participation in the poll, they were contacted by the professors from the universities that participated and collaborated in the study, so that access through the classroom is highlighted.

3. Results

3.1. Consumption and trust of conventional media

The results presented on Table 1 show the consumption of communication media for university students in Mexico, Spain and Chile. In this sense, the scarce exposure of this collective to audiovisual and written communication media was underlined. Thus, the type of media consumed least by Mexican youth was the television, as shown by most of those polled, with 42.5%, choosing the "rarely" option. In Spain and Chile, on their part, the printed press was the least consumed by university students, as most of them, 37.3% and 41.3%, respectively, indicated that they were exposed "rarely" to this medium. Following this, and with very similar results, we find the consumption of the printed press in the case of Mexican students (40.8%) and the consumption of television in the case of the Spanish and Mexican students (32.5% and 37.8%, respectively). Therefore, university youth from Mexico, Spain and Chile, have a scarce exposure to these types of media, with television and printed press reflecting the lowest consumption by all of them. Exposure to the other types of media is also reduced in the three countries examined, as shown by the numbers relative to the consumption of the radio and printed magazines.

In turn, the consumption of digital media was the greatest among the Mexican, Spanish and Chilean university students. In this respect, the high percentage of students in the three countries that confirmed utilizing social networks "always" was underlined, more specifically, 47.9% in Mexico, 47.4% in Spain, and 47.4% in Chile. The digital press, on its part, was consumed "often" by 36.4% of the Spanish and 32.5% of the Chileans, and "sometimes" by 31.6% of the Mexicans, a figure that is very close to those who declared being expose to it "often" (31.2%). As for the consumption of blogs, the behavior was less homogeneous. In this sense, it was notable that blogs were the digital media to which Ibero-American youth were least exposed to.

These data show how university students mainly and predominantly consume digital media, as compared to their scarce exposure to conventional media. Therefore, university youth share a pattern of behavior with respect to the consumption of media that is independent from the national context where they reside. This clearly shows that these young people are socializing through technological tools, so that they inform themselves about political matters through them.

Table 1. Consumption of the communication media by students from Mexico, Spain and Chile (2017-2018)						
	MEXICO		**SPAIN**		**CHILE**	
	Predominant option	Total percentage	Predominant option	Total percentage	Predominant option	Total percentage
I consume television	Rarely	42.5%	Rarely	32.5%	Rarely	37.8%
I consume written press	Rarely	40.8%	Rarely	37.3%	Rarely	41.3%
I consume digital press	Sometimes	31.6%	Often	36.4%	Often	32.5%
I consume radio	Rarely	37.3%	Rarely	32.4%	Rarely	31.2%
I consume printed magazines	Rarely	36.6%	Rarely	31.6%	Rarely	30.4%
I consume Social networks	Always	47.9%	Always	47.4%	Always	47.4%
I consume Blogs	Sometimes	35.5%	Rarely	28.9%	Never	30%

Note. Minimum value of 0 and maximum value of 4. There are 5 values: Never, Rarely, Sometimes, Often, Always.

Nevertheless, the fact that these youths consume a type of media more than another does not imply that they are not able to discriminate their credibility. Related to this, Table 2 shows the results on the trust that the young Mexicans, Spanish and Chilean have on the communication media. It is noteworthy that the media that they trust the most are also the media that they least consume. Thus, most of the youth from Mexico, Spain and Chile only mentioned trusting the three conventional media. On the one hand, the printed magazines were trusted by 58.7% of the Mexican students, 55.5% of the Spanish students and 61.5% of the Chilean students, while on the other hand, and also predominantly, we find news from the radio, which generate credibility among 48.3% of Mexican youth, 51.4% of Spanish youth, and 63.8% of the Chilean youth. Lastly, 54.2% of those polled in Mexico, 50.2% in Spain, and 50.1% in Chile considered that the printed press also deserved credibility. Lastly, in the Mexican case, most of the students also trusted radio programs (41.4%).

The rest of the media, both conventional and digital, did not generate trust among the Ibero-American university students as a predominant option. As for the conventional media, the television programs generated the greatest consensus, as 51.5% of the Mexicans, 73% of the Spanish, and 70.2% of the Chileans did not trust them. The television news programs did not deserve credibility among most of the youth, with this option being predominant for 50.6% in Mexico, 54.2% in Spain, and 60.4% in Chile. As for the digital media, it is interesting to note that the students predominantly distrust them, despite their high consumption of this type of media. Thus, around six out of ten students did not trust email messages, social networks or blogs. In more detail, electronic mail did not generate trust among 60.5% of the Mexicans, 68.1% of the Spanish, and 64.9% of the Chileans.

Table 2. Trust in the communication media by students from Mexico, Spain and Chile (2017-2018)						
	MEXICO		**SPAIN**		**CHILE**	
	Predominant option	Total percentage	Predominant option	Total percentage	Predominant option	Total percentage
Trust TV news	No	50.6%	No	54.2%	No	60.4%
Trust TV programs	No	51.5%	No	73%	No	70.2%
Trust radio news	Yes	48.3%	Yes	51.4%	Yes	63.8%
Trust radio programs	Yes	41.4%	No	56.3%	No	43.1%
Trust emails	No	60.5%	No	68.1%	No	64.9%
Trust web pages	No	46.7%	No	48.8%	No	47.9%
Trust blogs	No	56.8%	No	61.2%	No	60.1%
Trust alternative media	No	42.3%	No	37.3%	No	40.5%
Trust social networks	No	56.8%	No	66.3%	No	72.3%
Trust printed press	Yes	54.2%	Yes	50.2%	Yes	50.1%
Trust printed magazines	Yes	58.7%	Yes	55.5%	Yes	61.5%

Note. There are 3 values: (1) It is trusted, (2) It is not trusted, (3) Do not know.

In the case of the social networks, these numbers were 56.8%, 66.3% and 72.3%, respectively, with the results for blogs being 56.8%, 61.2% and 60.1%. Likewise, although the numbers were lower, the lack of trust on webpages were found to be 46.7% in Mexico, 48.8% in Spain, and 47.9% in Chile, with alternative media being 42.3% in Mexico, 37.3% in Spain and 40.5% in Chile. This information shows

that the young, despite consuming digital media, are critical of the use they make of the new technologies. Thus, the fact that the young are socialized in the digital world enables them to have the ability to distinguish the quality of the medium they utilize.

3.2. Offline political participation

Table 3 shows the data on offline political participation by the young Ibero-American university students. In agreement with the results, this is mainly confined to the act of voting. Thus, most of those polled in Spain, 77.2%, and in Chile, 83.9%, confirmed being involved in the electoral political participation. Only Mexico was an exception to this pattern of behavior, as most of the young university students of the country, 57.5%, declared that they did not vote. In contrast, the Mexican students were greatly involved in other forms of offline political participation, such as attending a conference (76.9%) and participating in student organizations (58.8%). On the contrary, the Spanish and Chilean university students were not involved in other forms of participation, except for the former, with respect to attending a conference (54.5%).

The involvement of the youth on the remaining forms of offline activism was minor, especially in sometimes of them. Thus, more than seven out of ten polled attested to not participating in electoral meetings (79% in Mexico, 79.9% in Spain, and 87.3% in Chile), in contributing in influencing in public policies (72.2% in Mexico, 71.9% in Spain, and 79.7% in Chile), in contacting a politician (68.8% in Mexico, 78.6% in Spain, and 88.7% in Chile) and supporting a campaign (68.4% in Mexico, 76.4% in Spain, and 80.5% in Chile). These data show that the offline manners of participation mentioned were not an option for the youth for becoming involved politically. This modality can be favored by all of them and they are all related or promoted by the established political parties and the traditional political class. The participation in a NGO was also minor among the young university students in these countries, and it should be indicated that 70.1% of the Mexicans, 56.9% of the Spanish and 66.5% of the Chileans were not involved. Accordingly, most of the youth did not take part in the political participation activities offline, except for voting during elections. This implies the need to explore whether the political participation of university students is channeled through other venues, mainly through the Internet.

Table 3. Offline participation by students from Mexico, Spain and Chile (2017-2018)						
	MEXICO		**SPAIN**		**CHILE**	
	Predominant option	Total percentage	Predominant option	Total percentage	Predominant option	Total percentage
Vote	No	57.5%	Yes	77.2%	Yes	83.9%
Electoral meetings	No	79%	No	79.9%	No	87.3%
Support a campaign	No	68.4%	No	76.4%	No	80.5%
Sign in a public consultation	No	70.6%	No	54.5%	No	68.9%
Participate in student organizations	Yes	58.8%	No	50.7%	No	51.1%
Attend a conference	Yes	76.9%	Yes	54.5%	No	57.8%
Contact a politician	No	68.8%	No	78.6%	No	88.7%
Contribute in influencing policies	No	72.2%	No	71.9%	No	79.7%
NGO	No	70.1%	No	56.9%	No	66.5%

Note. The minimum value is 0, and the maximum value is 1. There are 2 values: (0) No, (1) Yes.

3.3. Online political participation

Table 4 shows the results related to online political participation. The existence of various forms of cyber activism that are conducted by most of the youth is notable. Thus, the most common acts of online participation conducted by Mexican, Spanish and Chilean university students were to search for information about politics, read humorous political content, read discussions on politics and watch political content.

Nevertheless, there are specificities between the different countries analyzed with respect to the diversity and intensity of the forms of online political participation conducted. In this sense, Mexicans were the ones who involved themselves to a greater degree in a great number of online participation

activities, more specifically in nine of them. On the contrary, this participation did not reach a high intensity, as most of the students mentioned doing so "sometimes". These forms of digital participation conducted "sometimes" by the Mexicans were: read humorous content about politics (38.2%), search for information about politics (36.6%), read discussions about politics (33.7%), watch videos of political content (33.4%), share humorous content about politics (26.8%), follow reporter's and opinion leader's accounts (26.8%), share a video of political content (25.6%), and give a "like" to a commentary about politics (24.9%). Likewise, 27.4% of the Mexicans participated in discussions about politics, although they did so "rarely".

The Spanish on their part, became involved in a sometimeswhat smaller number of cyber activism activities, more specifically in six, although they did so with a greater intensity than the young Mexicans. Thus, most of the Spanish university students declared having participated "often" in watching videos of political content (30%), read discussion about politics (26.5%). Besides this, they affirmed having become involved "sometimes" in signing petitions about collective matters (24.9%) and in sharing humorous content about politics (19%). Lastly, the young Chileans were the ones that were the least involved in a smaller variety of online participation activities, more specifically, four. The intensity with which they participated in them was less than the Spanish university students, in line with what Mexican students do. Thus, most of the Chileans mentioned participating "sometimes" in searching information about politics (30.3%), read discussions about politics (30.1%), watch videos with political content (28.1%) and read humorous content about politics (26.7%).

The rest of the online participation activities were not conducted by most of the Ibero-American students. These forms of participation in which neither the Mexicans, Spanish nor Chileans were involved in, require a greater degree of activism. These are: publish personal opinions about politics, post information about politics, follow politician's accounts and respond to politician's comments. These results allow us to conclude that the young Mexican, Spanish and Chilean university students politically participate online to a greater degree than they do so offline. The forms of cyber activism they conducted had a passive component, as they are not related to the viewing or the reading of diverse types of content about politics. Nevertheless, the active search for political information is also a very commonly-conducted activity, which implies a more active role.

Table 4. Political participation in social networks by students from Mexico, Spain and Chile (2017-2018)						
	MEXICO		SPAIN		CHILE	
	Predominant option	Total percentage	Predominant option	Total percentage	Predominant option	Total percentage
I search for information on politics	Sometimes	36.6%	Often	26.8%	Sometimes	30.3%
I read humorous political content	Sometimes	38.2%	Often	26.5%	Sometimes	26.7%
I share humorous content	Sometimes	26.8%	Sometimes	19%	Never	32.1%
I read discussions	Sometimes	33.7%	Often	27%	Sometimes	30.1%
I participate in discussions	Rarely	27.4%	Never	34.9%	Never	42.7%
I watch videos of political content	Sometimes	33.4%	Often	30%	Sometimes	28.1%
I share videos of political content	Sometimes	25.6%	Never	29.3%	Never	51.4%
I publish personal opinions about politics	Never	34.9%	Never	43.4%	Never	52%
I give a *like* to a comment	Sometimes	24.9%	Never	29.5%	Never	25.5%
I post information about politics	Never	36.6%	Never	42.4%	Never	56.2%
I follow politician's accounts	Never	26.9%	Never	46.3%	Never	51.9%
I follow accounts from journalists, opinion leaders	Sometimes	26.8%	Never	36.8%	Never	41.2%
I answer politician's comments	Never	58%	Never	68.4%	Never	71%
I sign petitions about collective matters	Never	40.1%	Sometimes	24.9%	Never	37.5%

Note. The minimum value is 0, and the maximum value is 4.
There are 5 values: Never, Rarely, Sometimes, Often and Always.

4. Discussion and conclusions

The new technologies have modified the habits of the citizens in all aspects of life. This new reality promotes the shaping of the digital media themselves into a new agent of socialization. In line with this, the political socialization that could be occurring at the heart of the internet takes on a special importance, especially with respect to the youth. In a time that the disaffection with the representation system pushes the citizens away from the traditional politics (Dalton, 2004), the new technologies could be shaping themselves as an alternative (Grossman, 1995). Due to this, it is of great interest to examine if the youth introduce themselves or not into politics through the Internet, and if this is the case, how this process is done and what the consequences are.

The aim of the present study was to investigate on the political socialization of the youth through the internet, the skills they have for this, and the political participation conducted online and offline. In this way, the intention was to verify if the youth initiated their contact with politics through the new technologies, hence previously requiring the necessary digital skills for this. Likewise, the aim of this contribution also aimed to observe if this online learning promoted or not the involvement of forms of online and offline participation. With this purpose, a poll was given to young university students from Mexico, Spain and Chile, reaching a sample size in each of the countries of 1,239, 627 and 1,058 students polled, respectively. The choice of the population studied is justified because the young university students are considered adults, which indicates that they can fully exercise their political rights, such as voting. The design of the poll was oriented towards obtaining information about two sets of questions. In first place, the consumption of media, as an indicator of political socialization, and on the trust placed on these media, as a reflection of the skills possessed by the youth. And in second place, on the political participation online as well as offline.

The results obtained show that the young Mexicans, Spanish and Chileans mainly consume digital communication media, so that they obtain political information through them. This is demonstrated by the social networks, followed by the digital press, being the sources to which they are most exposed to. Therefore, the youth introduced themselves to political matters through the new technologies, as it is through them that they know what is occurring in the political reality. This, together with their scarce exposure to the audiovisual and written communication media, confirms that the digital media play a political socialization role for these Ibero-American university students. Nevertheless, this political learning produced at the heart of the internet is not exempt of criticism by the youth. Thus, they are able to distinguish between credibility and trust that the media deserve, both conventional and digital. This especially important in the area of new technologies, in which the myriad of information available makes necessary being able to discriminate when facing the existence of numerous contents that are not reliable. In this sense, most of the university students from these countries do not trust the digital media they utilize, which implies that they count with an important ability to shape their own criteria, which is a necessity for performing as citizens. This civil socialization experienced by the youth in the internet seems to shape itself as a step prior to the learning of how to politically participate digitally. In this way, a significant part of the Spanish university students take part in activities of cyber activism. Nevertheless, the forms of online political participation they tend to conduct have a more passive character as they are related to reading or viewing of political content. In spite of this, they also take part in forms of participation that are more active, such a searching for political information.

As compared to the political activism that young Mexicans, Spanish and Chilean students partake in the digital networks, their decreased involvement is in offline political participation activities. Only the electoral participation, meaning voting, is predominant among the university students of the countries analyzed, except for Mexico. Nevertheless, and as already pointed out, both types of participation, online and offline, should not be considered completely different. In this sense, the consumption of political information on the internet by the youth, as well as the activities of activism they conduct online, can condition a posterior offline participation, such as voting. Nevertheless, it is necessary to continue to delve and broaden the analysis conducted in order to confirm the results obtained and to further delve into the learning about politics on the internet by the youth.

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References

Aguilera, O. (2012). Repertorios y ciclos de movilización juvenil en Chile (2000-2012). *Notas y Debates de la Actualidad*, *27*(57), 101-108. http://bit.ly/2JVxrT3

Albrecht, S. (2006). Whose voice is heard in online deliberation? A study of participation and representation in political debates on the internet. *Information, Communication & Society*, *19*(1), 62-82. https://doi.org/10.1080/13691180500519548

Bosetta, M., Dotceac, A., & Trenz, H.J. (2018). Political participation on Facebook during Brexit does user engagement on media pages stimulate engagement with campaigns? *Journal of Language and Politics*, *17*(2), 173-194. http://doi.org/10.1075/jlp.17009.dut

Casteltrione, I. (2016). Facebook and political participation: Virtuous circle and participation intermediaries. *Interactions: Studies in Communication & Culture*, *7*(2), 177-196. https://doi.org/10.1386/iscc.7.2.177_1

Crovi, D. (2013). Jóvenes al fin, contraste de opiniones entre estudiantes y trabajadores. In Crovi, D., Garay, L.M., López, R., & Portillo, M. (Eds.), *Jóvenes y apropiación tecnológica. La vida como hipertexto* (pp. 183-196). Distrito Federal: Sitesa/UNAM. https://bit.ly/2IJi6Tn

Dalton, R.J. (2004). *Democratic challenges, democratic choices. The erosion of political support in advanced industrial democracies.* Oxford: Oxford University Press. https://doi.org/10.1017/s1537592705630150

De-la Garza, D., & Barredo, D. (2017). Democracia digital en México: Un estudio sobre la participación de los jóvenes usuarios mexicanos durante las elecciones legislativas federales de 2015. *Index Comunicación*, *7*(1), 95-114. http://bit.ly/2Jyukkr

DiMaggio, P., & E, H. (2001). *From the 'digital divide' to 'digital inequality': Studying internet use as penetration increases. Working Paper nº 15. Center for Arts and Cultural Policy Studies, Woodrow Wilson School.* Princeton: Princeton University. https://bit.ly/2KSUpL5

Fernández, A. (2015). Factores que influyen en la confianza en los medios: explorando la asociación entre el consumo de medios y las noticias sobre el Movimiento 15M. *Hipertext*, *13*, 1-16. https://doi.org/10.2436/20.8050.01.22

García, M.C., Mercedes, D.H., & Fernández, C. (2014). Jóvenes comprometidos en la Red: El papel de las redes sociales en la participación social activa. [Engaged youth in Internet. The role of social networks in social active participation]. *Comunicar, 43*, 35-43. https://doi.org/10.3916/C43-2014-03

García-Peñalvo, F.J. (2016). La socialización como proceso clave en la gestión del conocimiento. *Education in the Knowledge Society*, *17*(2), 7-14. https://doi.org/10.14201/eks2016172714

Gil-de Zúñiga, H., Veenstra, A., Vraga, E., & Shah, D. (2010). Digital democracy: Reimagining pathways to political participation. *Journal of Information Technology & Politics*, *7*(1), 36-51. https://doi.org/10.1080/19331680903316742

Gómez, S., Tejera, H., & Aguilar, J. (2013). *La cultura política de los jóvenes en México*. México: Colegio de México.

Grossman, L.K. (1995). *The electronic republic: Reshaping democracy in the information age*. New York: Viking. https://doi.org/10.1016/s0740-624x

Gualda, E., Borrero, J.D., & Cañada, J.C. (2015). La 'Spanish Revolution' en Twitter (2): Redes de hashtags y actores individuales y colectivos respecto a los desahucios en España. *Redes, 26*(1), 1-22. https://doi.org/10.5565/rev/redes.535

Hargittai, E. (2002). Second-level digital divide: Differences in people's online skills. *First Monday, 7*(4), 1-20. https://doi.org/10.5210/fm.v7i4.942

Haro, C., & Sampedro, V. (2011). Activismo político en Red: Del movimiento por la vivienda digna al 15M. *Teknokultura, 8*(2), 167-185. http://bit.ly/2JTwOcA

Hernández, E., Robles, M., & Martínez, J. Jóvenes interactivos y culturas cívicas: sentido educativo, mediático y político del 15M. [Interactive youth and civic cultures: The educational, mediatic and political meaning of the 15M]. *Comunicar, 40*, 59-67. https://doi.org/10.3916/C40-2013-02-06

Manríquez, M.T., & Augusti, E.C. (2015). Participación multi-asociativa de los jóvenes y espacio público: Evidencias desde el caso chileno. *Revista Del CLAD Reforma y Democracia, 62*, 167-192. http://bit.ly/2Hxvv1x

Mardones, R. (2014). La encrucijada de la democracia chilena: una aproximación conceptual a la desafección política. *Papel Político, 19*(1), 39-59. https://doi.org/10.11144/Javeriana.PAPO19-1.edca

Mascheroni, G. (2017). A practice-based approach to online participation: Young people's participatory habitus as a source of diverse online engagement. *International Journal of Communication, 11*, 4630-4651. http://bit.ly/2QfGuiN

Min, S.J. (2010). From the digital divide to the democratic divide: Internet skills, political interest, and the second-level digital divide in political internet use. *Journal of Information Technology & Politics, 7*(1), 22-35. https://doi.org/10.1080/19331680903109402

Min, S.J., & Wohn, D. (2018). All the news that you don't like: Cross-cutting exposure and political participation in the age of social media. *Computers in Human Behavior, 83*, 24-31. https://doi.org/10.1016/j.chb.2018.01.015

Morales, H. (2002). Visibilidad de la movilización juvenil en México. Notas para su análisis. *Última, 17*, 11-39. https://doi.org/10.4067/S0718-22362002000200002

Norris, P. (2001). *Digital divide: Civil engagement, information poverty, and the internet worldwide*. Cambridge: Cambridge University Press. https://doi.org/10.1017/cbo9781139164887.003

Oser, J., Hooghe, M., & Marien, S. (2013). Is online participation distinct from offline participation? A latent class analysis of participation types and their stratification. *Political Research Quarterly*, *66*(1), 91-101. https://doi.org/10.1177/1065912912436695

Pasquino, G., Bartolini, S., & Cotta, M. (1996). *Manual de Ciencia Política*. Madrid: Alianza Editorial.

Portillo, M. (2015). Construcción de ciudadanía a partir del relato de jóvenes participantes del# YoSoy132. *Global Media Journal México*, *12*, 1-18. http://bit.ly/2WmnvIP

Quiñónez, L.C. (2014). Medios y elecciones 2012: viejos y nuevos desafíos para la comunicación política en México. *Nóesis*, *23*(45), 24-48. https://doi.org/10.20983/noesis.2014.1.1

Recuero, F. (2016). *La participación política online: Un análisis de sus condicionantes. Actas del XV Congreso Nacional de Educación Comparada: Ciudadanía mundial y educación para el desarrollo. Una mirada internacional*. Sevilla: Universidad Pablo de Olavide.

Resina, J. (2010). Ciberpolítica, redes sociales y nuevas movilizaciones en España: El impacto digital en los procesos de deliberación y participación ciudadana. *Mediaciones Sociales*, *7*(2), 143-164. http://bit.ly/2LZ8f0n

Sveningsson, M. (2014). 'I don´t like it and I think it´s useless, people discussing politics on Facebook´: Young Swedes' understandings of social media use for political discussion. *Cyberpsychology*, *8*(3), 1-16. https://doi.org/10.5817/CP2014-3-8

Van-Dijk, J., & Hacker, K. (2003). The digital divide as a complex and dynamic phenomenon. *The International Society*, *19*(4), 315-326. https://doi.org/10.1080/01972240309487

Vesnic-Alujevic, L. (2012). Political participation and Web 2.0 in Europe: A case study of Facebook. *Public Relations Review*, *38*(3), 466-470. https://doi.org/10.1016/j.pubrev.2012.01.010

Vierner, M., Cárcamo, L., & Scheihing, E. (2018). Pensamiento crítico de los jóvenes ciudadanos frente a las noticias en Chile. [Critical thinking of young citizens towards news headlines in Chile]. *Comunicar*, *54*, 101-110. https://doi.org/10.3916/C54-2018-10

Vromen, A., Loader, B., Xenos, M., & Bailo, F. (2016). Everyday making through Facebook engagement: Young citizens' political interactions in Australia, the United Kingdom and the United States. *Political Studies*, *64*(3), 513-533. https://doi.org/10.1177/0032321715614012

Zaheer, L. (2016). Use of social media and political participation among university students. *Pakistan Vision*, *17*(1), 295. https://doi.org/10.1016/j.tele.2017.04.002

Zepeda, R. (2014). El movimiento estudiantil chileno: desde las calles al congreso nacional. *RASE*, *7*(3), 689-695. http://bit.ly/2QjaV7z

Safe and inclusive educational apps: Digital protection from an ethical and critical perspective

Aplicaciones educativas seguras e inclusivas: La protección digital desde una perspectiva ética y crítica

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ABSTRACT

The mediated use of technology fosters learning from early childhood and is a potential resource for inclusive education. Nevertheless, the huge range of options and exposure to interactive digital content, which is often online, also implies a series of risks. The definition of protection underlying the current strategies to protect children is inadequate as it only extends to reducing children's exposure to harmful content. This study proposes the expansion of this definition. Through systematic observation of 200 apps within the Catalan sphere for children under 8 years of age and principal component analysis, the results support a multidimensional conceptualisation of protection which, instead of being restricted to the potential risks, also considers aspects related to the educational and inclusive potential of digital resources. Five factors are suggested in order to select these resources and contribute to the digital competence of teachers and students. The first factor concerns the use of protection mechanisms and the existence of external interference, the second factor indicates the presence of adaptation tools; the exposure to stereotypes corresponds to the third factor and the last two consider the previous knowledge required and the verbal component of the apps. Finally, the scope of the suggested definition and its limitations as a guide for future analysis will be discussed.

RESUMEN

El uso mediado de la tecnología fomenta el aprendizaje desde la infancia y representa un potencial recurso para la educación inclusiva. Al mismo tiempo, la creciente exposición a contenidos digitales interactivos, a menudo conectados a la red, conlleva una serie de riesgos para los niños. A las estrategias actualmente empleadas para protegerlos, que se limitan a reducir su exposición a contenidos perjudiciales, parece subyacer una definición de protección inadecuada. Esta investigación propone que se amplíe esta definición. A través de una observación sistemática de 200 apps para menores de ocho años en el ámbito catalán y un análisis de componentes principales, se propone una definición multidimensional de protección que no se limita a detallar los riesgos potenciales, sino que también considera aspectos relacionados con el potencial educativo e inclusivo de los recursos digitales. Se sugieren cinco factores a considerar para seleccionar estos recursos y contribuir a la competencia digital de docentes y alumnos. El primer factor concierne al uso de mecanismos de protección y la existencia de interferencias externas; el segundo factor indica la presencia de herramientas de adaptación; la exposición a estereotipos corresponde al tercer factor y los últimos dos consideran los conocimientos previos requeridos y el componente verbal de las apps. Finalmente se discute el alcance de la definición propuesta y sus limitaciones para guiar análisis futuros.

KEYWORDS | PALABRAS CLAVE

Children, educational technology, apps, safety, inclusive education, content analysis, protection of minors, cybersafety, digital competence.
Niños, tecnología educativa, apps, seguridad, educación inclusiva, análisis de contenido, protección de menores, ciberseguridad, competencia digital.

1. Introduction

Data from the report "EU Kids online" (Livingstone, 2014) and Nielsen Group (2012) relating to the adoption of technologies by children and young people in Europe shows they connect to the internet on a daily basis, using various devices (mobile phones in particular), and at an increasingly young age. This trend has continued to date.

According to the OFCom report (2017), 65% of children aged between 3 and 4 and 75% of those aged between 5 and 7 years old use tablets on a daily basis in the UK, and 23% in the age range 3 to 4 and 47% of those aged 5 to 7 use smartphones. The Common Sense Census corroborates these data (Rideout, 2017). At the same time, the number of apps for pre-school age children has increased considerably (the Apple Store alone has over 80,000 apps for children, in line with the growing demand for digital tools from educators and families that can help children to learn, play and entertain themselves (Troseth, Russo, & Strouse, 2016). The contextual framework for this research focuses on the Catalan sphere, which has registered exponential growth in its digital games industry since 2012, as noted in the report "Llibre blanc de la indústria catalana del videojoc" (Desarrollo Español de Videojuegos, 2016).

The possible benefits for learning processes that may derive from digital games in general, and for children in particular, is one of the most extensively debated issues in the literature. In fact, the learning potential offered by interactive digital resources is widely supported (Herodotou, 2017; Flewitt, Messer, & Kucirkova, 2015; Kirkorian & Pempek, 2013), although children's exposure to potentially harmful online content generates controversy. In this regard, the European Commission (2006) identifies three macro-categories of risks for underage users: risks related to getting in touch with strangers (cyber-bullying, grooming and sexting), rather than exposure and access to different kinds of inappropriate and harmful content (for instance pornography or violence), or privacy risks (for example, services that use geo-localization).

Lievens (2015) also notes the existence of three types of online risks for children: those related to content, in which the child is a recipient; risks relating to contact, in which they are proactive participants; and behavioural risks, in which the child is an actor who breaches certain behavioural rules (e.g. making purchases or downloading illegal content). This type of classification makes clear the complexity of the phenomenon as well as the different types of threat children face online and offline, implying that new measures for prevention and protection need to be found.

With this objective in mind, the European Union report establishing a "European framework for the digital competence of educators" (Redecker, 2017) stresses that safety measures cannot be limited to setting up external barriers (preventing access to potentially harmful content, for instance). Instead, the priority should be to empower learners to identify and manage risks autonomously. Following the conclusions of Livingstone, Mascheroni and Staksrud (2015), an educator's role as a mediator is a key factor in limiting the potential risks associated with the use of technologies in online settings. However, the ability to select the most suitable devices and content "should not be taken for granted" (Felini, 2015: 114).

Scholars generally agree that the gatekeepers of children's technology use need support (in terms of information or training) to perform this selection and to understand the risks associated with the use of mobile devices (European Commission, 2015; De Haan, Van-der-Hof, Bekkers, & Pijpers, 2013). At the same time, however, they stress the need for a structural change that could redefine educators' skills within the framework of a more general process of pedagogical innovation (Howard, Yang, Ma, Maton, & Rennie, 2018; Redecker, 2017; Suárez-Guerrero, Lloret-Catalá, & Mengual-Andrés, 2016).

On the other hand, initiatives such as the International Age Rating Coalition (IARC) have attempted to enable parents and educators to select digital resources by classifying digital content for suitable age groups. IARC is used worldwide and is currently the system adopted to classify all apps in the Windows Store for PCs, tablets and smartphones. It has the added value of allowing the target age to be identified using an ad hoc classification for each country, such as the Pan European Game Information (PEGI) system in Europe, which was formerly used to classify audiovisual and console video games by age. PEGI classifies content according to five age groups: 3, 7, 12, 16 and 18. To determine the classifications it uses a residual definition, meaning the product is considered suitable for all ages (PEGI 3) or for children aged 7 or above (PEGI 7) if it does not include the following disturbing elements: violence, bad language, horror,

or anything that may be frightening, explicit references to drugs and/or sex, discrimination, gambling or betting, or online gaming with other people. Indeed, developers of games targeting children under 8 years old do not tend to include explicit scenes of violence or the other elements mentioned, but it does not necessarily follow that all video games devoid of this type of content will have been developed with children in mind.

The limited classification criteria may explain why, according to the PEGI report (2013), 58% of the total 25,387 content items classified using the PEGI system between 2003 and 2015 were deemed to be PEGI 3 or PEGI 7; in other words, suitable for children. Similarly, the "Anuario de la industria del videojuego" (AEVI, 2013) highlights the fact that over half the 20 best-selling videogames are classified as suitable for PEGI 3 (for all audiences) or PEGI 7. These data underscore the limited ability of the current definition of protection to engender the reality of the risks children face, for instance, the risk of exclusion or exposure to more normalised but no less harmful content (such as stereotypes related to ethnicity or gender).

The limitations that affect the current attempts at regulation derive from a definition of "protection" which falls short for two reasons, the first being that the definition is merely residual (i.e. the absence of certain threats deems the content to be appropriate), whilst the second is that it

> The current definition of protection circumscribes the task of prevention to reducing the potential risks and children's exposure to harmful content, thus situating the child-player as a mere object of protection.

does not take into account the suitability of the apps' characteristics for the target audience, infringing children's right to participation in and access to Information and Communication Technologies (ICT) as laid down by the United Nations under the Convention on the Rights of the Child (Assembly of the United Nations, 1989) and the Convention on the Rights of Persons with Disabilities (Assembly of the United Nations, 2006). For instance, it has been proven that digital games can increase social skills (e.g. self-concept, self-efficacy, awareness of emotions, etc.) and communicative skills in children with autistic spectrum disorder (ASD) (Hourcade & al., 2013; Gay & Leijdekkers, 2014) and with Down's syndrome (Porter, 2018; Yussof & al., 2016). However, to fully take advantage of these possible benefits, teachers need to know which digital resources are most suited to students and how to guarantee the safe use of technology during the learning process (Soler, López-Sánchez, & Lacave, 2018).

The first step is to agree on a definition, which will depend on the role attributed to child players. In the author's view, the current definition of protection circumscribes the task of prevention to reducing the potential risks and children's exposure to harmful content, thus situating the child-player as a mere object of protection. In contrast, initiatives such as the Better Internet for Kids campaign by the European Commission (2012) place particular emphasis on the need to promote activities to empower children from an early age in order to foster their engagement in the digital world. And teachers play a key role in this regard.

Taking into account these limitations, this research defends a broader conceptualisation of child protection in line with that established by BinDhim and Trevena (2015), encompassing both the absence of threats and accessibility. From this perspective, the research is grounded on the paradigm of Universal Design for ICT, envisaging accessible design that can adapt to all boys and girls, both with normal development and special educational needs (Holt, Moore, & Beckett, 2014; Sobel, O'Leary, & Kientz, 2015; Odom, & Diamond, 1998). The research aims to offer a new and more critical and ethical perspective on the concept of protection related to underage users. To explore the theoretical-empirical consistency of this definition, and to establish which aspects teachers should take into account when selecting educational digital tools, we conducted a content analysis and principal component analysis, that are explained below.

2. Instruments and method

2.1. Sample and features of the selected apps

The sample was limited to apps targeting children under 8 years old (apps classified as PEGI 3 and PEGI 7 and/or 4+ in the Apple Store), due to the scarcity of studies focusing on early childhood and the need to consider the specific features of child development during the first few years of life.

Apps were selected using a search engine (Google Search) and two databases (Apple Store and Google Play Store) and based upon two inclusion criteria: 1) the app should be aimed at children from 0 to 7 years old following the explicit statement of the developer or, if this information was not available, by the distributors; 2) the app developer should be based in Catalonia and/or at least one version of the app should be in Catalan (see Acknowledgments).

To ensure a heterogeneous sample, simple random sampling was used to exclude apps by the same developers with the same programming and visual engine but different content (for example: colouring in princesses, colouring in cars, colouring in animals). Using these criteria, the final sample included 200 apps in Catalan or developed in Catalonia aimed at children under 8 years old.

The apps analysed were created by 87 different developers and were all launched between 2011 and 2017. Due to the geographic focus of the research, 80% of the apps in the sample were developed in Spain (149 in Catalonia and 11 outside this region). 47% of the sample works on more than one operating system and 34.5% (n=69) are completely free. Of the paid-for apps, 36 cost less than €3, 15 between €3 and €10 and 3 between €10 and €30.

2.2. Analytical approach

The methodology used in the research was content analysis through structured observation, which is usually used in the study of digital and interactive applications for children (Amy, Alisa, & Andrea, 2002; Bruckman & Bandlow, 2002). The methodological framework of the project is the post-positivist research paradigm (Creswell, 2008). The observation sheet used to perform the content analysis was composed of a total of twenty variables, of which six were descriptive and dichotomous and aimed at identifying some basic features of the apps, such as: a) whether the app is aimed at a group with special educational needs; b) whether the responses adapt to the user; c) whether it includes the option to select different levels of difficulty; d) whether it can be used offline; e) whether it can be used by multiple players; and finally, f) whether it uses geolocation systems.

Table 1 shows the other variables —also dichotomous (presence=1 / absence=0) used for the operationalization of the "child protection" construct, considering the safe use of digital content and its accessibility.

Table 1. Dichotomous variables observed and their average value in the sample (n=200)	
Variables	**Mean**
Absence of information for parents and/or educators	0.64
Absence of barriers to block external links or purchases	0.47
Invasive content (does not interrupt interaction, can be removed)	0.21
Invasive content (does not interrupt interaction, cannot be removed)	0.13
Non-invasive content (does not appear during the game)	0.29
Gender stereotypes	0.20
Ethnic stereotypes	0.06
Absence of visual adaptation tools	0.94
Absence of auditory adaptation tools	0.91
Absence of reduced mobility adaptation tools	0.86
On-screen verbal feedback	0.26
Verbal messages required to play	0.20
Scenario and elements can be recognised from 12 years old	0.05
Text is required to play	0.50

The conceptualization of the variables in the previous table is generally self-explanatory (presence or absence of certain technical features or design characteristics). Ethnic stereotypes, however, were defined as the set of qualities or behaviours that are attributed in a generalized way to a culture, or to a person, according to their origin.

As defined by Cusack (2013: 17), "'gender stereotyping' is the practice of ascribing to an individual man or woman specific attributes, characteristics or roles by reason only of her or his membership in the social group of men or women".

As regards the procedure, a researcher carried out observation of the 200 apps in the sample in the last quarter of 2017 using an iPad and a Samsung Galaxy tablet. The observation protocol of each app involved an initial 10-minute interaction with the game, after which the researcher started coding the information using an Excel sheet. During the coding process the researcher was free to return to the app as necessary and with no time restrictions until the analysis form was complete.

Nine experts, six women and three men, validated the observation sheet (content validity by expert judgments): five professors (three from the area of education technology and two from special and inclusive education); a full professor in education and mother of two children under eight, one of them with Down's syndrome; a children's app developer; a communication professional and father of three children under the age of 8; and a nursery school teacher with vast experience in educational inclusion and pre-schoolers with functional diversity. Two researchers conducted a pilot test, independently observing the same three apps, which were not included in the final sample.

Table 2 shows the results of the inter-rater reliability measure for the three apps, which show a very good level of agreement (Landis & Koch, 1977).

Table 2. Inter-rater reliability measure calculated using Cohen's Kappa coefficient				
Symmetric Measures				
Measure of agreement	Value	Asymp Standard error	Approx. T	Approx. Sig
Kappa (app1)	.857	.027	18.647	.000
Kappa (app2)	.778	.033	16.876	.000
Kappa (app3)	.759	.034	16.618	.000

An analysis of the observed frequencies and contingency tables was chosen to describe the characteristics of the apps analysed. Following this, principal component analysis was conducted (hereinafter referred to as PCA) to observe the eigenvalues of each component. PCA was performed using the Varimax orthogonal rotation method. Descriptive and inferential statistical analysis was performed using statistics software IBM SPSS Statistics.

3. Results

3.1. Description of the sample of 200 apps

In terms of the target age group, it is notable that in 126 cases the developer does not state the group the app is designed for, and in 9 the app is stated as suitable for all ages. In other words, 67.5% of the apps do not include any precise instructions from the developers with regard to the target age group. 163 of the apps can be used offline (81.5%), 27 can be used offline without access to all content (13.5%) and 10 cannot be used offline (5%). When it comes to privacy, the presence and use of geolocation systems was considered, but was only recorded in 2 apps.

To stimulate collaborative and inclusive peer-to-peer play, apps need to allow games to be played by more than one user. However, 177 apps (88.5%) are designed for a single player. Only 13 apps are explicitly aimed at a particular group (children with ASD, Down's syndrome, attention deficit disorder, attention deficit hyperactivity disorder or other learning disorders). In 9 cases (3 in apps for children with ASD) the apps are adaptive (4.5%) —in other words, the user's response determines the difficulty of the game— whereas 73 apps include the option to choose different levels of difficulty (36.5%).

3.2. Adequacy with the protection and safety assumptions for children under eight years' old

A descriptive analysis was carried out of the characteristics of the apps according to the definition of child protection used in this research, encompassing both the idea of safety in the strict sense and elements related to access in the design and content of apps for children. 35% of the sample provides information for parents and/or educators in the application itself, and 1.5% provides a link via an external website. In other words, only 36.5% contain information for parents and educators.

Barriers to block children from accessing external links or purchases during the game are incorporated in 57 apps (28.5%). Considering they are not necessary in another 49 cases (24.5%), 47% of the sample does not comply with the requirement to prevent access (involuntary or conscious) to external links or purchases by children. Likewise, only 40.5% of the apps analysed are free from external interference, with most exhibiting at least one of the following features:

- Invasive advertisements or messages that interrupt the interaction (n=7; 3.5% of the sample).
- Invasive advertisements or messages that, despite not interrupting the interaction, cannot be removed (n=25; 12.5%);
- Invasive advertisements or messages that do not interrupt the interaction but can be removed, for example by clicking on the "x" symbol to close the window (n=41; 20.5%);
- Non-invasive advertisements or messages that do not appear during the game (n=58; 29%).

As expected, none of the content covered by PEGI was found, although gender stereotypes were found in 39 cases (19.5%), and ethnic stereotypes in 11 cases (5.5%). In terms of aspects related to accessibility, three different dimensions were considered: the range of strategies or mechanisms for visual, auditory and motor adaptation. Visual adaptation tools were only found in 13 apps (6.5%). From these, only 3 apps allow identification, inversion or adaptation of colours, 7 allow text size to be changed, 6 the screen or element size to be changed and 2 have a voice-over. Similar data was recorded with the visual adaptation tools (only 13 apps analysed included these) and auditory adaptation tools (19 apps).

Finally, tools to adapt to reduced physical and motor skills were found in 28 cases (14%). The sample therefore has serious shortcomings in terms of accessibility, especially if we consider that none of the apps analysed allow the keyboard to be adapted or the use of external devices for reduced mobility. Only two apps recognise drawing on the screen and two allow the use of alternative gestures as a different mode of interacting with the screen and achieving the goal of the game (i.e. tap instead of drag).

Approximately half the sample (109 apps, 54.5%) does not include verbal messages. In 40 apps (20%) verbal messages are essential to play, which presents both cognitive and communicative adaptation problems for some groups with special educational needs. Conversely, feedback on the game screen is verbal in 25.5% of the cases analysed. In relation to the adequacy for the target, text was identified as necessary to play in 99 apps (49.5%).

Exclusively taking into account the 70 apps explicitly aimed at children aged 6 or under (at pre-school age reading and writing skills are not usually developed), text is necessary to be able to play in over half (n=37; 53%). Bearing in mind that the study focuses on children aged between 0 and 8 years old, this could be interpreted as an indicator of the game developers' poor understanding of the target group. Scenarios and elements that could only be recognised by children over 12 years old were also observed (10.5%).

3.3. Reduction of dimensions

The PCA included variables associated with the idea of protection (Table 3), with the exception of one variable present in very few cases ("Invasive advertisements or message that interrupt the interaction", n=7). The descriptive variables were not considered, because in themselves they do not constitute a problem of accessibility or safety for underage users. As already mentioned, the variables used in the PCA are dichotomous, their presence (1) or absence (0) being recorded during observation. The PCA allowed us to extract five components with values over the Kaiser criterion of 1. The five components together explained 60.4% of the variance. The Kaiser-Meyer-Olkin measure for sampling adequacy is 0.663, above the commonly recommended value of 0.6 (Kaiser & Rice, 1974), and Bartlett's sphericity test is significant, $x2$ (91)=488.758, p<.001, which indicates that the correlations between the variables are high enough to justify the PCA.

Table 3. Rotated component matrix					
	C1	**C2**	**C3**	**C4**	**C5**
Absence of barriers to block external links or purchases	.781	.074	.047	.137	-.057
Invasive content (does not interrupt interaction, can be removed)	.755	.056	.165	-.108	.045
Non-invasive content (does not appear during the game)	.665	.093	.085	.102	.333
Invasive content (does not interrupt interaction, cannot be removed)	.656	.069	.034	.008	-.057
Absence of information for parents and/or educators	.592	.081	-.155	-.150	-.276
Absence of auditory adaptation tools	.137	.807	.054	-.083	-.129
Absence of visual adaptation tools	.025	.776	.084	.239	.077
Absence of reduced mobility adaptation tools	.108	.758	-.006	-.166	-.071
Ethnic stereotypes	.067	-.002	.847	.053	-.092
Gender stereotypes	.075	.108	.818	-.039	.055
Scenario and elements can be recognised from 12 years old	.122	-.074	-.053	.802	-.093
Text is required to play	-.072	.027	.051	.647	.061
On-screen verbal feedback	.081	.042	-.038	-.172	.812
Verbal messages required to play	-.181	-.291	-.023	.235	.556
Total of the explained variance	20.8%	12.3%	10.2%	8.9%	8.2%
Composite Reliability (CR)	0.82	0.82	0.82	0.69	0.64
Average Variance Extracted (AVE)	0.48	0.61	0.69	0.53	0.48

The reliability of the constructs was measured with the composite reliability index (CR) (Bagozzi & Yi, 1988) and the average variance extracted (AVE) (Fornell & Larcker, 1981). The values for each of the components extracted are summarised in the last two rows of Table 3. Both indices are above or approaching their respective cut-off values (CR>.60 and AVE>.50) for all five components. A cut-off value of $\lambda=0.5$ was established in order to make a decision about the number of variables to retain for each component. All the variables contained in the five components showed positive factorial loadings (in other words, the variables showed positive correlation with the respective latent component).

The first component, the "Security dimension", accounts for 20.8% of the total variance and brings together items associated with insufficient prevision of protection mechanisms on one hand, and the existence of external interference, on the other. The absence of barriers to block external links or purchases is the aspect that contributes most to the first component in terms of factorial load ($\lambda=0.781$), followed by the presence of invasive advertisements or messages that, although they do not interrupt the action, may represent a negative interference, especially considering the age of the users. These invasive advertisements and/or messages have different characteristics, as they may sometimes be removed by the user ($\lambda=0.755$), whilst others do not appear during the game ($\lambda=0.665$) or simply cannot be removed ($\lambda=0.656$). Lastly, this component encompasses an aspect related to the absence of information for parents/educators ($\lambda=0.592$).

The second component accounts for 12.3% of the total variance. It was labelled "Adaptation tools" and identifies variables associated with the presence (or in this case lack of) strategies and mechanisms that favour inclusive use of the app. Specifically, the second component establishes a connection between three aspects: the absence of auditory adaptation tools ($\lambda=0.807$), visual adaptation tools ($\lambda=0.776$), and reduced physical and motor skills adaptation tools ($\lambda=0.758$). The third component ("Exposure to stereotypes") accounts for 10.2% of the total variance. In this case, reference is made to ethnic stereotypes ($\lambda=0.847$) or gender stereotypes ($\lambda=0.818$).

The fourth and fifth components account for 8.9% and 8.2% of the total variance and are "Prior knowledge" and "Verbal component", respectively. Both identify issues with adequacy. The first makes special reference to textual barriers –text is required to play ($\lambda=0.647$)– associated with the user's ability to recognise the scenario and elements from 12 years old onwards ($\lambda=0.802$). Verbal barriers themselves are identified in component five: either the feedback is verbal on the game screen ($\lambda=0.812$) or verbal messages are necessary to play ($\lambda=0.556$).

In sum, the outputs derived from the PCA suggest that in the case under analysis focusing on apps in the Catalan language or developed in Catalonia, the traditional definition of protection (identified by the first component) contributes to 34.4% of the total variance explained (20.8/60.4*100). On the other hand, roughly two thirds of the variance explained (the remaining 65.6%) is accountable to an idea of

child protection encompassing aspects related to accessibility (adaptation tools, users' prior knowledge and auditory skills) and inclusiveness (absence of stereotypes).

4. Discussion and conclusions

The spread of digital technologies, the growing use of mobile devices in childhood and their progressive introduction into the classroom, implies a challenge for teachers, new knowledge and digital skills. Child protection in the digital environment is a complex issue that should be approached in a more comprehensive way than it is at present. In this sense, children's right to participation and accessibility from early childhood justifies our proposal for a more critical and ethical definition of protection; one that is not limited to preventing threats but that takes into account other aspects such as universal design and the accessibility of apps for young children.

The results suggest an invitation to teachers and educators in general to consider at least 5 aspects related to the design and development of educational digital tools (in this case, apps) that contribute to this updated definition of protection:

1) App mechanisms and strategies that could help to increase "safety" in its most traditional conceptualization and that include:

- Barriers to connecting to the internet and the absence of external interference accountable for the risks associated with being online (contact with strangers and the violation of privacy, and the use of geolocation).
- Information provided by the app (or not provided in 63.5% of the sample analysed) and aimed at parents and educators should ideally inform them of the game's educational and recreational potential and warn of any potential risks. This information would empower educators as well as increasing their feelings of safety thanks to their perception of being able to control the risk factors.

2) Exposure and access to unsuitable or harmful content within the app itself has an undesirable effect in the mid and long term. None of the content "screened" by current age classification systems used for apps for children was observed during the analysis (explicit scenes involving sex, drugs, violence, etc). This notwithstanding, rather than stressing the ability of the PEGI system to classify apps for underage users, these results reveal its limitations in detecting other risks users may be exposed to (discrimination, exclusion, etc.), such as "exposure to stereotypes" (Component 3) relating to both gender and ethnicity;

3) Integration of visual, auditory and reduced physical or motor skills "adaptation tools" (Component 2) which protect the right to accessibility and participation for all children, within the framework of universal design and inclusive education;

4) Adaptation of the interactive content and design for the target group, considering children's "prior knowledge" (Component 4). Despite the fact that the suitable age is often specified (as is the case with board games), the industry tendency to treat child users as a single undifferentiated target group is criticised. Reading and writing skills being essential to be able to play the game, an element found in the vast majority of the sample, is considered an accessibility issue (especially bearing in mind the audiovisual potential of interactive games);

5) Finally, the verbal component of the app should be considered (Component 5). This aspect ends up being a hindrance for children with normal development (who are learning to speak and/or are not familiar with the language), or those with special educational needs (deafness or hypoacusia, auditory memory and processing disabilities, ADHD and other learning difficulties), as in many apps it is the only way to access information.

Our proposal aims to contribute to the debate on the digital skills of teachers, but without suggesting that the set of characteristics observed is exhaustive. In addition, there were some limitations that affected the research; in terms of the instrument, it was not possible to measure its external validity as it was created specifically for the study. Additionally, from a methodology perspective, the single context and limited size of the sample prevent us from generalizing the results across the thousands of apps on the market for children under 8 years old. These limitations open up possibilities for future research to test this proposal in other contexts, with the objective of establishing guidelines to critically select resources that can guarantee

children's safety and ensure their right to participation.

Introducing digital competences into pedagogical practices in the classroom is not only up to teachers, but implies a structural change within educational institutions (Suárez-Guerrero, Lloret-Catalá & Mengual-Andrés, 2016; Howard, Yang, Ma, Maton, & Rennie, 2018). However, empowering teachers would at least produce a set of spill-over effects on students and the educational community at large. Becoming familiar with the different stages of designing, planning and implementing the use of digital technology is one of the priorities addressed by the "European framework for the digital competence of educators" (Redecker, 2017), with particular emphasis on an educational context in which, in the near future, teachers would not just select but would actually develop digital tools. To sum up, protecting children from an ethical and inclusive perspective means providing them with critical knowledge from pre-school onwards, to help them become fully integrated in the digital world.

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References

Asociación Española de Videojuegos (Ed.) (2013). *Anuario de la industria del videojuego*. Madrid: AEVI. http://bit.ly/2Q2vKUE

Assembly of the United Nations (Ed.) (1989). Convention on the Rights of the Child. UN Office of the High Commissioner for Human Rights. http://bit.ly/2Yor3Yr

Assembly of the United Nations (Ed.) (2006). Convention on the Rights of Persons with Disabilities [A/RES/61/106]. http://bit.ly/2W85M85

Bagozzi, R.P., & Yi, Y. (1988). On the evaluation of structural equation models. *Journal of the Academy of Marketing Science*, *16*(1), 74-94. https://doi.org/10.1007/BF02723327

BinDhim, N., & Trevena, L. (2015). Health-related smartphone apps: Regulations, safety, privacy and quality. *BMJ Innovations*, *1*(2), 43-45. https://doi.org/10.1136/bmjinnov-2014-000019

Bruckman, A., & Bandlow, A. (2002). Human-computer interaction for kids. In Bruckman, A., Bandlow, A., & Forte, A. (Eds.), *The human-computer interaction handbook* (pp. 428-440). New Jersey, USA: Erlbaum Associates Inc. https://doi.org/10.1201/b11963-42

Creswell, J.W. (2008). *Research design: Qualitative, quantitative, and mixed methods approaches*. Los Angeles: Sage Publications. http://bit.ly/2WJTFuM

Cusack, S. (2013). Gender stereotyping as a Human Rights violation: Research report. Prepared for the UN Office of the High Commissioner for Human Rights. http://bit.ly/2Hh4nnm

De-Haan, J., der Hof, S.V., Bekkers, W., & Pijpers, R. (2013). Self-regulation. In *Towards a better Internet for Children* (pp. 111-129). http://bit.ly/2JfzRwp

Desarrollo Español de Videojuegos (Ed.) (2016). Llibre blanc de la indústria catalana del videojoc 2016. http://bit.ly/30pMfzc

European Commission (Ed.) (2006). Recommendation of the European Parliament and of the Council of 20 December 2006 (2006/952/EC) on the protection of minors and human dignity and on the right of reply in relation to the competitiveness of the European audiovisual and on-line information services industry. http://bit.ly/2W0Jx3B

European Commission (Ed.) (2012). Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: European Strategy for a better Internet for Children. COM(2012). http://bit.ly/2JgVOej

Felini, D. (2015). Beyond today's video game rating systems: A critical approach to PEGI and ESRB, and proposed improvements. *Games and Culture*, *10*(1), 106-122. https://doi.org/10.1177/1555412014560192

Flewitt, R., Messer, D., & Kucirkova, N. (2015). New directions for early literacy in a digital age: The iPad. *Journal of Early Childhood Literacy*, *15*(3), 289-310. https://doi.org/10.1177/1468798414533560

Fornell, C., & Larcker, D.F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, *18*(1), 39-50. https://doi.org/10.2307/3151312

Gay, V., & Leijdekkers, P. (2014). Design of emotion-aware mobile apps for autistic children. *Health and Technology*, *4*(1), 21-26. https://doi.org/10.1007/s12553-013-0066-3

Herodotou, C. (2017). Young children and tablets: A systematic review of effects on learning and development. *Journal of Computer Assisted Learning*, *34*(1), 1-9. https://doi.org/10.1111/jcal.12220

Holt, R.J., Moore, A.M., & Beckett, A.E. (2014). *Together through play: Facilitating inclusive play through participatory design*. *In Inclusive designing: Joining usability, accessibility, and inclusion*. Switzerland: Springer International Publishing. https://doi.org/10.1007/978-3-319-05095-9_22

Hourcade, J.P., Williams, S.R., Miller, E.A., Huebner, K.E., & Liang, L.J. (2013). Evaluation of tablet apps to encourage social interaction in children with autism spectrum disorders. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 3197-3206). https://doi.org/10.1145/2470654.2466438

Howard, S.K., Yang, J., Ma, J., Maton, K., & Rennie, E. (2018). App clusters: Exploring patterns of multiple app use in primary learning contexts. *Computers & Education*, *127*, 154-164. https://doi.org/10.1016/j.compedu.2018.08.021

Kaiser, H.F., & Rice, J. (1974). Little jiffy, mark IV. *Educational and Psychological Measurement*, *34*(1), 111-117. https://doi.org/10.1177/001316447403400115

Kirkorian, H.L., & Pempek, T.A. (2013). Toddlers and touch screens: Potential for early learning? *Zero to Three*, *33*(4), 32-37. http://bit.ly/30fUJbQ

Landis, J.R., & Koch, G.G. (1997). The measurement of observer agreement for categorical data. *Biometrics*, *33*(1), 159-174. https://doi.org/10.2307/2529310

Lievens, E. (2015). Children, protection of. In Robin, M., Hwa-Ang, P., et al. (Eds.), *The International Encyclopedia of Digital Communication and Society* (pp. 1-5). https://doi.org/10.1002/9781118767771.wbiedcs018

Livingstone, S. (2014). EU Kids Online. Final report to the EC Safer Internet Programme from the EU Kids Online network 2011-2014. Contract number: SIP-2010-TN-4201001. http://bit.ly/2JCjJo4

Livingstone, S., Mascheroni, G., & Staksrud, E. (2015). Developing a framework for researching children's online risks and opportunities in Europe. http://bit.ly/30ghWuG

Nielsen Group (Ed.) (2012). American families see tablets as playmate, teacher, and babysitter. http://bit.ly/2YjoZku

Odom, S.L., & Diamond, K.E. (1998). Inclusion of young children with special needs in early childhood education: The research base. *Early Childhood Research Quarterly*, *13*(1), 3-25. https://doi.org/10.1016/S0885-2006

OFCom. Office of Communications (Ed.) (2017). Children and parents: Media use and attitudes report publication. http://bit.ly/2WOHkoY

Pan European Game Information (Ed.) (2013). PEGI Annual Report. http://bit.ly/2VkNJqz

Porter, J. (2018). Entering Aladdin's cave: Developing an app for children with Down syndrome. *Journal of Computer Assisted Learning*, *34*(4), 429-439. https://doi.org/10.1111/jcal.12246

Redecker, C. (2017). European framework for the digital competence of educators. DigCompEdu. JCR Science for Policy Report. http://bit.ly/2JhGb6l

Rideout, V. (2017). The common sense census: Media use by kids age zero to eight 2017. http://bit.ly/2W13F5N

Shuler, C. (2009). *iLearn; A content analysis of the iTunes App Store Education Section*, volume 2009. New York: The Joan Ganz Cooney Center at Sesame Workshop. http://bit.ly/2HhfAUM

Sobel, K., O'Leary, K., & Kientz, J.A. (2015). Maximizing children's opportunities with inclusive play: Considerations for interactive technology design. In *Proceedings of the 14th International Conference on Interaction Design and Children* (pp. 39-48). ACM. https://doi.org/10.1145/2771839.2771844

Soler, I.R., López-Sánchez, C., & Lacave, T.T. (2018). Percepción de riesgo online en jóvenes y su efecto en el comportamiento digital. [Online risk perception in young people and its effects on digital behaviour]. *Comunicar*, *56*, 71-79. https://doi.org/10.3916/C56-2018-07

Suárez-Guerrero, C., Lloret-Catalá, C., & Mengual-Andrés, S. (2016). Percepción docente sobre la transformación digital del aula a través de tabletas: un estudio en el contexto español. [Teachers' perceptions of the digital transformation of the classroom through the use of tablets: A study in Spain]. *Comunicar*, *49*, 81-89. https://doi.org/10.3916/c49-2016-08

Troseth, G.L., Russo, C.E., & Strouse, G.A. (2016). What's next for research on young children's interactive media? *Journal of Children and Media*, *10*(1), 54-62. https://doi.org/10.1080/17482798.2015.1123166

Yussof, R.L., Anuuar, W.S.W.M., Rias, R.M., Abas, H., & Ariffin, A. (2016). An approach in teaching reading for down syndrome children. *International Journal of Information and Education Technology*, *6*(11), 909. https://doi.org/10.7763/IJIET.2016.V6.815, https://doi.org/10.7763/IJIET.2016.V6.815

Effectiveness of MOOCs for teachers in safe ICT use training

Efectividad de los MOOC para docentes en el uso seguro de las TIC

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ABSTRACT

Despite the efforts made, there is still an alarming difference between the digital competence that teachers have and the one they should have in order to develop their students' digital competence. The lack of teacher training in safe and responsible use of ICT is a special cause for concern. Online courses in MOOC format meet all the required conditions to offer a possible solution to the unavoidable and urgent need for initial and in-service teacher training in this area of digital competence. However, there is currently no evidence in the literature on the effectiveness of these courses for this purpose. This study examines the instructional effectiveness of courses in MOOC format for teacher training in the safe and responsible use of ICT by analysing three different official courses. The courses were analysed using three different methods: a questionnaire to measure participants' perceptions, pre-tests and post-tests to measure the knowledge acquired, and LORI (Learning Object Review Instrument) to measure the quality of digital educational resources created by the participants. The results suggest that online courses in MOOC format are an effective way to train teachers in the safe and responsible use of ICT, and that these courses can enable the development of digital competence in the area of content creation.

RESUMEN

A pesar de los esfuerzos realizados, aún existe una alarmante diferencia entre la competencia digital que tienen los profesores y la que deberían tener para desarrollar la competencia digital en sus alumnos. De especial preocupación es la carencia de formación del profesorado en uso seguro y responsable de las TIC. Los cursos en línea con formato MOOC reúnen todas las condiciones necesarias para ofrecer una posible solución a la ineludible y apremiante necesidad de formación inicial y continua del profesorado en esta área de la competencia digital. Sin embargo, no existe actualmente evidencia en la literatura sobre la efectividad de estos cursos para tal cometido. Este estudio examina la efectividad instruccional de los cursos con formato MOOC para la formación del profesorado en el uso seguro y responsable de las TIC mediante el análisis de tres cursos oficiales diferentes. Estos se analizaron empleando tres instrumentos diferentes: un cuestionario para medir la percepción de los participantes, pre-tests y pos-tests para medir los conocimientos adquiridos y el instrumento LORI (Learning Object Review Instrument) para medir la calidad de recursos educativos digitales creados por los participantes. Los resultados sugieren que los cursos en línea con formato MOOC constituyen una forma efectiva de formar al profesorado en el uso seguro y responsable de las TIC, y que estos cursos pueden ayudar al desarrollo de la competencia digital en el área de creación de contenidos.

1. Introduction and state of the art

Digital competence is one of the basic competences that all students should have acquired by the end of their compulsory education in order to develop as individuals and be able to successfully integrate in society (Diario Oficial de la Unión Europea, 2006). This competence can be defined as "that which involves the creative, critical and safe use of information and communication technologies in order to meet the goals related to work, employability, learning, use of free time, inclusion, and social participation" (Ministerio de Educación, Cultura y Deporte, 2015: 10). In its most recent policies, actions and communications, the European Commission has confirmed that acquiring an adequate level of proficiency in the use of information and communication technologies (ICT) is one of its most relevant priorities (Comisión Europea, 2010, 2018).

In order to improve citizens' level of digital competence, the European Commission has developed the framework "DigComp: The Digital Competence Framework for Citizens" (Vuorikari, Punie, Carretero, & Van den Brande, 2016). Despite the efforts made by government institutions, recent studies indicate that younger people, in spite of being considered "digital natives", have an insufficient level of digital competence (Johnson & al., 2014; Pérez-Escoda, Castro-Zubizarreta, & Fandos-Igado, 2016). This fact is proof that digital competence is not inherently acquired by having access to the Internet and making intensive use of technology, but rather, specific training is required, an issue that had been previously pointed out in the literature (Fernández-Cruz & Fernández-Díaz, 2016; Napal, Peñalva-Vélez, & Mendióroz, 2018; Pérez-Escoda & al., 2016). Another related issue that previous studies have also raised is the threat of a new digital divide, not due to lack of access to technology, but due to lack of digital competence (Pérez-Escoda & al., 2016; Van-Deursen & Van-Dijk, 2011).

Teachers should play a central role in ensuring that their students acquire the digital competence they lack. Nonetheless, in order to successfully achieve this goal, it is necessary that teachers themselves have an adequate level of digital competence. In this regard, it should be taken into account that the use that educators make of ICT is very different from that of other professions (Røkenes & Krumsvik, 2014). For this reason, the term "teacher's digital competence" has been coined to refer specifically to the "set of abilities, knowledge, skills, dexterity and attitudes related to the critical, safe and creative use of the information and communication technologies in education" (INTEF, 2017a: 2). In order to facilitate the development of teacher's digital competence, several initiatives have emerged at both national and international levels. UNESCO published a framework describing the competences that teachers need to have in order to effectively use ICT in their professional practice (UNESCO, 2011). Subsequently, the European Commission developed the framework "DigCompEdu: European Framework for the Digital Competence of Educators" (Redecker & Punie, 2017) with the aim of defining the digital competence that educators must have in order to succeed in making students digitally competent. In addition, the European Commission has elaborated a digital education action plan that includes eleven initiatives to support ICT use and development of digital competence in the educational context, which are meant to be applied before the end of 2020 (Comisión Europea, 2018). In Spain, the Instituto Nacional de Tecnologías Educativas y de Formación del Profesorado (INTEF) published the "Marco Común de Competencia Digital Docente", conceived as a reference framework for diagnosing and improving the digital competence of teachers (INTEF, 2017b). Despite the numerous actions taken by different national and international organisations, results of recent research show that there is an alarming difference between the digital competence that teachers should have in order to develop digital competence in their students, and the one they actually have (Almerich, Suárez, Jornet, & Orellana, 2011; Falcó, 2017; Fernández-Cruz & Fernández-Díaz, 2016; Fernández-Cruz, Fernández-Díaz, & Rodríguez-Mantilla, 2018; Kaarakainen, Kivinen, & Vainio, 2018; Napal & al., 2018; Suárez-Rodríguez, Almerich, Díaz-García, & Fernández-Piqueras, 2012). Therefore, there is a compelling need for initial and in-service teacher training in digital competence.

Teacher's digital competence encompasses multiple areas, as shown by the different frameworks developed to date (INTEF, 2017b; Redecker & Punie, 2017; UNESCO, 2011). Among the areas in which lack of training is of special concern, that related to safety and responsible use of technology stands out. There is strong evidence that teachers have a clear lack of knowledge in this area (De-los-Arcos &

al., 2015; Falcó, 2017; Govender & Skea, 2015; Mannila, Nordén, & Pears, 2018; Napal & al., 2018; Pusey & Sadera, 2011; Shin, 2015). Specifically, previous studies have shown the lack of teacher training concerning the different risks to which children are exposed on the Internet (Govender & Skea, 2015; Mannila & al., 2018; Pusey & Sadera, 2011; Shin, 2015), device and personal data protection (Mannila & al., 2018; Napal & al., 2018; Pusey & Sadera, 2011), digital identity (Napal & al., 2018; Pusey & Sadera, 2011), rules of behaviour on the Internet (Falcó, 2017; Napal & al., 2018; Pusey & Sadera, 2011), and copyright and licensing of digital educational materials (De-los-Arcos & al., 2015; Falcó, 2017; Mannila & al., 2018; Napal & al., 2018; Pusey & Sadera, 2011; Shin, 2015). Without knowledge of these topics, teachers will hardly be able to educate their students in safe and responsible use of technology, as demanded by the teacher's digital competence frameworks developed. This deficiency in teacher training is a severe problem given that there is a clear need to teach children to use technology in a safe and responsible way since they lack the necessary knowledge (Ey & Cupit, 2011; Gamito, Aristizabal, Vizcarra, & Tresserras, 2017; Sharples, Graber, Harrison, & Logan, 2009).

Children are not fully aware of many of the risks that Internet use entails (Ey & Cupit, 2011; Gamito & al., 2017), which is specially concerning considering that most of them are exposed to these risks from a very young age, sometimes leading them to experience adverse incidents (Garmendia, Jiménez, Casado, & Marcheroni, 2016). For this reason, educational institutions should teach children not only about privacy, digital identity, and rules of behaviour on the Internet, but also how to protect themselves against the various dangers of the Internet.

> Teachers should play a central role in ensuring that their students acquire the digital competence they lack. Nonetheless, in order to successfully achieve this goal, it is necessary that teachers themselves have an adequate level of digital competence.

Another major deficiency is the lack of digital competence in creating digital educational materials (Fernández-Cruz & al., 2018; Napal & al., 2018; Ramírez-Montoya, Mena, & Rodríguez-Arroyo, 2017). One consequence of this deficiency is that currently, most teachers do not use authoring tools to create digital educational resources (Fernández-Cruz & al, 2018), which have proven to be capable of providing several benefits for student learning (Gordillo, Barra, & Quemada, 2017; Gürer & Yıldırım, 2014). This deficiency is not only due to the lack of skills in using authoring tools but also to the aforementioned lack of knowledge with regard to licensing of digital materials and copyright, which makes it difficult for teachers to reuse existing content on the web as well as to distribute their own creations.

In view of the unavoidable and compelling need to train teachers to effectively develop their digital competence, new training actions must be undertaken. One possible solution is the use of courses in MOOC format for teacher training. MOOCs are online courses that allow for massive participation and that can be accessed without restriction and free of charge (Siemens, 2013). The overwhelming student-teacher ratio in MOOCs makes individual guidance and monitoring unfeasible, which is why these courses adopt instructional designs that are different from those of traditional online courses in order to allow massive assessment and feedback. The instructional design of a MOOC is a key aspect since it exerts a great influence on the motivation and academic performance of participants (Castaño, Maiz, & Garay, 2015). Based on MOOCs, new types of online courses have emerged such as SPOCs: courses with the same characteristics as MOOCs, except that the number of participants is relatively small and access is only granted to a specific group of people. The term "courses in MOOC format" encompasses all online courses with instructional designs that are characteristic of MOOCs, that is to say, courses that are designed to allow massive participation even if it does not occur.

Courses in MOOC format meet all the necessary conditions to offer a low-cost solution for initial and continuous training of all teachers in digital competence. In fact, prior studies have pointed out that

teachers find these courses attractive for digital competence training (Castaño-Muñoz, Kalz, Kreijns, & Punie, 2018; Gómez-Trigueros, 2017; Ortega-Sánchez & Gómez-Trigueros, 2019). The suitability of courses in MOOC format for addressing teacher training deficiencies has not gone unnoticed by the European Union either, who led an initiative in 2018 to train teachers in safe Internet use through a MOOC (Better Internet for Kids, 2018). Although there is a notable and growing amount of research about MOOCs in the scientific literature (Chiappe-Laverde, Hine, & Martínez-Silva, 2015; Deng, Benckendorff, & Gannaway, 2019; Liyanagunawardena, Adams, & Williams, 2013; Veletsianos & Shepherdson, 2016), not enough attention has been devoted to examining the instructional effectiveness of these courses since, as Deng and others (2019) point out in their recent literature review, the measures of learning outcomes in MOOCs taken to date are not very sophisticated and are often based on a single variable such as the final grade or the completion rate. The majority of existing scientific literature on MOOCs has focused on topics such as course characteristics, types of MOOCs, challenges, potential impacts on education, participant characteristics and behaviour, and certification (Chiappe-Laverde & al., 2015; Deng & al., 2019; Liyanagunawardena & al., 2013; Veletsianos & Shepherdson, 2016).

Existing evidence on the effectiveness of courses in MOOC format aimed at teacher training in digital competence is even weaker than that which exists for MOOCs in general. Different experiences have been reported in the literature in which courses in MOOC format were used to train teachers in different areas of digital competence (Castaño-Muñoz & al., 2018; De-La-Roca, Morales, Teixeira, Hernandez, & Amado-Salvatierra, 2018; Gómez-Trigueros, 2017; Ramírez-Montoya & al., 2017; Sánchez-Elvira & Santamaría-Lancho, 2013; Tsvetkova, 2016). Notwithstanding, several of these studies did not carry out any evaluation of the effectiveness of the courses, and those that did only provided evidence obtained by means of questionnaires completed by the participants themselves as the sole instrument for gathering information. Whereas current evidence on the effectiveness of courses in MOOC format for training in teacher's digital competence is scarce and weak, evidence that these courses can be effective in educating teachers in safe and responsible use of ICT is directly non-existent. Thus, further research is needed on the ability of courses in MOOC format to produce positive impacts on teachers in terms of learning outcomes related to digital competence and especially to the safe and responsible use of technology. This study examines the instructional effectiveness of courses in MOOC format for teacher training in safe and responsible use of ICT by means of the analysis of three official courses.

2. Research method

The aim of this study is to provide empirical evidence on the effectiveness of online courses in MOOC format for teacher training in safe and responsible use of ICT, in order to determine whether this type of instruction is an adequate solution to remedy the existing lack of teacher training on this subject. The research questions were as follows:

a) Are courses in MOOC format an effective way of training teachers in safe and responsible use of ICT?

b) Are courses in MOOC format an effective way of developing in teachers the digital competence to create digital educational materials for teaching safe and responsible use of ICT?

Evidence of effectiveness was obtained through the analysis of three courses in MOOC format organised by official public entities, whose characteristics are summarised in Table 1. The three courses covered the following topics on safe and responsible use of ICT: digital identity, privacy management, risks for children associated with Internet use (including access to inappropriate content, identity theft, cyberbullying, grooming, sexting, dangerous online communities, and technology addiction), good practices in the use of social networks, rules of behaviour on the Internet (netiquette), and licensing of digital materials. These are subjects in which, as seen in the introduction, teachers generally have a great lack of knowledge. In addition to providing training in the aforementioned topics, the courses also aimed to help teachers develop their digital competence to create digital educational materials. The courses were delivered through a virtual learning environment and consisted of a wide range of resources and activities, including videos recorded by experts, interactive multimedia resources (which presented examples of practical cases), additional materials to be used in the classroom with students, video tutorials

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on how to use different applications, forums, links to external resources, self-assessment tests, guided exercises, and digital resource creation workshops with peer review evaluation.

The final task in all the courses consisted of a workshop in which participants had to employ an authoring tool to create a digital educational resource about any of the topics related to safe and responsible use of ICT covered in the course. The aim of this final task was for participants to apply the digital competence acquired throughout the course to create and publish an educational resource that could be later utilised, both by themselves to teach their students how to make safe and responsible use of technology, as well as by other members of the educational community to educate on this subject and create new digital educational resources.

Table 1. Characteristics of the courses in MOOC format analysed			
	Course A	**Course B**	**Course C**
Profile of the participants	Teachers from public, private publicly funded, and private schools in the Comunity of Madrid	Teachers from public, private publicly funded, and private schools in the Comunity of Madrid	Teachers from publicly funded non-university schools in in the Comunity of Castilla y León
Start date	March 2016	October 2016	March 2018
Duration	4 weeks	6 weeks	7 weeks
Estimated dedication	20 hours	30 hours	30 hours
Certification	2 credits	2 credits	3 credits
Enrolled participants	357	634	159
Participants who completed the course (Completion rate)	236 (66%)	565 (89%)	78 (49%)
Sample			
Questionnaire	222	426	75
Pre-test and post-test	200	535	74
Digital educational resources	40	40	40

Three different instruments were used for the analysis of the courses. In order to measure the participants' perception of the different characteristics of the courses, a questionnaire was used, which had Likert questions with five possible answers (1 totally disagree – 5 totally agree) and closed-ended questions. These questionnaires were completed by the participants after finishing the courses. Two additional measures were taken with the aim of analysing the learning outcomes.

On the one hand, the knowledge about safe and responsible use of ICT acquired by the participants during each course was measured by means of a pre-test and a post-test. The pre-test was the first activity completed by the participants whereas the post-test was the last one. Both tests were identical and were comprised of multiple-choice questions. On the other hand, with the aim of obtaining a measure of the digital competence for creating digital educational materials on safe and responsible use of ICT acquired by the participants during each course, the LORI instrument (Leacock & Nesbit, 2007) was used for evaluating, in each course, the quality of 40 educational resources created by participants chosen at random. Thus, 120 resources were evaluated, 14% of the total. Each one of these resources was evaluated by three reviewers with extensive experience in the use of LORI and in the creation of digital educational materials. The score for each criterion was obtained by averaging all the evaluations.

3. Results

3.1. Participants' perception

The results of the questionnaire completed by the participants are shown in Table 2. The overall course scores lie within a range of 3.8-4.1 on a scale of 1 to 5, indicating that participants were, in general, satisfied with the training. The high degree of acceptance of the courses is also reflected in the fact that between 87 and 93% of the participants stated that they would recommend them to other teachers. The courses were rated positively in terms of structure, guidance, assessment, duration, and difficulty, although

it is true that, in one of the courses analysed, the participants did not agree that the workload was adequate. The results evidence that the safe and responsible use of ICT is an important topic for teachers, and that the courses were effective for teacher training, not only in this area, but also in other areas of digital competence, such as digital content creation. Further proof of this latter fact is that teachers claimed that the digital resources they had created during the courses were of high enough quality that they could be used to teach their students how to use technology in a safe and responsible way.

Table 2. Participants' perception									
	Course A			Course B			Course C		
	N	M	SD	N	M	SD	N	M	SD
The course structure is adequate	218	3.8	0.9	425	4.1	0.8	75	3.9	1.1
The guidance provided to students allows one to follow the course easily	218	3.5	1.2	422	4.0	1.0	75	3.9	1.0
The course assessment is adequate	217	3.2	1.2	425	4.1	0.8	75	4.0	0.9
The course workload is adequate	218	2.9	1.1	423	3.5	1.1	75	3.5	1.2
The course duration is adequate	217	3.3	1.2	425	3.9	1.0	75	3.7	1.2
The course difficulty is achievable	216	3.7	1.0	421	3.9	1.0	75	3.9	1.0
I consider the topics covered in this course to be of great importance	218	4.6	0.6	424	4.5	0.8	75	4.3	0.9
The course has allowed me to improve my knowledge about safe and responsible use of ICT	-	-	-	425	4.4	0.8	75	4.4	0.8
The course has allowed me to improve my digital competence	-	-	-	424	4.1	1.0	75	4.3	1.0
I will be able to use the materials I have created in this course in my classroom	211	3.9	1.3	423	3.8	1.1	75	4.1	1.1
What is your general opinion of the course? 1 (Awful) – 5 (Excellent)	219	3.8	0.8	426	4.1	0.7	75	4.1	0.9
	N	Yes	No	N	Yes	No	N	Yes	No
I would recommend this course to a colleague	218	87%	13%	422	93%	7%	75	91%	9%

3.2. Acquired knowledge

Table 3 shows the results of the pre-test and post-test taken by the participants of the courses analysed. In order to determine the magnitude of the difference between the scores achieved by the participants in the post-test and the pre-test, the Cohen's d effect size (Cohen, 1992) was calculated. When using Cohen's d, a value of 0.2 indicates a small effect size; a value of 0.5, a medium one, and a value over 0.8, a large one. In all courses it was found that the difference between post-test and pre-test scores was statistically significant with a large effect size (with Cohen's d values ranging from 1.6 to 1.8). These results prove that the courses had a strong positive impact on the participants in terms of knowledge acquired regarding safe and responsible use of ICT.

Table 3. Results of the pre-test and post-test						
		Pre-test (0-10)		Post-test (0-10)		Cohen's d effect size	p-value (2-tailed) Paired samples t-test (α = 0.05)
	N	M	SD	M	SD	
Course A	200	5.5	1.5	8.4	1.1	1.6	< 0.001
Course B	535	5.5	1.5	8.7	1.1	1.8	< 0.001
Course C	74	5.6	1.4	8.3	1.2	1.7	< 0.001

3.3. Digital content creation

Table 4 shows the results of the evaluation conducted with LORI to measure the quality of a sample of the digital educational resources created by the participants during the courses. The overall quality of the resources evaluated, calculated as the average of the scores obtained for each of the LORI items, reached an average score greater than 3 on a scale of 1 to 5 in all courses. Taking into account that educational resources rated above that threshold using LORI can be considered of good quality (Gordillo, Barra, & Quemada, 2014), it can be stated that most participants finished the course with an acceptable digital

competence to create digital educational materials. However, about 30% of the participants of courses A and C, and 13% of those of course B were not capable of creating high-quality resources. Overall, the resources evaluated were positively rated in terms of content quality, learning goal alignment, motivation, design, usability, reusability and standards compliance. However, notable deficiencies were observed regarding the resources' ability to provide feedback to students and adapt to their behaviour. Quality evaluations also show that teachers had difficulty creating accessible resources.

Table 4. Quality of the digital educational resources measured with LORI						
	Course A (N=40)		Course B (N=40)		Course C (N=40)	
	M	SD	M	SD	M	SD
Overall quality (average of the scores) (1-5)	3.2	0.4	3.5	0.5	3.3	0.6
LORI items (1-5)						
1. Content quality	3.6	0.6	3.6	0.6	3.5	0.7
2. Learning goal alignment	3.5	0.5	3.7	0.6	3.8	0.8
3. Feedback and adaptation	2.3	0.9	2.7	1.0	2.3	1.0
4. Motivation	3.2	0.6	3.2	0.7	3.3	0.7
5. Presentation design	3.2	0.7	3.2	0.6	3.6	0.8
6. Interaction usability	3.4	0.6	3.6	0.5	3.4	0.7
7. Accessibility	2.7	0.6	3.3	0.7	2.9	0.6
8. Reusability	3.0	0.7	3.7	0.7	3.3	0.7
9. Standards compliance	4.1	0.3	4.3	0.4	3.4	1.3

4. Discussion and conclusions

This study provides, for the first time, strong empirical evidence that online courses in MOOC format are an effective way of training teachers in safe and responsible use of ICT. Based on the results obtained, it can be stated that these courses offer a possible solution to the concerning lack of teacher training in the area of digital competence related to the safe and responsible use of technology. Given that measurements of learning outcomes in MOOCs reported in the scientific literature to date are overly simplistic and frequently based on a single variable such as the completion rate or the final grade (Deng & al., 2019), this study makes an important contribution to research on MOOC courses by reporting on the measurement of learning outcomes from three different courses, which is based on three aspects: the participants' perception, the knowledge acquired by the participants calculated as the difference between the scores achieved in a post-test and a pre-test, and the quality of a set of digital educational resources created by the participants during the courses. In this respect, an important finding of this study is that completion rates of courses in MOOC format should not be used as a measure of learning outcomes. Although the completion rate for the three courses analysed in this study was very varied (49%, 66% and 89%), the knowledge acquired by the participants who completed them was very similar.

This study also provides solid empirical evidence on the effectiveness of courses in MOOC format in the development of teacher's digital competence to create digital content aimed at teaching how to make safe and responsible use of technology. Although Ramírez-Montoya and others (2017) previously reported on the use of a MOOC to train teachers in the creation of digital learning resources, that work did not provide any evidence on the real effectiveness of the course for that purpose. The results of this study show that most participants of the courses were capable of creating good-quality educational resources on safe and responsible ICT use and considered that they would be able to use these resources with their students. However, the results also show that a significant percentage of the participants (between 13% and 30% depending on the course) did not acquire the digital competence needed to create high-quality digital educational resources. Moreover, difficulties were observed on the teachers' part in creating content with a high level of accessibility, as well as educational resources with the ability to provide feedback and adapt to the students' behaviour. Nevertheless, these difficulties had their origin not only in a lack of digital competence, but also in the limitations of the current authoring tools. While the results obtained suggest that courses in MOOC format can be of great help for developing teacher's digital competence to create digital educational materials, these also indicate that this help might not be sufficient for some educators.

Future works should investigate the profile of these educators for whom other training activities could turn out to be more effective. The results also indicate that the training activities that address the content creation area of the digital competence should, in addition to teaching teachers how to use authoring tools, pay special attention to technical aspects such as accessibility and content reusability, and delve into the creation of adaptive resources and the provision of feedback. These training activities should include active learning, one of the most popular strategies for teacher training in ICT use (Røkenes & Krumsvik, 2014).

Future research works should examine the instructional effectiveness of online courses in MOOC format for teacher training in areas of teacher's digital competence other than safe and responsible use of ICT and digital content creation. Another interesting line of research would be to compare the instructional effectiveness of courses in MOOC format with that of other training activities. Of special interest would be to analyse effectiveness according to the profile of the participants since, that way, it would be possible to determine when the use of courses in MOOC format is the most suitable solution for overcoming the training shortcomings of teachers, and when the most suitable solution is another type of training activity. Although the evidence provided by this study suggests that online courses in MOOC format can be an effective solution to the unavoidable need to train teachers in certain areas of digital competence, there might exist other training activities that are more effective for teachers with a specific profile.

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References

Almerich, G., Suárez, J., Jornet, J., & Orellana, M. (2011). Las competencias y el uso de las tecnologías de información y comunicación (TIC) por el profesorado: estructura dimensional. *Revista Electrónica de Investigación Educativa*, *13*(1), 28-42. http://bit.ly/2XOU7by

Better Internet for Kids (Ed.) (2018). #SaferInternet4EU campaign and Safer Internet Day 2018: Public report on campaign activities and successes. https://bit.ly/2TmG5PL

Castaño, C., Maiz, I., & Garay, U. (2015). Diseño, motivación y rendimiento en un curso MOOC cooperativo. [Design, Motivation and Performance in a Cooperative MOOC Course]. *Comunicar*, *22*(44), 19-26. https://doi.org/10.3916/C44-2015-02

Castaño-Muñoz, J., Kalz, M., Kreijns, K., & Punie, Y. (2018). Who is taking MOOCs for teachers' professional development on the use of ICT? A cross-sectional study from Spain. *Technology, Pedagogy and Education*, *27*(5), 607-624. https://doi.org/10.1080/1475939X.2018.1528997

Chiappe-Laverde, A., Hine, N., & Martínez-Silva, J.A. (2015). Literatura y práctica: Una revisión crítica acerca de los MOOC. [Literature and practice: A critical review of MOOCs]. *Comunicar*, *22*(44), 9-18. https://doi.org/10.3916/C44-2015-01

Cohen, J. (1992). A power primer. *Psychological Bulletin*, *112*(1), 155-159. https://doi.org/10.1037/0033-2909.112.1.155

Comisión Europea (Ed.) (2010). Comunicación de la Comisión al Parlamento Europeo, al Consejo, al Comité Económico y Social Europeo y al Comité de las Regiones: Una agenda digital para Europa. https://bit.ly/2VLzmk3

Comisión Europea (Ed.) (2018). Comunicación de la Comisión al Parlamento Europeo, al Consejo, al Comité Económico y Social Europeo y al Comité de las Regiones sobre el plan de acción de educación digital. https://bit.ly/2YCsVwN

De-La-Roca, M., Morales, M., Teixeira, A., Hernandez, R., & Amado-Salvatierra, H. (2018). The experience of designing and developing an edX's MicroMasters program to develop or reinforce the digital competence on teachers. In *Proceedings of the 2018 Learning With MOOCS conference (LWMOOCS 2018)*, volume 2018 (pp. 34-38). https://doi.org/10.1109/LWMOOCS.2018.8534697

De-los Arcos, B., Cirigottis, G.E., Egglestone, N., Farrow, R., McAndrew, P., Perryman, L.A., & Weller, M. (2015). OER data report 2013-2015: Building understanding of open education. https://bit.ly/2U97WzM

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

Diario Oficial de la Unión Europea (Ed.) (2006). Recomendación del Parlamento Europeo y del Consejo de 18 de diciembre de 2006 sobre las competencias clave para el aprendizaje permanente (2006/962/CE). https://bit.ly/2JTJLDr

Ey, L.A., & Cupit, C.G. (2011). Exploring young children's understanding of risks associated with Internet usage and their concepts of management strategies. *Journal of Early Childhood Research*, *9*(1), 53-65. https://doi.org/10.1177/1476718X10367471

Falcó, J.M. (2017). Evaluación de la competencia digital docente en la Comunidad Autónoma de Aragón. *Revista Electrónica de Investigación Educativa*, *19*(4), 73-83. https://doi.org/10.24320/redie.2017.19.4.1359

Fernández-Cruz, F.J., & Fernández-Díaz, M.J. (2016). Generation Z's teachers and their digital skills. [Los docentes de la Generación Z y sus competencias digitales]. *Comunicar*, *24*(46), 97-105. https://doi.org/10.3916/C46-2016-10

Fernández-Cruz, F.J., Fernández-Díaz, M.J., & Rodríguez-Mantilla, J.M. (2018). El proceso de integración y uso pedagógico de las TIC en los centros educativos madrileños. *Educación XXI*, *1*(21), 395-416. https://doi.org/10.5944/educXX1.17907

Gamito, R., Aristizabal, M.P., Vizcarra, M.T., & Tresserras, A. (2017). La relevancia de trabajar el uso crítico y seguro de Internet en el ámbito escolar como clave para fortalecer la competencia digital. *Fonseca*, *15*, 11-25.

https://doi.org/10.14201/fjc2017151125

Garmendia, M., Jiménez, E., Casado, M.A., & Marcheroni, G. (2016). Net Children go mobile: Riesgos y oportunidades en Internet y uso de dispositivos móviles entre menores españoles (2010-2015). https://bit.ly/2EeNiaI

Gómez-Trigueros, I.M. (2017). El MOOC como recurso para la adquisición de la competencia digital en la formación de los maestros de educación primaria. *Revista de Tecnología de Información y Comunicación en Educación*, *11*(1), 77-88. http://bit.ly/2ZpELuC

Gordillo, A., Barra, E., & Quemada, J. (2014). Towards a learning object pedagogical quality metric based on the LORI evaluation model. In *Proceedings of the 2014 Frontiers in Education Conference (FIE 2014)* (pp. 3088-3095). https://doi.org/10.1109/FIE.2014.7044499

Gordillo, A., Barra, E., & Quemada, J. (2017). An easy to use open source authoring tool to create effective and reusable learning objects. *Computer Applications in Engineering Education*, *25*(2), 188-199. https://doi.org/10.1002/cae.21789

Govender, I., & Skea, B. (2015). Teachers' understanding of e-safety: An exploratory case in KZN South Africa. *Electronic Journal of Information Systems in Developing Countries*, *70*(1), 1-17. https://doi.org/10.1002/j.1681-4835.2015.tb00505.x, https://doi.org/10.1002/j.1681-4835.2015.tb00505.x

Gürer, M., & Yıldırım, Z. (2014). Effectiveness of learning objects in primary school social studies education: Achievement, perceived learning, engagement and usability. *Egitim ve Bilim*, *39*(176), 131-143. https://doi.org/10.15390/EB.2014.3714

INTEF (Ed.) (2017a). Cinco años de evolución de la competencia digital docente. https://bit.ly/2Eeyp8e

INTEF (Ed.) (2017b). Marco Común de Competencia Digital Docente. https://bit.ly/2BSzanb

Johnson, L., Adams-Becker, S., Estrada, V., Freeman, A., Kampylis, P., Vuorikari, R., & Punie, Y. (2014). Horizon report Europe: 2014 schools edition. https://doi.org/10.2791/83258

Kaarakainen, M.T., Kivinen, O., & Vainio, T. (2018). Performance-based testing for ICT skills assessing: A case study of students and teachers' ICT skills in Finnish schools. *Universal Access in the Information Society*, *17*(2), 349-360. https://doi.org/10.1007/s10209-017-0553-9

Leacock, T.L., & Nesbit, J.C. (2007). A framework for evaluating the quality of multimedia learning resources. *Educational Technology & Society*, *10*(2), 44-59. http://bit.ly/2F9IXqM

Liyanagunawardena, T.R., Adams, A.A., & Williams, S.A. (2013). MOOCs: A systematic study of the published literature 2008-2012. *The International Review of Research in Open and Distance Learning*, *14*(3), 202-227. https://doi.org/10.19173/irrodl.v14i3.1455

Mannila, L., Nordén, L.Å., & Pears, A. (2018). Digital competence, teacher self-efficacy and training needs. In *Proceedings of the 2018 ACM Conference on International Computing Education Research (ICER '18)* (pp. 78-85). https://doi.org/10.1145/3230977.3230993

Ministerio de Educación, Cultura y Deporte (Ed.) (2015). Orden ECD/65/2015. http://bit.ly/2XOVyGY

Napal, M., Peñalva-Vélez, A., & Mendióroz, A. (2018). Development of digital competence in secondary education teachers' training. *Education Sciences*, *8*(3), 104-115. https://doi.org/10.3390/educsci8030104

Ortega-Sánchez, D., & Gómez-Trigueros, I.M. (2019). Massive open online courses in the initial training of social science teachers: Experiences, methodological conceptions, and technological use for sustainable development. *Sustainability*, *11*(3), 578-588. https://doi.org/10.3390/su11030578

Pérez-Escoda, A., Castro-Zubizarreta, A., & Fandos-Igado, M. (2016). Digital skills in the Z Generation: Key questions for a curricular introduction in primary school. [La competencia digital de la Generación Z: Claves para su introducción curricular en la Educación Primaria]. *Comunicar*, *24*(49), 71-79. https://doi.org/10.3916/c49-2016-07

Pusey, P., & Sadera, W.A. (2011). Cyberethics, cybersafety, and cybersecurity: Preservice teacher knowledge, preparedness, and the need for teacher education to make a difference. *Journal of Digital Learning in Teacher Education*, *28*(2), 82-85. https://doi.org/10.1080/21532974.2011.10784684

Ramírez-Montoya, M.S., Mena, J., & Rodríguez-Arroyo, J.A. (2017). In-service teachers' self-perceptions of digital competence and OER use as determined by a xMOOC training course. *Computers in Human Behavior*, *77*, 356-364. https://doi.org/10.1016/j.chb.2017.09.010

Redecker, C., & Punie, Y. (2017). *European framework for the digital competence of educators. DigCompEdu*. Luxembourg: EU Publications. https://doi.org/10.2760/159770

Røkenes, F.M., & Krumsvik, R.J. (2014). Development of student teachers' digital competence in teacher education - A literature review. *Nordic Journal of Digital Literacy*, *9*(4), 250-280. http://bit.ly/2Rgk5SZ

Sánchez-Elvira, A., & Santamaría-Lancho, M. (2013). Developing teachers and students' digital competences by MOOCs: The UNED proposal. In *Proceedings of the 2013 Open and Flexible Higher Education Conference* (pp. 362-376). http://bit.ly/2XmEDyQ

Sharples, M., Graber, R., Harrison, C., & Logan, K. (2009). E-safety and Web 2.0 for children aged 11-16. *Journal of Computer Assisted Learning*, *25*(1), 70-84. https://doi.org/10.1111/j.1365-2729.2008.00304.x

Shin, S.K. (2015). Teaching critical, ethical and safe use of ICT in pre-service teacher education. *Language Learning & Technology*, *19*(1), 181-197. https://doi.org/10125/44408

Siemens, G. (2013). Massive open online courses: Innovation in education? In McGreal, R., Kinuthia, W., & Marshall, S. (Eds.), *Open Educational Resources: Innovation*, *research and practice* (pp. 5-16). Athabasca University: Commonwealth of Learning. http://bit.ly/2RhB5bs

Suárez-Rodríguez, J.M., Almerich, G., Díaz-García, I., & Fernández-Piqueras, R. (2012). Competencias del profesorado en las TIC. Influencia de factores personales y contextuales. *Universitas Psychologica*, *11*(1), 293-309. https://doi.org/10.11144/Javeriana.upsy11-1.cpif

Tsvetkova, M.S. (2016). The ICT competency MOOCs for teachers in Russia. *Olympiads in Informatics*, *10*, 79-92. https://doi.org/10.15388/ioi.2016.special.09

UNESCO (Ed.) (2011). UNESCO ICT competency framework for teachers. https://bit.ly/2V9TuYC

Van-Deursen, A., & Van-Dijk, J. (2011). Internet skills and the digital divide. *New Media and Society*, *13*(6), 893-911. https://doi.org/10.1177/1461444810386774

Veletsianos, G., & Shepherdson, P. (2016). A systematic analysis and synthesis of the empirical MOOC literature published in 2013-2015. *International Review of Research in Open and Distributed Learning*, *17*(2), 198-221. https://doi.org/10.19173/irrodl.v17i2.2448

Vuorikari, R., Punie, Y., Carretero, S., & den Brande, L.V. (2016). DigComp 2.0: The digital competence framework for citizens. Update phase 1: the conceptual reference modelLuxembourg: EU: . Publications. https://doi.org/10.2791/11517

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Study of the academic production on communication in Spain and Latin America

Estudio de la producción académica sobre comunicación en España e Hispanoamérica

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ABSTRACT

This paper approaches the state of academic production in communication confined to the Hispanic sphere (Spain and Latin America) during the period extending between 2013 and 2017. As in previous meta-research, the aim here is to highlight potential shortcomings in the discipline, both theoretically and methodologically. From an instrumental standpoint, a systematic, objective and quantitative content analysis was implemented on a probabilistic sample of 1,548 articles from the seven main journals in the field, all indexed in the first quartiles of the SJR-Scopus ranking. Aside from the percentage report for each variable, two-stage cluster analyses were performed twice to identify statistically significant publication patterns. As far as the results are concerned, it is worth highlighting the empirical nature of the studies, generally relying on quantitative methodologies, although no specific theoretical corpora are referenced. On the other hand, and although social networks and ICTs have gained a notable prominence, traditional media continue to be, collectively, the most prominent in communication research. Finally, the challenges of the field seem to revolve around two axes: providing studies with methodological robustness and, above all, with the theoretical background necessary to confront, with guarantees, the understanding of the liquid communicative manifestations that flow, at great speed, from the Information Society.

RESUMEN

El presente trabajo aborda el estado de la producción académica en comunicación circunscrita al ámbito hispánico España e Hispanoamérica durante el período que transcurre de 2013 a 2017. Al igual que en otras metainvestigaciones precedentes, el objetivo aquí radica en poner de manifiesto las posibles carencias de la disciplina, tanto a nivel teórico como metodológico. Desde un punto de vista instrumental, se implementó un análisis de contenido sistemático, objetivo y cuantitativo sobre una muestra probabilística de 1.548 artículos pertenecientes a las siete principales revistas del área, todas ellas indexadas en los primeros cuartiles del ranking SJR-Scopus. Además del reporte porcentual de cada variable, se ejecutaron dos análisis de conglomerados bietápicos para identificar patrones de publicación estadísticamente significativos. En lo que a los resultados respecta, cabe destacar el cariz empírico de los trabajos, apoyados habitualmente en metodologías cuantitativas, aunque sin hacer alusión a corpus teóricos concretos. Por otro lado, y si bien las redes sociales y las TIC han cobrado un notable protagonismo, los medios tradicionales continúan siendo, de manera agregada, los de mayor relieve en la investigación en comunicación. Finalmente, los desafíos del área parece que girarán en torno a dos ejes: nutrir a los estudios de la robustez metodológica y, muy en especial, del acervo teórico necesarios para afrontar, con garantías, la comprensión de las líquidas manifestaciones comunicativas que manan, a gran velocidad, de la Sociedad de la Información.

1. Introduction

While not exhaustive, it is necessary to highlight the growing proliferation of reflections from the Hispanic sphere on communication as a field of theoretical study (De-la-Peza, 2013; Fuentes-Navarro, 2017; Moreno-Sardà, Molina, & Simelio-Solà, 2017; Piñuel, 2010; Silva & de-San-Eugenio, 2014; Vassallo & Fuentes-Navarro, 2005; Vidales, 2015). At the same time, numerous efforts have been made to understand the heterogeneous methodological approaches used to conduct research in this prolific area (Castillo & Carretón, 2010; Lozano & Gaitán, 2016; Marí-Sáez & Ceballos-Castro, 2015; Miquel-Segarra, 2018; Ortega-Mohedano, Azurmendi, & Muñoz-Saldana, 2018; Saperas, 2018).

This abundance of contributions is due to the fact that "the interest in meta-research in communication has once again gained strength" (Caffarel-Serra, 2018: 284), and has done so, in effect, backed by two essential factors: first of all, "the search for a system with which to bring order the theoretical findings in the field" (Martín-Algarra, 2008: 153); and, second, the mastery of techniques that enable the attainment of those findings. In this respect, one of the most important collective initiatives in Spain has been the recent "MapCom Project"[1], to which we will return later by referencing work done by some of its members.

There is, however, a certain dissent around the hierarchy that these two tasks —theoretical reflection and methodological application— hold within academia. In this sense, the most critical voices call attention to "a tendency to continue encouraging a purely instrumental research model, with a certain degradation of theory as an end in itself" (Sierra, 2016: 46). With regard to empirical deployment, and although they are not mutually exclusive, the debate between quantitative and qualitative traditions is no less evocative. There are authors who highlight the rise of a phenomenological perspective, centered on "processes, language and human experience where culture and communication are inexhaustible sources of meanings" (Salinas & Gómez, 2018: 11). From another angle, "the emergence of new research techniques and new tools for the quantitative (statistical) analysis of communication not only constitutes a technical advance, but also substantially affects the development of communication as a scientific discipline and, in particular, has a decisive influence on the development of more sophisticated theories" (Igartua, 2012: 17). In light of the foregoing, the present study emerges with a clear purpose: to X-ray the current state of research in communication through the analysis of papers published in major Spanish and Latin American journals.

1.1. State of the art: Identification of previous empirical studies

In this section, a brief chronological overview of the main prior empirical references concerning both the Spanish and international contexts will be made. Beginning with our immediate environment, Caffarel-Serra, Ortega-Mohedano and Gaitán-Moya (2017) focus on the analysis of a representative sample of 288 documents relating to the period 2007-2014: 239 doctoral theses and 49 research projects, reaching the conclusion that 60.71% of the papers are confined to the study of mass media (49.45% traditional versus 11.26% digital).

Along these lines, Goyanes, Rodríguez-Gómez and Rosique-Cedillo (2018) record 3,653 articles published in the 11 leading Spanish journals from 2005 to 2015. Among its many findings, the prevalence of journalism (press and journalistic practices), audiovisual communication (film and television) and studies on audiences and receivers are noteworthy, as they all account for 51% of scientific production. Based on the data provided by some authors and others, we postulate that:

• H1: traditional media will have a greater role than digital media.

In one of their latest studies, Martínez-Nicolás, Saperas and Carrasco-Campos (2019) disclose the findings of a content analysis conducted on a large sample of 1,098 articles from the leading communication journals in Spain during the 1990-2014 period, allowing them to trace different research evolution timelines. As the main result of their meticulous work, it is worth noting that almost 80% of the articles constituted empirical research, while 18% were theoretical-conceptual and only 2% methodological. Thus, we contend that:

• H2: the works in the sample will exhibit a pronounced empirical approach.

At the international level, Bryant and Miron's study (2004) includes a sample of 1,806 articles published in the journals "Journalism and Mass Communication Quarterly", "Journal of Communication" and "Journal of Broadcasting and Electronic Media" between 1956 and 2000. After their inquiry, they declare that Framing Theory is the most prominent, followed closely by Agenda Setting and Cultivation Theory.

Therefore, it seems coherent to pose that:

• H_3: Framing Theory will be the most recurring theoretical corpus.

For their part, Potter and Riddle (2007) examine 962 articles from 16 high-impact journals in the period 1993-2005, concluding that 71.4% of the studies reviewed use quantitative methods —where the survey with 32% and the experiment with 29% prevail— and 15.4% qualitative techniques. This logic prompts a new hypothesis, as well as an intimately associated research question:

• H_4: quantitative methods will have a greater presence than qualitative methods.
• RQ1: What kind of samples will the authors of empirical papers use?

Gómez-Rodríguez, Morrell and Gallo-Estrada (2017) focused on the journal "Comunicación y Sociedad", a leading publication in Mexico. They evaluated a total of 209 papers assigned to the 2004-2016 cycle and identified some

> With regard to empirical deployment, and although they are not mutually exclusive, the debate between quantitative and qualitative traditions is no less evocative.

recurrent themes, which fall under the labels of: sociocultural environment (43.6%), academic (24.9%), socioeconomic (16.7%) and sociopolitical (14.8%). Therefore, and in relation to the papers pertaining to our study, we ask ourselves:

• RQ2: What topics will be addressed most frequently?

Finally, Walter, Cody and Ball-Rokeach (2018) aim to dissect 1,574 articles published in "Journal of Communication" from 1951 to 2016, performing a longitudinal analysis and comparing stages. In the most recent one, from 2010 to 2016, they found that the audience (69.3%) was the main player in the studies as opposed to the message (19.3%), the source and the policies (both with 4.6%). On the other hand, the dominant research paradigm was positivism (87.5%), well above critical and cultural —both of which were evidenced in 4.6% of studies— and rhetorical (3%). Consequently, two new hypotheses emerge:

• H5: the main object of study will be the audience.
• H6: the dominant paradigm to which studies adhere will be positivist.

Next, the method used in the study will be described, supported by all the preceding empirical initiatives.

2. Material and method

2.1. Objective and sample

The purpose of the study was to outline the state of communication research in the Hispanic sphere through the examination of academic papers. These works, which have constituted the units of analysis, have been grouped ex post to identify, in a statistically significant way, patterns of publication or clusters, also compared, according to their impact factor and geographical origin of the journals where they were included (Spain or Latin America).

For this purpose, a content analysis was performed for being a systematic, objective and quantitative method (Riffe, Lacy, & Fico, 2014; Wimmer & Dominick, 2011), commonly applied to the study of academic texts, as we have seen in the previous section. Initially, one of the key considerations in any content analysis lies in designing a sampling plan (Igartua, 2006) which, in this case, was "multi-stage" (Neuendorf, 2016). Therefore, and in a first phase, the journals selected were those with the greatest impact in 2017 —the latest year for which data are available— in the international database "SJR-Scopus" in the category of communication[2] (www.scimagojr.com). It was determined that journals had to rank in the first two quartiles in order to be rated as high-impact, resulting in a total of seven titles, sorted according to their position in the ranking: "Comunicar" (Q1), "El Profesional de la Información" (Q1), "Communication & Society" (Q2), "Revista Latina de Comunicación Social" (Q2), "Cuadernos.info" (Q2), "Comunicación

y Sociedad" (Q2) and "Palabra Clave" (Q2). Likewise, and from 2017 onwards, it was deemed reasonable to go back five years, to 2013, in order to give the sample a certain time perspective.

In short, all those articles were stored —except editorials and reviews— contained in the websites of the seven journals during the period in question, generating a sample of n=1,548 articles. This figure represents 48.77% of the universe of published works (N=3,174) in each and every one of the Spanish and Latin American journals that were indexed in SJR-Scopus in this five-year period, which represented a margin of error of ~1.8% for a 95% confidence interval.

2.2. Categories of analysis, coding and reliability

As a guide for the examination of this representative corpus of analysis, and based on other previous studies (Barranquero & Limón, 2017; Caffarel-Serra, Ortega-Mohedano, & Gaitán-Moya, 2017; Gómez-Rodríguez, Morrell, & Gallo-Estrada, 2017; Goyanes, Rodríguez-Gómez, & Rosique-Cedillo, 2018; Martínez-Nicolás & Saperas, 2016; Martínez-Nicolás, Saperas, & Carrasco-Campos, 2019; Saperas & Carrasco-Campos, 2018; Walter, Cody, & Ball-Rokeach, 2018), a codebook was prepared consisting of the following nominal polychotomous variables, along with their reliability indicator:

1) Type of article (α_k=0.92): 1=empirical, 2=theoretical/essayistic, or 3=methodological.

2) In the case of empirical work, what method (α_k=0.83) is used? (Table 1).

3) In the case of empirical work, what type of sample (α_k=0.84) is utilized?: 0=non-empirical work, 1=probability sample, or 2=non-probability sample.

4) Theory (α_k=0.70) that provides a conceptual basis for the study (Table 1).

5) Main object of study (α_k=0.93): 1=source, 2=message, 3=audience, or 4=policies/structure.

6) Main means of communication or documentary support (α_k=0.87) in the article (Table 2).

7) General topic (α_k=0.87) of the work (Table 2).

8) Paradigm (α_k=0.96) where research is framed (Walter, Cody, & Ball-Rokeach, 2018): 1=positivist: study supported by empirical assumptions and verifiable hypotheses, using quantitative or mixed methods; 2=cultural: qualitative study about the everyday practices that create and sustain culture; 3=critical: study focused on questions of power, political economy, status quo and social structure; or 4=rhetorical: study that conceives communication as the practical art of discourse.

In total, 8 multi-categorical variables in addition to those used to identify the unit of analysis; that is, the number of the article, its publication year and the journal where it appears. Likewise, the SJR impact factor of the journals during the five years examined was collected, assigning to each unit of analysis the average impact factor of the journal in the year in which it appeared. This parameter, which acted as an independent variable, was of great help in profiling the types of articles (or clusters) resulting from the processing of the results in more detail. Finally, the data collection, which ran from September 3 to December 21, 2018, involved a team of two coders. After this process, and in order to check the reliability of their work, a random subsample was selected from ~10% of the cases, which both coders analyzed. The statistical parameter used for the reliability calculation was the Krippendorff alpha (Krippendorff, 2011; 2017), found by using the "Kalpha macro" (Hayes & Krippendorff, 2007) for SPSS (version 24). As can be seen above, the reliability of the eight variables was very satisfactory, while the average rose to M (α_k)=0.87 (SD=0.07).

3. Analysis and results

This section is structured in the following way: an initial section, as a preamble, with the percentage and individualized report of codebook items; and a block where it was used —in duplicate— two-stage cluster analysis, "an exploration tool designed to uncover the natural groupings of a data set" (Rubio-Hurtado & Vilà-Baños, 2017: 118), accompanied by analysis of variance (ANOVA) and contingency tables (χ^2).

3.1. Univariate report

Firstly, with regard to the type of article published in the journals from the sample (H_2), there is a marked tendency towards the empirical (80.9%) as opposed to the theoretical-essayistic (12.8%) and the

methodological (6.3%). Therefore, it is interesting to note both the methodological techniques used in this set of empirical works and the different theories and concepts used in the entirety of the works (Table 1).

Table 1. Theories, concepts and methods employed in the articles			
Theories and concepts	**%**	**Methods**	**%**
Media Literacy	8.3	Content analysis	15.6
Framing Theory	5.1	Survey	14.2
Parameters of the Web 2.0	3.6	Case study	11.7
Engagement	3.4	Methodological triangulation	7.9
Agenda Setting	3.3	Bibliometric or cybermetric analysis	6.3
Film and narrative theories	3.3	Discourse analysis	5.7
Uses and Gratifications	3	Interview	4.7
Social Identity Theories	2.4	Economic analysis	2.6
Web design fundamentals	2.3	Experiment	2.3
Cultural Studies	2.1	Network analysis	2
Corporate Social Responsibility (CSR)	2.1	Heuristic analysis	1.9
Transmedia Theory	2	Automatic content analysis	1.4
Media Ecology	1.7	Focus groups	1.2
Health communication	1.4	Participant observation	0.6
"Infotainment" and "Politainment"	0.9	Delphi method	0.5
Selective exposure	0.9	Ethnographic study	0.5
Narrative persuasion models	0.5	User "eye tracking" test	0.5
Other[3]	3.9	Other[4]	1.2
Subtotal	50.2	Subtotal	80.9
No concrete theoretical framework used	49.8	Non-empirical Works	19.1
Total	100	Total	100

If we group the methods into quantitative, qualitative and mixed, we find that the former are present in 46.8% of the papers, the latter in 24.9% and, thirdly, triangulation is present 7.9% of the time (H4). Another important aspect at the methodological level lies in the sample design (RQ_1). In this sense, 61.4% of the papers resort to non-probability sampling compared to 19.4% who use statistical criteria for the handling of representative samples —it should be remembered that the remaining 19.1% are non-empirical studies. In relation to the theoretical framework (H_3), it is worth pointing out that the proportion of texts that rely on some specific conceptual scaffolding as opposed to those that do not is practically the same: 50.2% as opposed to 49.8%. On an individual basis, Media Literacy (8.3%) and Framing Theory (5.1%) are the most widespread.

Table 2. Media and topics of the papers			
Media	**%**	**Topics**	**%**
Social networks	14	Uses and motivations of the receivers	11.3
World Wide Web and ICT	13.5	Politics	10.9
Press (traditional and digital)	11.6	Digital Society and big data	10.6
Media in general or multiple media at once	11.5	Education and sports	10.2
Scientific articles	9.1	State of academic research	8.4
Film and serial fiction	8.6	Informational coverage in general	7.6
Television	7.3	Culture, tourism and heritage	6.9
Libraries and document repositories	5.2	Economy	6.7
Receivers of communication	5.1	Corporate and institutional communication	5.9
Advertising content	4.5	Gender issues	3.6
Professional and journalistic practices	4.1	Social movements	3.5
Cultural Industries	1.6	Persuasive and advertising communication	3.1
Radio	1.5	War conflicts	2.9
Videogames	0.7	Migration	2.8
Magazines and supplemental publications	0.6	Healthcare and health	2.3
Other[5]	1.1	Other[6]	3.3
Total	100	Total	100

With regard to the object of study —in its broadest and most generic sense— (H_5), the intermediate link in the process —that is, the message— is the protagonist par excellence (44.6%) of the papers, followed

by the audience (21.3%), the source (17.1%) and, lastly, the communication policies and structure (17%). The means or, alternatively, the documentary supports on which the papers focus, as well as their general topics, are distributed as follows (Table 2).

If we aggregate traditional media, we obtain 38.8% of the works compared to 28.2% of digital media (H_1). For their part, the themes around which the studies revolve are also the most diverse (RQ_2), highlighting the uses and motivations of the receivers (11.3%). To complete the percentage review of the variables in the codebook, we find the paradigm to which the articles are ascribed (H6). In this sense, the one that dominates Spanish and Latin American research in communication is positivistic (56%), at a great distance from cultural (21.1%), critical (14.9%) and, most particularly, rhetorical (8%).

3.2. Cluster analysis

At the multivariate level, a first two-stage cluster analysis was performed which covers both continuous and categorical variables (Rundle-Thiele & al., 2015), in which we included the 6 most relevant items of the codebook; namely: the theory employed in the articles, the method, the object of the study, the communication medium in which they are centered, the topic in question and the paradigm within which the sample studies are circumscribed.

Cluster Nº	Size		Centers of Predictive Factors (%)						Impact Factor	
	N	%	Medium	Method	Object	Topic	Theory	Paradigm	M_{SJR}	SD
1	259	16.7%	Press (38.2)	Content Analysis (70.3)	Message (98.1)	Politics (30.9)	Not used (20.1)	Positivist (98.8)	0.469	0.231
2	203	13.1%	Professional Practices (21.2)	Interview (21.7)	Source (84.2)	Economy (27.6)	Not used (67.5)	Positivist (56.7)	0.453	0.225
3	228	14.7%	Film (38.6)	Case study (38.2)	Message (92.5)	Culture (21.5)	Not used (28.5)	Cultural (43.9)	0.402	0.222
4	244	15.8%	Scientific papers (52)	Bibliometric analysis (31.1)	Message (68)	Academia (48.4)	Not used (75)	Positivist (93)	0.543	0.255
5	312	20.2%	Media in general (29.5)	Not used (69.2)	Policies (59.9)	Digital Society (30.1)	Not used (88.1)	Critical (46,8)	0.431	0.247
6	302	19.5%	Receivers (22.8)	Survey (54)	Audience (97.7)	Uses and motivations (47.4)	Media Literacy (33.1)	Positivist (78.1)	0.581	0.339
Total	1,548	100							0.483	0.268

Table 3. Characterization of the 6 clusters (first extraction)

The silhouette measure of cohesion and separation, which alludes to cluster quality and must exceed the minimum level of 0.0 (Norušis, 2012), is 0.2, an acceptable value although regular. On the other hand, the importance of all the predictive items in the configuration of the groups is very high, since four of them reached the maximum value of 1 (topic, medium, object and method), another one was 0.96 (theory) and the definitive one was 0.78 (paradigm).

Cluster Nº	% Total	Journals	
		Spanish	Latin American
Cluster 1	16.7%	16.6	17.1
Cluster 2	13.1%	13.3	12.6
Cluster 3	14.7%	10.9–	24.6+
Cluster 4	15.8%	19.7+	5.7–
Cluster 5	20.2%	18.6–	24.1+
Cluster 6	19.5%	20.9+	15.9–
N	1,548	1,113	435

Table 4. Contingency table with the 6 clusters, Spanish and Latin American journals (% column)

Note. – Statistically lower value (analysis of corrected standardized residuals). + Statistically higher value (analysis of corrected standardized residuals).

Subsequently, the 6 clusters resulting from this first extraction presented a size coefficient of 1.54, which denotes some homogeneity between them, as can be seen in Table 3.

Starting from the creation of the 6 groups, these can be compared according to their SJR impact factor. Analysis of variance (ANOVA) shows statistically significant differences between clusters [$F_{6\ Clusters\ x\ SJR-IF}$ (5; 1,542)=18.66; $p<0.001$; $n^2=0.057$]. More specifically, and after Dunnett's T3 post-hoc test, it was deduced that the "3" and "6" clusters are those that show the greatest imbalances [$t(528)=-6.903$; $p<0.001$; $d=-0.624$], labeled as medium size according to "effect size" (Cohen, 1988; Johnson et al., 2008). Also, the 6 clusters were cross-referenced with the journals where the papers are published, recoding them into two groups: Spanish versus Latin American. The following contingency table reflects the distribution of the two according to publications.

In terms of the values shown in Table 4, significant differences are observed in 4 of the 6 clusters [$\chi^2(5, N=1,548)=87.52$; $p<.001$; $v=0.238$]. More specifically, and taking into account the corrected standardized residuals, Latin American journals tend to include article types 3 and 5 to a greater extent, while Spanish journals opt for cases 4 and 6.

Cluster Nº	Size		Centers of Predictive Factors (%)						Impact Factor	
	N	%	Method	Object	Theory	Topic	Paradigm	Medium	M_{SJR}	SD
1	150	19.3%	Case study (48)	Message (94.7)	Narrative (32)	Culture (22.7)	Cultural (44.7)	Film (43.3)	0.371	0.202
2	266	34.2%	Content analysis (61.7)	Message (96.6)	Framing (20.7)	Politics (26.7)	Positivist (97.4)	Social Media (31.2)	0.501	0.252
3	121	15.6%	Interview (19)	Source (54.5)	CSR (15.7)	Corporate communication (16.5)	Cultural (39.7)	Media in general (27.3)	0.411	0.249
4	240	30.9%	Survey (55)	Audience (93.3)	Media Literacy (44.2)	Uses and motivations (47.9)	Positivist (76.7)	ICT (24.2)	0.606	0.345
Total	777	100							0.494	0.289

Table 5. Characterization of the 4 clusters (second extraction)

The second two-stage cluster analysis differs from the previous one in only one of the items used for its execution: the variable "theory", which was recoded to take into account only those works that employed some kind of conceptual corpus, considering the rest as "missing". The silhouette measure of cohesion and separation reached 0.3, an even more acceptable value. As far as the importance of the predictive items is concerned, the method becomes the most prominent element (with a value of 1), followed by the object of study (value 0.92), the theory (value 0.52), the topic (value 0.42) and, ultimately, the paradigm and the medium (both with a value of 0.40). The four clusters derived from the analysis have a size coefficient (from the largest to the smallest) of 2.20, which is not problematic (Tkaczynski, 2017). Below is a profile of the four clusters.

Table 6. Contingency table with the 4 clusters and the Spanish and Latin American journals (% column)

Cluster Nº	% Total	Journals	
		Spanish	Latin American
Cluster 1	19.3%	13.4–	31.9+
Cluster 2	34.2%	37.9+	26.5–
Cluster 3	15.6%	13.2–	20.6+
Cluster 4	30.9%	35.5+	21–
N	777%	529	248

Note. – Statistically lower value (analysis of corrected standardized residuals). + Statistically higher value (analysis of corrected standardized residuals).

These 4 clusters can also be compared according to their impact factor. Thus, this new analysis of variance reveals the existence of differences between groups according to their SJR-IF once again [$F_{4\ Clusters\ x\ SJR-IF}$ (3; 773)=26.79; $p<0.001$; $n^2=0.094$]. Comparatively, and according to Dunnett's T3 post-hoc test, it is clusters 1 and 4 that reveal the greatest imbalances [$t(388)=-7.55$;

$p<0.001$; $d=-0.831$], characterized by an elevated size according to "effect size" (Cohen, 1988; Johnson et al., 2008). Finally, these four clusters were cross-referenced with the journals where the articles are published.

According to the values shown in Table 6, significant differences are observed in all clusters [$\chi^2(3, N=777)=53.33$; $p<0.001$; $v=0.262$]. On the basis of the corrected standardized residuals, Latin American journals tend to include article types 1 and 3 to a greater extent, while Spanish journals prefer cases 2 and 4.

4. Discussion and conclusions

In short, the findings derived from this study enable us to assert that, although social networks and ICTs have gained much prominence, conventional media continue to be, in an aggregate manner, the most important in current communication research, which in turn reveals a markedly practical character. Somehow, a certain "lack of reflection on its epistemological dimension, on its conceptual definition" (Vidales, 2015: 12) is noted, appealing in overwhelming proportion to its empirical aspect. In this sense, the most common methodologies are quantitative, although some shortcomings are evident in their more canonical application, especially with regard to the use of representative samples (an unusual practice). From another perspective, the fact that accepted practice lies in the execution of empirical works should in no way imply the precariousness of its theoretical foundation. However, it is astonishing that almost half of the studies do not appeal to a theory or, at least, to some kind of solid conceptual notion on which to base their further research. As for the articles that do refer to some kind of theoretical corpus, Media Literacy stands out, one of the paradigms that obtains greater visibility, for example, in the journal "Comunicar" —although not exclusively—, and Framing Theory, in tune with international trends and other previous studies in the Hispanic sphere (Piñeiro-Naval & Mangana, 2019).

Continuing with this brief summary, and despite the fact that messages are the primary object of study, one theme stands out above the others: the uses and motivations of receivers in their interaction with media artifacts. Bearing in mind that the audience is the second object of study and that the survey is also the second most used method, there is a trend towards greater concern for processes and effects. Nevertheless, until 2017, content analysis studies —or, alternatively, discourse analysis— still hold the message in a prominent place; these works are all encompassed, simultaneously, in the positivist paradigm. The following list summarizes, in abbreviated form, the answers to the hypotheses and research questions formulated:

- H_1. Traditional Media > Digital Media (accepted).
- H_2. Empirical Works > Theoretical / Methodological (accepted).
- H_3. Most recurring corpus: Framing Theory (partially accepted).
- H_4. Quantitative Methods > Qualitative Methods (accepted).
- H_5. Main object of study: Audience (rejected).
- H_6. Positivist Paradigm > Cultural / Critical / Rhetorical (accepted).
- PI_1. Types of samples in empirical studies? Non probabilistic.
- PI_2. Most frequent topic? Uses and motivations of receivers.

Another aspect of the work that should be highlighted —perhaps the most novel— revolves around the detection of significant publication patterns, also known as clusters. In short, there are two opposite poles. On the one hand, we find a series of positivistic works focused on the audience and its interaction with ICTs and social media that, on a theoretical level, rely on a Media Literacy trend while, on an empirical level, use surveys to approach the receivers of communication. These papers, usually included in journals of Spanish origin, are the ones with the highest impact factor. On the other side of the scale emerge studies framed in the cultural paradigm that, by means of a qualitative case study, analyze the narrative structure of cinematographic messages —or, alternatively, of serial fiction. These papers have a greater presence in Latin American journals, which implicitly results in a lower impact factor. In short, it seems clear that "research in communication is an object of study that will continue to develop in our country following the trends that are consolidated in a society and a market that are increasingly more communicative" (Caffarel-Serra, Ortega, & Gaitán, 2018: 69). Meta-research will therefore fulfill a fundamental mission in the

eclectic field of Communication Sciences: to highlight the shortcomings of the discipline and to warn academics of the risks it will face if not addressed. In light of the results of the study, the most demanding challenges will lie in the two tasks indicated at the beginning of the text: to provide research with a remarkable methodological robustness and, especially, with a rich theoretical repertoire so that its authors can understand and assimilate, with guarantees, the liquid communicative manifestations that flow very quickly from the Information and Knowledge Society.

Notes

[1] Information about the MapCom project: www.mapcom.es

[2] Note that "Comunicar" is also indexed in Education and Cultural Studies, while "El Profesional de la Información" and "Cuadernos.info" appear in Information Sciences, assumed as areas related to Communication.

[3] Other theories and concepts specifically identified are: Cultivation Theory, Stakeholders Theory, Priming, Spiral of Silence, Conceptual Metaphor Theory, Grounded Theory, Transparency, Neuromarketing, Gamification, Augmented Reality, e-WoM, Internet of Things, Memes or Think Tanks.

[4] Other methods that appear sporadically include: situational analysis, data envelopment analysis or iconographic analysis.

[5] Other media include: photographs, infographs, drawings, graffiti or videos.

[6] Other topics include: environment, history, religion, humanism, philosophy, aesthetics, poetry or legislation.

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References

Barranquero, A., & Limón, N. (2017). Objetos y métodos dominantes en comunicación para el desarrollo y el cambio social en las Tesis y Proyectos de Investigación en España (2007-2013). *Revista Latina de Comunicación Social*, *72*, 1-25. https://doi.org/10.4185/RLCS-2017-1151

Bryant, J., & Miron, D. (2004). Theory and research in mass communication. *Journal of Communication*, *54*(4), 662-704. https://doi.org/10.1111/j.1460-2466.2004.tb02650.x

Caffarel-Serra, C. (2018). La metainvestigación en comunicación, una necesidad y una oportunidad. *adComunica*, *15*, 293-295. https://doi.org/10.6035/2174-0992.2018.15.16

Caffarel-Serra, C., Ortega, F., & Gaitán, J.A. (2018). Communication research in Spain: Weaknesses, threats, strengths and opportunities. [La investigación en comunicación en España: Debilidades, amenazas, fortalezas y oportunidades]. *Comunicar*, *26*(56), 61-70. https://doi.org/10.3916/C56-2018-06

Caffarel-Serra, C., Ortega-Mohedano, F., & Gaitán-Moya, J. (2017). Investigación en Comunicación en la universidad española en el periodo 2007-2014. *El Profesional de la Información*, *26*(2), 218-227. https://doi.org/10.3145/epi.2017.mar.08

Castillo, A., & Carretón, M. (2010). Investigación en Comunicación. Estudio bibliométrico de las Revistas de Comunicación en España. *Comunicación y Sociedad*, *23*(2), 289-327. https://bit.ly/2LZRkLd

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Hillsdale, New Jersey: Lawrence Earlbaum Associates. https://doi.org/10.1016/c2013-0-10517-x

De-la Peza, M.C. (2013). Los estudios de comunicación: disciplina o indisciplina. *Comunicación y Sociedad*, *20*, 11-32. https://bit.ly/30BgRh1

Fuentes-Navarro, R. (2017). *Centralidad y marginalidad de la Comunicación y su estudio*. Salamanca: Comunicación Social. https://bit.ly/2KUafoA

Gómez-Rodríguez, G., Morrell, A.E., & Gallo-Estrada, C. (2017). A 30 años de Comunicación y Sociedad: Cambios y permanencias en el campo académico de la comunicación. *Comunicación y Sociedad*, *30*, 17-44. https://doi.org/10.32870/cys.v0i30.6838

Goyanes, M., Rodríguez-Gómez, E.F., & Rosique-Cedillo, G. (2018). Investigación en comunicación en revistas científicas en España (2005-2015): De disquisiciones teóricas a investigación basada en evidencias. *El Profesional de la Información*, *27*(6), 1281-1291. https://doi.org/10.3145/epi.2018.nov.11

Hayes, A.F., & Krippendorff, K. (2007). Answering the call for a standard reliability measure for coding data. *Communication Methods and Measures*, *1*(1), 77-89. https://doi.org/10.1080/19312450709336664

Igartua, J.J. (2006). *Métodos cuantitativos de investigación en comunicación*. Barcelona: Bosch. https://bit.ly/2MQWiKU

Igartua, J.J. (2012). Tendencias actuales en los estudios cuantitativos en comunicación. *Comunicación y Sociedad*, *17*, 15-40. https://bit.ly/2EmFDZ1

Johnson, B.T., Scott-Sheldon, L.A.J., Snyder, L.B., Noar, S.M., & Huedo-Medina, T.B. (2008). Contemporary approaches to meta-analysis in communication research. In Hayes, A.F., Slater, M.D., & Snyder, L.B. (Eds.), *The SAGE Sourcebook of Advanced Data Analysis Methods for Communication Research* (pp. 311-347). Thousand Oaks, California: Sage. https://doi.org/10.4135/9781452272054

Krippendorff, K. (2011). Agreement and information in the reliability of coding. *Communication Methods and Measures*, *5*(2), 93-112. https://doi.org/10.1080/19312458.2011.568376

Krippendorff, K. (2017). Reliability. In Matthes, J., Davis, C.S., & Potter, R.F. (Eds.), *The International Encyclopedia of Communication Research Methods* (pp. 1-28). New Jersey, USA: John Wiley & Sons. https://doi.org/10.1002/9781118901731.iecrm0210

Lozano, C., & Gaitán, J. (2016). Vicisitudes de la investigación en comunicación en España en el sexenio 2009-2015. *Disertaciones*, *9*(2), 139-162. https://doi.org/10.12804/disertaciones.09.02.2016.07

Marí-Sáez, V.M., & Ceballos-Castro, G. (2015). Análisis bibliométrico sobre 'Comunicación, Desarrollo y Cambio Social' en las diez primeras revistas de Comunicación de España. *Cuadernos.info*, *37*, 201-212. https://doi.org/10.7764/cdi.37.828

Martín-Algarra, M. (2009). La comunicación como objeto de estudio de la teoría de la comunicación. *Anàlisi*, *38*, 151-172. https://bit.ly/2wapqS7

Martínez-Nicolás, M., & Saperas, E. (2016). Objetos de estudio y orientación metodológica de la reciente investigación sobre comunicación en España (2008-2014). Análisis de los trabajos publicados en revistas científicas españolas. *Revista Latina de Comunicación Social*, *71*, 1365-1384. https://doi.org/10.4185/RLCS-2016-1150es

Martínez-Nicolás, M., Saperas, E., & Carrasco-Campos, A. (2019). La investigación sobre comunicación en España en los últimos 25 años. *Empiria*, *42*, 37-69. https://doi.org/10.5944/empiria.42.2019.23250

Miquel-Segarra, S. (2018). Análisis de la investigación publicada en las revistas de comunicación con índice ESCI (Emerging Source Citation Index). In Caffarel-Serra, C., Gaitán, J.A., Lozano, C., & Piñuel, J.L. (Eds.), *Tendencias metodológicas en la investigación académica sobre Comunicación* (pp. 109-129). Salamanca: Comunicación Social. https://bit.ly/2uNJTLs

Moreno-Sardà, A., Molina, P., & Simelio-Solà, N. (2017). CiudadaniaPlural.com: De las humanidades digitales al humanismo plural. *Revista Latina de Comunicación Social*, *72*, 87-113. https://doi.org/10.4185/RLCS-2017-1155

Neuendorf, K.A. (2016). *The content analysis guidebook*. Oaks, California: Sage. https://bit.ly/2RiyXAk

Norušis, M.J. (2012). *IBM SPSS statistics*. River, New Jersey: Prentice Hall. https://bit.ly/2RgijBo

Ortega-Mohedano, F., Azurmendi, A., & Muñoz-Saldana, M. (2018). Metodologías avanzadas de investigación en Comunicación y Ciencias Sociales: La revolución de los instrumentos y los métodos, Qualtrics, Big Data, Web Data et al. In undefined In C. Caffarel-Serra, Gaitán, J.A., Lozano, C., & Piñuel, J.L. (Eds.), *Tendencias metodológicas en la investigación académica sobre Comunicación* (pp. 169-188). Salamanca: Comunicación Social. https://bit.ly/2uNJTLs

Piñeiro Naval, V., & Mangana, R. (2019). La presencia del framing en los artículos publicados en revistas hispanoamericanas de Comunicación indexadas en Scopus. *Palabra Clave*, *22*(1), 117-142. https://doi.org/10.5294/pacla.2019.22.1.6

Piñuel, J.L. (2010). La comunicación como objeto científico de estudio, campo de análisis y disciplina científica. *Contratexto*, *18*, 67-107. https://doi.org/10.26439/contratexto2010.n018.200

Potter, W.J., & Riddle, K. (2007). A content analysis of the media effects literature. *Journalism and Mass Communication Quarterly*, *84*(1), 90-104. https://doi.org/10.1177/107769900708400107

Riffe, D., Lacy, S., & Fico, F. (2014). *Analyzing media messages. Using quantitative content analysis in research*. New York: Routledge. https://doi.org/10.4324/9780203551691

Rubio-Hurtado, M.J., & nos, R.V.B. (2017). El análisis de conglomerados bietápico o en dos fases con SPSS. *REIRE*, *10*(1), 118-126. https://doi.org/10.1344/reire2017.10.11017

Rundle-Thiele, S., Kubacki, K., Tkaczynski, A., & Parkinson, J. (2015). Using two-step cluster analysis to identify homogeneous physical activity groups. *Marketing Intelligence & Planning*, *33*(4), 522-537. https://doi.org/10.1108/MIP-03-2014-0050

Salinas, J., & Gómez, J.S. (2018). Investigación cualitativa y comunicación en la era digital: una revisión crítica de la literatura científica. In Salinas, J., & Gómez, J.S. (Eds.), *La Investigación Cualitativa en la Comunicación y Sociedad Digital: nuevos retos y oportunidades* (pp. 11-23). Sevilla: Egregius. https://bit.ly/30y5p5M

Saperas, E. (2018). La investigación comunicativa en España en tiempos de globalización. La influencia del contexto académico y de investigación internacionales en la evolución de los estudios sobre medios en España. In Rodríguez-Serrano, A., & Gil-Soldevilla, S. (Eds.), *Investigar en la Era Neoliberal. Visiones críticas sobre la investigación en comunicación en España* (pp. 207-225). Valencia: Aldea Global. https://doi.org/10.7203/puv-alg38-313-4

Saperas, E., & Carrasco-Campos, A. (2018). Journalism research: A dominant field of communication research in Spain. A meta-research on Spanish peer-reviewed journals (2000-2014). *Estudos em Comunicação*, *26*(1), 281-300. https://doi.org/10.20287/ec.n26.v1.a16

Sierra, L.I. (2016). La paradójica centralidad de las teorías de la comunicación: Debates y prospectivas. *Palabra Clave*, *19*(1), 15-56. https://doi.org/10.5294/pacla.2016.19.1.2

Silva, V., & de San-Eugenio, J. (2014). La investigación en Comunicación ante una encrucijada: De la teoría de los campos a la diseminación y diversidad gnoseológica. Estudio inicial comparado entre España, Brasil y Chile. *Palabra Clave*, *17*(3), 803-827. https://doi.org/10.5294/pacla.2014.17.3.10

Tkaczynski, A. (2017). Segmentation using two-Step cluster analysis. In Dietrich, T., Rundle-Thiele, S., & Kubacki, K. (Eds.), *Segmentation in Social Marketing* (pp. 109-125). Singapore: Springer. https://doi.org/10.1007/978-981-10-1835-0_8

Vassallo, M., & Fuentes-Navarro, R. (2005). *Comunicación: Campo y objeto de estudio. Perspectivas reflexivas latinoamericanas*. Tlaquepaque, Jalisco: ITESO. https://bit.ly/2We50Gx

Vidales, C. (2015). Historia, teoría e investigación de la comunicación. *Comunicación y Sociedad*, *23*, 11-43. https://doi.org/10.32870/cys.v0i23.60

Walter, N., Cody, M.J., & Ball-Rokeach, S.J. (2018). The ebb and flow of communication research: Seven decades of publication. *Trends and Research Priorities. Journal of Communication*, *68*(2), 424-440. https://doi.org/10.1093/joc/jqx015

Wimmer, R.D., & Dominick, J.R. (2011). *Mass media research: An introduction*. Boston: Wadsworth. https://bit.ly/2POfkiB

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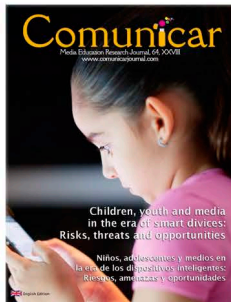Dr. Francisco-Jose Garcia-Ramos, Complutense University of Madrid (Spain)
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