



Smartphones in Higher Education.

A longitudinal qualitative study

Smartphones en Educación Superior.

Estudio cualitativo longitudinal

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ABSTRACT

The impact of technological tools in the educational field is unquestionable. The smartphone has established itself as the device with greater versatility and applicability in the academic/personal context of the subjects. For this reason, the following study addresses, from a longitudinal qualitative approach, the knowledge, use, benefits, and difficulties of the pedagogical application of smartphones, as well as the training needs perceived by higher education teachers, understanding the evolution of this trend in the last seven years. The participating sample is made up of 32 lecturers belonging to five Spanish universities, through the realization of six focus groups during the 2014-2015 and 2021-2022 academic years. The main results show that the lecturers value favorably the possibilities of the tool for communication and information search. However, in recent times more skeptical and critical evaluations are perceived, considering that the smartphone has not brought about the expected qualitative leap in the teaching methodologies applied in the classroom. Promoting the critical, responsible, and context-specific use of the mobile device, while effectively applying its technological possibilities in the creation of constructive pedagogical experiences in a temporally and spatially specified manner, may be one of the keys to a harmonious and not overloaded coexistence between academic and life experiences mediated with and without technology.

RESUMEN

La repercusión de las herramientas tecnológicas en el ámbito educativo es incuestionable. El smartphone se ha instaurado como el dispositivo con mayor versatilidad y aplicabilidad en el contexto académico/personal de los sujetos. Por este motivo, el siguiente estudio aborda, desde un enfoque cualitativo longitudinal, el conocimiento, uso, beneficios y dificultades de la aplicación pedagógica de los smartphones, al igual que las necesidades formativas percibidas por el profesorado de Educación Superior, comprendiendo la evolución de esta tendencia en los últimos siete años. La muestra participante está conformada por 32 docentes pertenecientes a cinco universidades españolas, a través de la realización de seis grupos focales durante los cursos 2014-2015 y 2021-2022. Los principales resultados evidencian que los docentes valoran favorablemente las posibilidades de la herramienta para la comunicación y búsqueda de información. Si bien, en los últimos tiempos se perciben valoraciones más escépticas y críticas, llegando a considerar que el smartphone no ha propiciado el salto cualitativo esperado en las metodologías docentes aplicadas en las aulas. Promover el uso crítico, responsable y ajustado a cada contexto del dispositivo móvil, así como aplicar eficazmente sus posibilidades tecnológicas en la creación de experiencias pedagógicas constructivas concretadas temporal y espacialmente puede ser una de las claves para la convivencia armónica, y no sobrecargada, entre las experiencias académicas y vitales mediadas con y sin tecnología.

KEYWORDS | PALABRAS CLAVE

Smartphone, mobile learning, qualitative research, focus group, Higher Education, lecturers.
Smartphone, aprendizaje móvil, investigación cualitativa, grupo focal, Educación Superior, profesorado.



1. Introduction

Information and Communication Technologies (ICT) have become an essential tool for human life in the 21st century. Their ease of use and their multiple functionalities are contributing to these technologies penetrating increasingly broader spheres of life and work, among which university classrooms have not been excluded (Ramírez-García et al., 2020; Ricoy & Fernández, 2013). ICTs have reached the educational system, specifically, the world of higher education, and have contributed to the evolution and transformation of the more traditional pedagogical dynamics, providing flexibility and richness to the teaching-learning-assessment processes, favoring learning in informal settings, and making the university an institution which is open and contextualized to the society in which we live (Lozano & Sánchez, 2018; Valtonen et al., 2021). Furthermore, recent research (Aguilar et al., 2019; Gupta et al., 2021) suggests that ICTs are going to generate a 180-degree change in the educational paradigm, including organizational criteria, materials, resources, and evaluation, and are advocating for students to acquire the sense of responsibility and self-direction as basic skills. In this respect, students highlight the need to have technological devices provided by the universities themselves and for teachers to use technology in teaching processes in a justified and relevant manner (Valtonen et al., 2021). Mobile devices are consolidated, in social terms, as the most used digital tools by the population today. Specifically, according to the latest report from the Spanish National Observatory of Technology and Society (ONTSI, 2021), the smartphone is configured as a universal device, used by four out of every five Internet users.

In this context of the democratization and global distribution of smartphones, one of the virtues users most value is, without a doubt, ubiquity, and mobility; the possibility they offer of being connected at any time and in any place. This characteristic is basic in an increasingly decentralized scenario for higher education, where physical spaces and spaces bound by university campuses are no longer determining elements in the learning and social interaction of students, but rather transcend towards a more global sphere via the connection to technological devices (Arain et al., 2019; Ramírez-Montoya & García-Peñalvo, 2017; Yáñez-Luna & Arias-Oliva, 2018). In this sense, there are multiple experiences (Aguas-Díaz et al., 2020; Artal et al., 2017; Ballesteros-Ballesteros et al., 2020; Cabero et al., 2017; Fernández & Tabuenca, 2019; González-Fernández & Salcines-Talledo, 2015; Jordano et al., 2016; Masero, 2019; Marçal & De Castro, 2017; Pérez-Gutiérrez & Cobo-Corrales, 2019; Romero-Rodríguez et al., 2021; Urrea & Sauleda, 2020) which, in recent years, have incorporated the use of smartphones into university classrooms through emerging methodologies, such as Mobile Learning, whose hallmark is the use of mobile devices to conduct educational actions (Santiago et al., 2015).

However, despite the notable development of programs and applications for smartphones, and the wide diffusion of these devices among students, their use for educational purposes remains scarce (Mergany et al., 2021). As described by Area-Moreira et al. (2018), the predominant university teaching model continues to be expository, without having taken advantage of the incursion of ICTs to make a qualitative leap towards student-centered pedagogical approaches that favor autonomous, active, and social learning processes. Even with the situation caused by the COVID 2019 pandemic, in which face-to-face teaching has been seriously compromised, public universities continue to rely primarily on the didactic tradition of face-to-face teaching (Area-Moreira et al., 2021). In the same way, the mere implementation of ICT in the classroom is not a guarantee of a critical-reflexive use, but rather requires –among other factors– a responsible and digitally competent teaching staff, capable of selecting and discriminating between the available resources: those that correctly adjust to contemporary reality and, therefore, guarantee methodologies adapted to the times, which are active, inclusive, and innovative (Aguilar-Gavira & Benítez-Gavira, 2020; González-Fernández et al., 2015).

In this respect, as stated by Nolasco and Ojeda (2016), the data points to the existence of a direct relationship between the knowledge, attitudes, and expectations that teachers express regarding the use of technology and the real success of its incorporation into the classroom. Therefore, the role of teachers is key in the results of these educational experiences. It seems that, as Traxler (2021) points out, the mobile learning paradigm, despite being two decades old and having attained many practical, pedagogical, and conceptual achievements, is now running out of steam because it has failed to adapt to a world in which mobile technologies are pervasive, ubiquitous, and intrusive, where people and communities can control

their own learning. Similarly, Mesquita-Romero et al. (2022), say that two decades has been enough time for educational administrations to effectively apply their digitization strategies.

In this regard, innumerable recent research works (Casanova et al., 2021; Ferrero-de-Lucas et al., 2021; Lu et al., 2021; Mercader & Gairín, 2017; Montalvo, 2019; Salcines-Talledo et al., 2017) and studies after the emergence of ICT in the classroom (Baelo & Arias, 2015; Castillo et al., 2010; Flores & Del Arco, 2013; Henríquez et al., 2014; Machuca, 2009; Marín, 2004; Maroto, 2007; Mirafía, 2012; Valerio & Paredes, 2008), have delved into this field of knowledge, analyzing the patterns of pedagogical use that teachers -and, more specifically, university professors- make of technologies, and have outlined some general profiles based on their knowledge, attitudes, uses and training needs. In addition, the most recent studies (Álvarez-Flores, 2021; Hernández et al., 2018) focus particularly on the critical-reflexive skills that are mentioned above, going beyond the vision of ICT from an exclusively technical perspective to adopt a more global approach, where the critical and safe use of the network occupies a privileged place. It has been reported that the mere extensive use of the media does not guarantee the acquisition of digital and media skills that citizens of the 21st century need, converting the preparation of the youngest members of society in the critical techno-social use of these devices into a great inexcusable challenge for the educational system (Mesquita-Romero et al., 2022).

Faced with this reality of the expansion of ICTs in the world of higher education, one characteristic of these technologies is noteworthy: the phenomenal speed of their evolution and development. As expressed by Grande et al. (2016), ICTs, in addition to having a greater scope than any technological resource to date, stand out for their speed of change, manifesting vertiginous transformations with an impact comparable to fundamental technological developments, such as the printing press or the steam engine. In fact, it seems that technology is guiding society towards transience and imminence, in a model permeated by the constant search for new stimuli and experiences. In his latest essay, Han (2021) reflects on how the smartphone is leading society to an insatiable consumption of information and stimuli, to the detriment of the magic of the solid, tangible, and silent. In this context, it would be coherent to think that, since the incorporation of ICT and, more specifically, the smartphone, into university classrooms, the changes and the quantitative and qualitative evolution of their use is remarkable. Furthermore, the uses, knowledge, attitudes and expectations of teachers, as key agents in the process, are dependent on these giant leaps and technological advances. For all of the above, this research seeks to study this field of knowledge in greater depth, considering the aim of addressing the reality of the knowledge, use, benefits and difficulties of the pedagogical application of smartphones, as well as the training needs perceived by teachers of higher education working in five national universities, by studying the evolution of this trend over the last seven years.

2. Material and method

2.1. Sample

The sample of this study is made up of thirty-two university professors and lectures (53.12% men and 46.88% women) from five Spanish universities: The University of Cantabria, the University of the Basque Country, the University of Zaragoza, the University of La Laguna and the University of Valladolid. A non-probabilistic, intentional, and opinionated sampling was used for their selection (Sáez-López, 2017), ensuring the diversity of the participants relative to the branch of knowledge, teaching category and years of teaching experience. In this regard, teachers from all branches of knowledge, different teaching categories, with professional experience ranging from three to thirty-three years participated in the study. The participation of teachers was in the form of six focus groups distributed in two periods of time: the first during the 2014-2015 academic year and the second during the 2021-2022 academic year.

2.2. Tools

A semi-structured ad-hoc template was designed with questions for the development of focus groups, as a qualitative data collection technique to examine concepts, perceptions, mental images, beliefs, emotions, interactions, thoughts, experiences, processes, and experiences. collectively manifested in the language of the participants (Hernández-Sampieri & Mendoza, 2018). The semi-structured question

guide created for the focus groups consisted of seven large blocks, each one with different questions and a final summary and closing block (See Annex 1: <https://figshare.com/s/07db0c68aed2dbcf8a41>).

The validation of the information collection technique was performed by a content analysis using expert judgment, with the aim of knowing whether the questions posed were adequate and relevant to collect information on the concepts to be dealt with. To do this, five expert judges were consulted, selected based on their extensive knowledge of the specific topic and their experience in conducting qualitative research. Along with the focus group question guide, following Escobar-Pérez and Cuervo-Martínez (2008), a template was also sent to the judges for the evaluation of the instrument (See Annex 2: <https://figshare.com/s/f8117add4f71ee42c700>). The judges gave a highly positive assessment of the script of the questions and thanks to their comments and assessments the instrument was improved by introducing sub-questions, examples, and nuances in the wording.

2.3. Procedure

The qualitative research follows a longitudinal design to address the evolution of the phenomenon under study over a period of seven years. The information collected in the six focus groups was recorded and transcribed for later content analysis with the support of the Atlas.ti 6.0 program, which allowed the content to be codified and categorized, and was able to select relevant citations and establish networks. In this case, a deductive-inductive categorization was conducted. The research was based on categories in the focus group script, but new categories also emerged at the time of analysis.

In order to provide greater validity and credibility to the results, a process of triangulation of researchers was carried out (Okuda & Gómez, 2005; Ruiz, 2003) for the coding of the data and the analysis of the categories, obtaining a Kappa coefficient of .80. Table 1 shows the matrix with the categories, subcategories and codes used in the analysis of qualitative data.

Table 1. Matrix of codes, categories and subcategories established for the analysis of the qualitative data		
Knowledge	Conceptual Associations	CON_ASO
	Self-perception Degree of Knowledge	CON_AUT
Use	Personal	USO_PER
	Academic/Professional Communication and Management	USO_ACA_CG
	Academic/Professional Teaching	USO_ACA_DOC
	Integrated	USO_INT
Benefits	Personal	BEN_PER
	Academic/Professional	BEN_ACA
Difficulties	Personal	DIF_PER
	Academic/Professional	DIF_ACA
Training	Learning Experience	FOR_EXP
	Training Needs	FOR_NEC

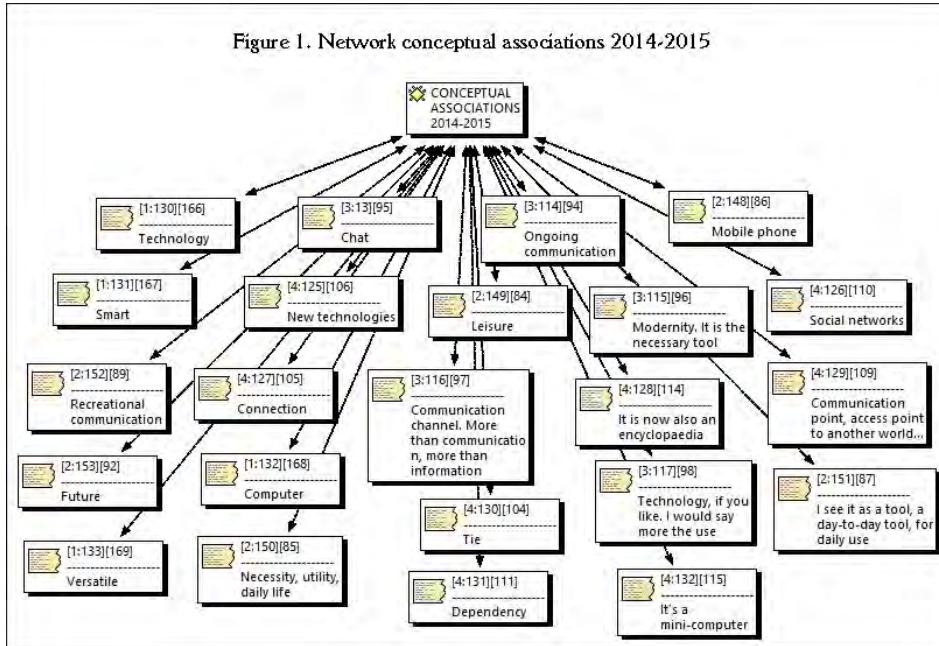
3. Results

The results obtained after analyzing the content of the focus groups based on the matrix shown in Table 1 are described below. As such, the manifestations of the participating teachers on the issues raised through citations and networks are organized around the applied categories. Furthermore, the evolution of the perceptions is presented according to the time dimensions: the academic year 2014-2015 and the academic year 2021-2022.

3.1. Knowledge

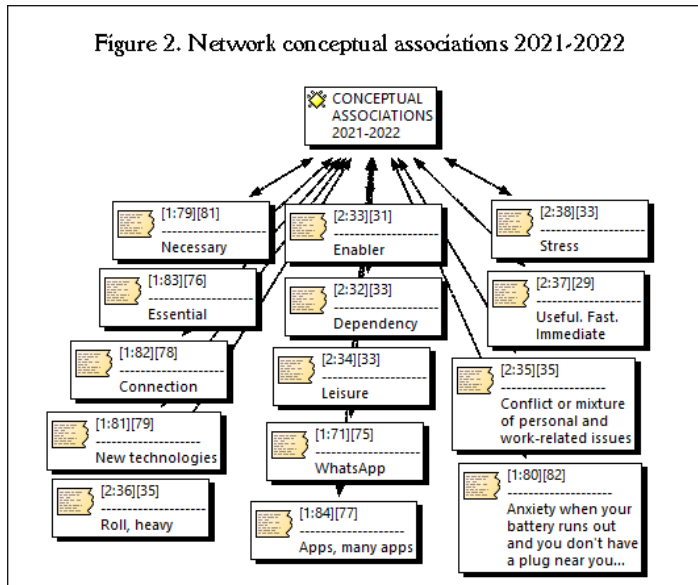
The conceptual, emotional, or operational associations made by the teachers in response to the word “smartphone” provide knowledge on the ideas, sensations and concepts that they link or that relate to the term. Two networks are presented below (Figure 1 and Figure 2) with the associations made by the participating teachers in the 2014-2015 academic year and by the participants during the 2021-2022 academic year.

Figure 1. Network conceptual associations 2014-2015



One can see that terms such as “connection”, “technology” and “utility” appear in both time periods, related to the description of the device and the possibilities it offers. However, there is an increase in the most negative associations, such as “dependence”, “attachment”, or “stress”, in the more recent manifestations.

Figure 2. Network conceptual associations 2021-2022



Regarding the subcategory “Self-perceived Knowledge”, the participants of the focus groups in the 2014-2015 academic year consider, for the most part, that their level was that of a “medium-low” user, while the participants in the 2021-2022 academic year said their level was “medium” user. In other words, teachers currently have a slightly higher self-conception of their teaching competence for the use and handling of the tool.

3.2. Use

The type of smartphone use by higher education teachers is collected in the analysis units coded around the subcategories “personal use” and “academic-professional use”. Both the participating teachers during the 2014-2015 academic year and during the 2021-2022 academic year, refer to a personal use associated, generally speaking, with communication and information:

- “I use it mainly for communication. I have email and WhatsApp. And then I always have the translator... I have installed and used the GPS, I have also installed the weather program... I use what I see that interests me and it is mainly for communication” (USO_PER_14-15).
- “I use it a lot as a personal newspaper. I think it is the modern-day way since until now we have read a print version of a newspaper and now we do it on this type of device” (USO_PER_14-15).
- “I, fundamentally, like V, use it mainly for communication. I also use it to look up information, because access is everything on the internet, be it repositories or whatever... But fundamentally, if I stop and think, I use it for communication and information search” (USO_PER_21-22).
- Regarding the academic-professional use of the smartphone, it is worth noting, in the two samples (2014-2015 and 2021-2022), a predominance in its use is mentioned for communication and management purposes in the professional field:
- “I use it more and more, although I thought I wouldn’t, for e-mail. I almost use the phone more for email than the computer. I also use WhatsApp groups and it helps you stay in touch” (USO_ACA_CG_2014-2015).
- “I am deputy director of the Department, so yes, there are a series of management issues that have to be performed and I do them with the mobile too” (USO_ACA_CG_2021-2022).
- “There are times when you have management issues, or things with projects and you need to provide an answer, other times with students... And then, for communication, we have a WhatsApp group for the entire work group. So, when tasks arise within the research group, we solve them via the WhatsApp group” (USO_ACA_CG_2021-2022).
- Similarly, although less frequently, teachers also refer to experiences related to the teaching use of the tool:
- “I apply other methodologies and, practically speaking, I don’t give lectures. So, what I do is encourage the use of the smartphone because it is the tool they have most at hand to find things. You raise any issue with them and the first thing I tell them is: ‘come on, let’s see what you find’. I want you to look for videos about such and such. So, there they are all looking and seeing. Well, it is one way of doing it” (USO_ACA_DOC_2014-2015).
- “I use an application called Socrative, in which you ask them the questions on the computer, and they answer from the smartphone, tablet or whatever they have. That has worked quite well, and I am very happy. (...) They did not want to answer questions I used to ask orally” (USO_ACA_DOC_2014-2015).
- “I use Kahoot!, Edpuzzle, Wikis and others, especially after COVID. I no longer aim to use it so much to motivate or encourage them, which I think ultimately depends on the teacher, regardless of the tool, but rather because they are already so familiar with it, it is much easier for them. Just imagine telling them “you have to write by hand”, “excuse me?” (USO_ACA_DOC_2021-2022).
- “I realized something. A few years ago, it did motivate them, it seemed innovative, for example, using Kahoot! but now they say ‘just like in high school’. So, for example, I like to break that association between high school and university. It is no longer new to them; it does not seem to motivate them much” (USO_ACA_DOC_2021-2022).

As seen in the comments, it is noteworthy how they attached great value to the inclusion of the smartphone as a pedagogical tool in their teaching in the 2014-2015 academic year, while they no longer perceive it as such a novel practice or motivating for students in the 2021-2022 academic year, despite having had to repeatedly use Mobile Learning as a result of the COVID-19 pandemic.

Finally, in relation to the "Use" category and despite the differentiation between the use of the tool in the personal and academic-professional spheres, teachers in recent years have been expressing their concern about the lack of limits between what is personal and professional given the omnipresence of technology, a circumstance that was not expressed in the first focus groups:

- "The truth is that I only use the smartphone for my personal use. I separate the personal from the work and I have a tablet for the agendas and for all class matters" (USO_INT_2014-2015).
- "I'm on holiday by the pool looking at my email... It's like, if you don't look at it, when you get back to work later, and have 500 emails, you can't handle everything. I prefer to look every day and delete them. I don't have any type of limitation, let's get on with it" (USO_INT_2021-2022).
- "I look at my mobile at midday because I get 200 emails and when I look at my mobile at night, and... I think there is no longer a separation between the personal and the professional in the case of teachers. It has disappeared" (USO_INT_2021-2022).

3.3. Benefits

The main advantages and potentialities that teachers perceive in relation to the use of the smartphone are collected in the subcategories "Personal benefits" and "Academic-professional benefits".

The personal benefits highlighted by the teachers in both the time periods fundamentally refer to speed and immediacy, free access to information, versatility, or agility in communication:

- "Thanks to the smartphone we can do several things at the same time. In other words, I am talking to a person and at the same time he or she is sending me information on WhatsApp and tells me they will look at it tonight... And they have not told me that information face-to-face" (BEN_PER_2014-2015).
- "The best thing for me is its immediacy, having access to any information or data and being able to control anything" (BEN_PER_2021-2022).
- On the other hand, the academic benefits most valued by teachers are convenience, versatility, and communication options with students, as well as the possibilities for student evaluation and motivation:
- "Because it is a vehicle for communication, access to information, facilitator of learning... It is a tool that, if used well, has lots of possibilities, which are still not fully known and exploited. And everything is in a single device. I mean that before you had to do one thing, and then another, another... but having everything compact in the same instrument really is an advantage or a benefit" (BEN_ACA_2014-2015).
- "There is an intrinsic motivation, the student is very interested in using the mobile" (BEN_ACA_2014-2015).
- "Something good is that immediacy has saved me many times, in the sense of answering an important email, validating a project... Because, in fact, I no longer have a laptop, I use the computer in the laboratory office and the smartphone. And, if I go to a congress, I use the smartphone" (BEN_ACA_2021-2022).
- "I think the students are motivated, they like it. For example, what we were talking about before Kahoot! or that type of application, they like them a lot" (BEN_ACA_2021-2022).

3.4. Difficulties

The analysis units included in the "Difficulties" category collect the main limitations, risks, or threats that higher education teachers identify in relation to the use of the smartphone. Specifically, there is an analysis of the content in the subcategories "Personal difficulties" and "Academic-professional difficulties".

The personal difficulties mentioned by the teachers in both periods are related to the vulnerability of privacy, lack of attention or the risks always derived from access to communication and information, such as anxiety, dependence and lack of limits between the professional and the personal. There are also references to the controversy between technological hyper connection, the need for intimacy and the real loneliness that it provokes.

- "I think the smartphone is responsible for a problem of chronic lack of attention that may be an illness" (DIF_PER_2014-2015).
- "But it is true that there are many people who now coordinate through WhatsApp much faster, much more immediately... But it makes me feel anxious. It is not good to be connected twenty-four hours a day with work issues. I restrict my spaces" (DIF_PER_2014-2015).
- "It is the loneliness of the big cities. But how can this be the case if you are surrounded by people and you do not go into the subway? Yet you feel completely alone. And where is there more communication? In towns with twenty inhabitants" (DIF_PER_2014-2015).
- "Yes, they sometimes put limitations on me at home. They tell me that there are times when you can't be on your mobile, that you shouldn't look at it, and I say 'but sometimes it's inevitable'. 'Very often you see the message and say 'well, I will answer it' and other times it is something urgent that you have to answer the student. Well, in the end you get used to the fact that you are available twenty-four hours a day. I have received emails at twelve o'clock at night, at one in the morning on a Saturday, and in the end, you get used to being connected 24/7, it seems that we are on permanent call" (DIF_PER_2021-2022).

After analysis of the textual citations, one can see that, in the first focus groups, the teachers were aware of the risks, but tried to define the spaces and times of professional and personal use of the tool. However, when analyzing the latest responses, one can also see that, despite continuing to be aware of the risks, they have difficulty in defining the moments and purposes of connection.

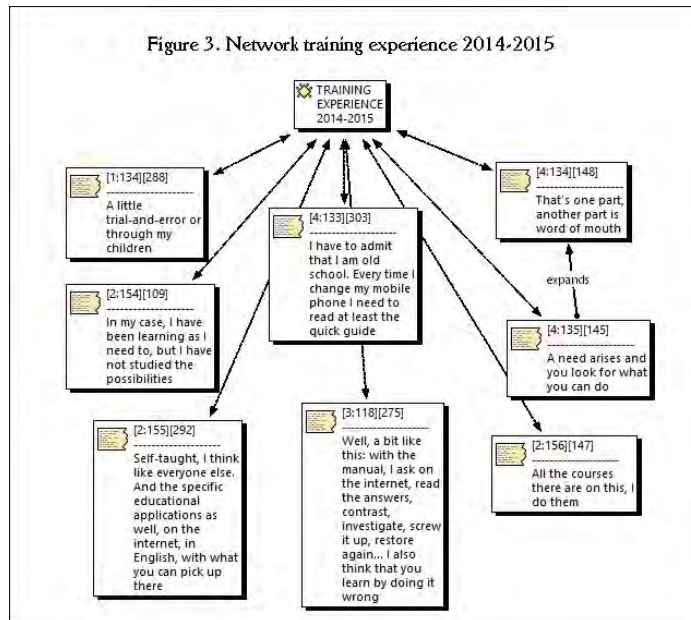
On the other hand, regarding the academic-professional difficulties mentioned in the first meetings with the teachers, they referred to how the smartphone could favor thoughtlessness and lack of criteria in the selection and consumption of content, leading to the isolation and disconnection of students.

For their part, the teachers who participated in the 2021-2022 focus groups consider that the teaching use of the tool is highly pernicious as it favors "multitasking", and time wasting. In both periods (2014-2015 and 2021-2022) they perceive that it promotes distraction and that some technical limitations, such as the small screen, hinder its usefulness.

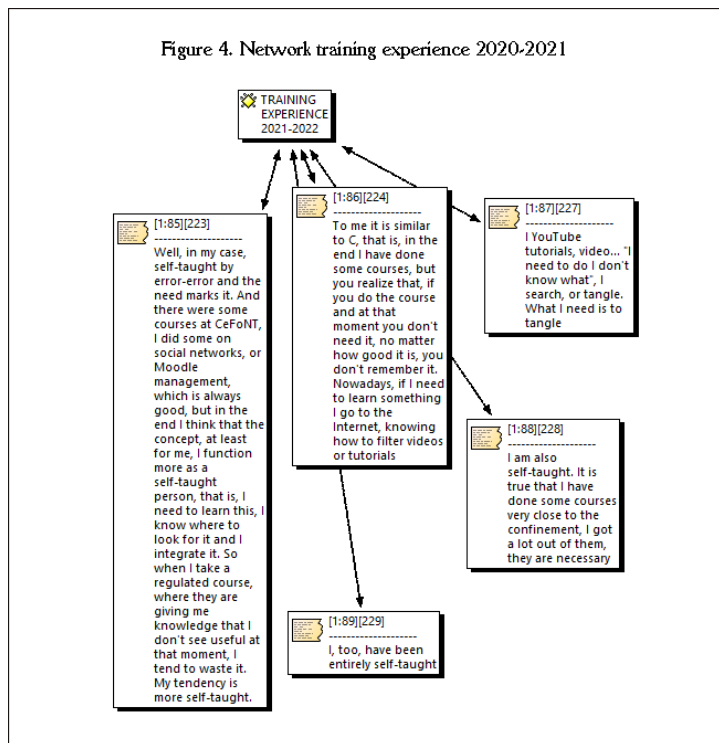
- "One difficulty I notice is that they monopolize the student's attention, which isolates them and, many times, you are talking to a wall because no one or very few people have heard you or are paying attention in class. I have noticed that a lot. And then you realize this when they ask you things I have repeated thirty times. Many are taking notes because they are in the habit of taking notes with it. Sure, this is small, it catches your attention and isolates you and you don't listen to the teacher. And that is a problem for me. And if they are looking at social networks, I don't even want to tell you" (DIF_ACA_2014-2015).
- "An advantage has been mentioned, but I can see it as a drawback: access to information is too easy. It takes a very judicious use of technology to really take advantage of it without the inconvenience of the enormous waste of time and energy that it can entail. In fact, do our students know more than they did twenty years ago? I am not sure at all" (DIF_ACA_2014-2015).
- "I believe that this immediacy gives us the option of making mistakes much faster, in other words, of not being reflexive in an absolutely categorical way" (DIF_ACA_2014-2015).
- "I don't see it as useful. Not Kahoot!, not Mentimeter, not any of these things. It seems a waste of time to me, it is like playing in class and I don't see that they learn anything doing that. Their motivation needs to come from home and participation is their duty, then I don't have to motivate them, I don't have to be doing weird things, I don't have to be wasting time on such nonsense" (DIF_ACA_2021-2022).

3.5. Training

Information from the category "Training" is analyzed according to the subcategories "Training experience" and "Training needs".



Firstly, Figure 3 and Figure 4 show that teachers refer to a highly intuitive, self-taught learning process, although, on some occasions, they mention more traditional training processes such as manuals or officially regulated courses.



Secondly, regarding the training needs, the demands related to the knowledge and handling of specific applications were verified in the 2014-2015 group, pointing out the importance of the format of the course or seminar to be taught. In other words, they consider the execution of an eminently practical and extensive training in which the teacher supervises and accompanies the learners throughout the entire process as

being fundamental. However, as regards the 2021-2022 academic year, they no longer require as much training due to both the possibilities they have for self-training through the Internet and the more critical view of the educational application of the smartphone.

4. Discussion and conclusions

The aim of the present study was to study in greater depth the pedagogical evolution of smartphones over the last seven years, from the point of view of university teachers. Firstly, regarding the conceptual associations that teachers make about the tool, despite collecting highly positive evaluations, like Lozano and Sánchez (2018), and Valtonen et al. (2021), there has been an increase in the more negative associations in recent years, regardless of manifesting a more effective management of it. Therefore, considerations related to anxiety, bondage or dependence emerge to the detriment of ideas such as functionality or usefulness to which they alluded during the first period. Therefore, it seems that there is a certain tendency to problematize or, at least, to perceive from a more critical perspective, the real possibilities of the smartphone. The personal use that higher education teachers made of the smartphone, in both time periods, is generally associated with communication and information search. In relation to its academic-professional use, there is a predominance of use for communication and management purposes. Although the evaluations of Mobile Learning teaching practices were initially highly favorable (Camacho, 2011; Santiago et al., 2015), teachers currently no longer perceive them as something new and motivating for students, unless it is pertinent and justified (Valtonen et al., 2021). In other words, the inclusion of ICTs, in contrast to what some previous research reported (Aguilar et al., 2019; Gupta et al., 2021; Lozano & Sánchez, 2018; Valtonen et al., 2021), has not led to a qualitative leap in teaching methodologies (Area-Moreira et al., 2018; Area-Moreira et al., 2021; Mergany et al., 2021).

In addition, the difficulties seen in the use of the smartphone are related to the fragility of privacy, attention and technological hyper connection, leading to situations of anxiety and dependence in users. Specifically, and in line with Mesquita-Romero et al., (2022), teachers mention how the manifest technological consumption of their students is far from being critical-reflexive, even promoting time wasting and «multitasking» when faced with such a large number of stimuli (Han, 2021). However, teachers perceive multiple benefits of the tool both at a personal and academic-professional level related to speed, versatility, immediacy, communicative agility, possibilities to motivate and assess learning (Arain et al., 2019; Ramírez-Montoya & García -Peñalvo, 2017; Yáñez-Luna & Arias-Oliva, 2018). Finally, regarding training, a decline in the more traditional face-to-face training processes in favor of online self-training is corroborated. Although in the first period the teachers expressed some training needs, especially related to the technical use of applications, these barriers seem to have been overcome now, in a self-taught way, and in addition, with a more residual interest derived from the critical perception shown about the real effectiveness of the use of the smartphone in the teaching-learning-assessment processes.

One of the main limitations of this research may lie in the fact that it only collected the opinions of teachers, which could be expanded to enrich the data collection in the future with the vision of other agents involved such as students, graduates, and employers. Furthermore, it would be of much interest to include the participation of an international sample for a global overview of the phenomenon. In the same vein, it would be necessary to focus future research on the proper management of the device both in the professional and personal environment, preventing disruptive, invasive, and omnipresent use, in favor of responsible, constructive, and critical use. Similarly, it seems pertinent to continue examining the reasons why Mobile Learning has not had the expected qualitative impact on higher education. Understanding what the appropriate technological means and applications are for each context, using these technologies to work as a team to collaboratively create and build resources, knowledge, and content, may be part of the solution. This is especially true in the face of saturation, lack of limits, or the imprecise application of technology.

Authors' Contribution

Idea, I.S.T., N.G.F.; Literature review (state of the art), I.S.T., N.G.F., L.D.H.; Methodology, I.S.T., N.G.F., L.D.H.; Data analysis, I.S.T., N.G.F., L.D.H.; M.A.M.; Results, I.S.T., N.G.F., L.D.H.; Discussion and conclusions, I.S.T., N.G.F., L.D.H.; M.A.M.; Writing (original draft), I.S.T., N.G.F., L.D.H.; Final revisions, I.S.T., N.G.F., L.D.H.; M.A.M.; Project design and sponsorship, I.S.T., N.G.F.

References

- Aguas-Díaz, C.J., Flores-Flores, J.L., Sarmiento-Sarmiento, I.K., & Aguirre-Robalino, D.F. (2020). Aprendizaje móvil (m-learning) como método educativo en educación superior. *Revista Arbitrada Interdisciplinaria Koinonía*, 5(1), 867-879. <https://doi.org/10.35381/r.k.v5i1.887>
- Aguiar, B.O., Velázquez, R.M., & Aguiar, J.L. (2019). Innovación docente y empleo de las TIC en la educación superior. *Revista Espacios*, (2), 40-40. <https://bit.ly/3nSSTfn>
- Aguilar-Gavira, S., & Benítez-Gavira, R. (2020). Retos competenciales del profesorado universitario ante una educación expandida y mediada por las TIC. In *Tecnologías educativas y estrategias didácticas* (pp. 1148-1157). UMA Editorial. <https://bit.ly/3AZj1YF>
- Álvarez Flores, E.P. (2021). Uso crítico y seguro de tecnologías digitales de profesores universitarios. *Formación Universitaria*, 14(1), 33-44. <https://doi.org/10.4067/S0718-50062021000100033>
- Arain, A.A., Hussain, Z., Rizvi, W.H., & Vighio, M.S. (2019). Extending UTAUT2 toward acceptance of mobile learning in the context of higher education. *Universal Access in the Information Society*, 18, 659-673. <https://doi.org/10.1007/s10209-019-00685-8>
- Area-Moreira, M., Bethencourt-Aguilar, A., Martín-Gómez, S., & Nicolás-Santos, M.B.S. (2021). Análisis de las políticas de enseñanza universitaria en España en tiempos de Covid-19. La presencialidad adaptada. *RED*, (pp. 21-21). <https://doi.org/10.6018/red.450461>
- Area-Moreira, M., San-Nicolás, Santos, B., & Sanabria-Mesa, A.L. (2018). Las aulas virtuales en la docencia de una universidad presencial: La visión del alumnado. *RIED*, 21(2), 179-198. <https://doi.org/10.5944/ried.21.2.20666>
- Artal, J.S., Casanova, O., Serrano, R.M., & Romero, E. (2017). Dispositivos móviles y flipped classroom. Una experiencia multidisciplinar del profesorado universitario. *EDUTEC*, 59, 1-13. <https://doi.org/10.21556/edutec.2017.59.817>
- Baelo, R., & Arias, A.R. (2015). Formación del profesorado universitario en tecnologías de la información y de la comunicación (TIC). In J. J. Maquilón, M. P. García, & M. L. Belmonte (Eds.), *Innovación educativa en la enseñanza formal* (pp. 347-356). EDITUM. <https://bit.ly/2XUWVGyp>
- Ballesteros-Ballesteros, V.A., Rodríguez-Cardoso, O.I., Lozano-Forero, S., & Nisperuza-Toledo, J.L. (2020). El aprendizaje móvil en educación superior: Una experiencia desde la formación de ingenieros. *Revista Científica*, 38(2), 243-257. <https://doi.org/10.14483/23448350.15214>
- Cabero, J., Fernández, B., & Marín, V. (2017). Dispositivos móviles y realidad aumentada en el aprendizaje del alumnado universitario. *RIED*, 20(2), 167-185. <https://doi.org/10.5944/ried.20.2.17245>
- Camacho, M. (2011). Mobile Learning: Aproximación conceptual y prácticas colaborativas emergentes. *Revista de Ciències de l'Educació*, 2, 43-50. <https://doi.org/10.17345/ute.2011.2.613>
- Casanova, D., Alsop, G., & Huet, I. (2021). Giving away some of their powers! Towards learner agency in digital assessment and feedback. *Research and practice in technology enhanced learning*, 16, 20-20. <https://doi.org/10.1186/s41039-021-00168-6>
- Castillo, M., Larios, V.M., & García, O. (2010). Percepción de los docentes de la utilización de las tecnologías de la información y la comunicación. *Revista Iberoamericana de Educación*, (6), 53-53. <https://doi.org/10.35362/rie5361711>
- Escobar-Pérez, J., & Cuervo-Martínez, A. (2008). Validez de contenido y juicio de expertos: Una aproximación a su utilización. *Avances en Medición*, 6, 27-36. <https://bit.ly/3oU8Kt>
- Fernández, J., & Tabuenca, M.F. (2019). Aprendizaje móvil y aprendizaje combinado en la asignatura de AICLE en los grados de educación primaria y educación infantil. *3C TIC: Cuadernos de desarrollo aplicados a las TIC*, 8, 84-101. <https://doi.org/10.17993/3ctic.2019.82.84-101>
- Ferrero-De-Lucas, E., Cantón-Mayo, I., Menéndez-Fernández, M., Escapa-González, A., & Bernardo-Sánchez, A. (2021). ICT and knowledge management in teaching and engineering students. [TIC y gestión del conocimiento en estudiantes de Magisterio e Ingeniería]. *Comunicar*, 66, 57-67. <https://doi.org/10.3916/C66-2021-05>
- Flores, O., & Del-Arco, I. (2013). Nativos digitales, inmigrantes digitales: Rompiendo mitos. Un estudio sobre el dominio de las TIC en profesorado y estudiantado de la universidad de Lleida. *Bordón*, 65, 59-74. <https://doi.org/10.13042/brp.2013.65204>
- González-Fernández, N., Gozávez-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-2015-367-285>
- González-Fernández, N., & Salcines-Talledo, I. (2015). El smartphone en los procesos de enseñanza-aprendizaje-evaluación en educación superior: Percepciones de docentes y estudiantes. *RELIEVE*, 21(2). <https://doi.org/10.7203/relieve.21.2.7480>
- Grande, M., Cañón, R., & Cantón, I. (2016). Tecnologías de la información y la comunicación: Evolución del concepto y características. *International journal of Educational Research and Innovation*, 6, 218-230. <https://bit.ly/2Zqhyh7>
- Gupta, C., Gupta, V., & Stachowiak, A. (2021). Adoption of ICT-Based Teaching in engineering: An extended technology acceptance model perspective. *IEEE Access*, 9, 58652-58666. <https://doi.org/10.1109/ACCESS.2021.3072580>
- Han, B.C. (2021). *No-cosas. Quiebras del mundo de hoy*. Taurus.
- Henríquez, P.S., González, C., & Organista, J. (2014). Clasificación de perfiles de uso de smartphones en estudiantes y docentes de la Universidad Autónoma de Baja California. México. *Revista Complutense de Educación*, 25(2), 245-270. https://doi.org/10.5209/rev_RCED.2014.v25.n2.41437
- Hernández, T.R., Carvajal, B.M., & Legañoa, M.A. (2018). La curación de contenidos científicos: Una herramienta para la gestión informativa en los docentes universitarios. *Revista Publicando*, 14(3), 258-272. <https://bit.ly/3i5ZGPg>
- Hernández-Sampieri, R., & Mendoza, C.P. (2018). *Metodología de la investigación. Las rutas cuantitativa, cualitativa y mixta*. McGraw-Hill. <https://bit.ly/3tnP5oZ>
- Jordano, M., Castrillo, M.D., & Pareja-Lora, A. (2016). El aprendizaje de lenguas extranjeras mediante tecnología móvil en el contexto de la educación a distancia y combinada. *RIED*, 19, 25-40. <https://doi.org/10.5944/ried.19.1.15287>

- Lozano, L., & Sánchez, M. (2018). Pertinencia Pedagógica y Uso de las TIC en la Educación Superior. In F. Murillo (Ed.), *Avances en democracia y liderazgo distribuido en educación: Actas del II Congreso Internacional de Liderazgo y Mejora de la Educación* (pp. 200-204). RILME. <https://bit.ly/3u8tkYP>
- Lu, A., Wong, C.S.K., Cheung, R.Y.H., & Im, T.S.W. (2021). Supporting flipped and gamified learning with augmented reality in higher education. *Frontiers in Education*, 6, 623745-623745. <https://doi.org/10.3389/educ.2021.623745>
- Machuca, Y. (2009). Los docentes universitarios ante la incorporación de las tecnologías de la información y comunicación al acto didáctico. *Eduweb*, 3(1), 113-123. <https://doi.org/https://bit.ly/3q9CYtj>
- Marçal, E., & De-Castro, R.M. (2017). Mobile learning em aulas de campo: Um estudo de caso em Geologia. *RIED*, 20(2), 315-336. <https://doi.org/10.5944/ried.20.2.17711>
- Marín, V. (2004). Las nuevas tecnologías y la formación de los profesores universitarios. *Etic@net*, 3, 1-13. <https://bit.ly/3q7ViTP>
- Maroto, A. (2007). El uso de las nuevas tecnologías en el profesorado universitario. *Pixel-Bit*, 30, 61-72. <https://bit.ly/3AO5aW1>
- Masero, I.C. (2019). Móviles y aprendizaje en la educación superior. *3C TIC: Cuadernos de desarrollo aplicados a las TIC*, 8, 13-25. <https://doi.org/10.17993/3ctic.2019.84.13-25>
- Mercader, C., & Gairín, J. (2017). ¿Cómo utiliza el profesorado universitario las tecnologías digitales en sus aulas? *REDU*, 15(2), 257-274. <https://doi.org/10.4995/redu.2017.7635>
- Mergany, N.N., Dafalla, A.E., & Awooda, E. (2021). Effect of mobile learning on academic achievement and attitude of Sudanese dental students: A preliminary study. *BMC Medical Education*, 21, 121-121. <https://doi.org/10.1186/s12909-021-02509-x>
- Mesquita-Romero, V., Fernández-Morante, C., & Cebeiro-López, B. (2022). Critical media literacy to improve students' competencies. [Alfabetización mediática crítica para mejorar la competencia del alumnado]. *Comunicar*, 70. <https://doi.org/10.3916/C70-2022-04>
- Miratía, O.J. (2012). Necesidades de formación de los docentes universitarios en relación a las herramientas Web 2.0 y perspectivas futuras. *@tic: Revista d'Innovació Educativa*, 9, 71-78. <https://doi.org/10.7203/atic.9.1951>
- Montalvo, N. (2019). Percepción y uso de las TIC por los docentes universitarios. *Etic@net*, 19(2), 100-118. <https://doi.org/10.30827/eticanet.v19i2.11851>
- Nolasco, P., & Ojeda, M.M. (2016). La evaluación de la integración de las TIC en la educación superior: Fundamento para una metodología. *RED*, (pp. 48-48). <https://doi.org/10.6018/red/48/9>
- Okuda, M., & Gómez, C. (2005). Métodos en investigación cualitativa: Triangulación. *Revista Colombiana de Psiquiatría*, 34, 118-124. <https://bit.ly/3te8HM0>
- ONTSI (Ed.) (2021). *Tendencias en el uso de dispositivos tecnológicos 2021*. Observatorio Nacional de Tecnología y Sociedad. <https://bit.ly/3nXtQYM>
- Paredes-Labra, J., & Valerio-Mateos, C. (2008). Evaluación del uso y manejo de las tecnologías de la información y la comunicación en los docentes universitarios. Un caso mexicano. *RELATEC*, 7(1), 13-32. <https://bit.ly/39zFpge>
- Pérez-Gutiérrez, M., & Cobo-Corrales, C. (2019). Evaluación formativa y compartida a través del mobile learning en el Grado en Magisterio en Educación Primaria en la Universidad de Cantabria. *Infancia, Educación y Aprendizaje*, 5(2), 48-53. <https://doi.org/10.22370/ieya.2019.5.2.1501>
- Ramírez-García, A., Salcines-Talledo, I., & González-Fernández, N. (2020). Los dispositivos móviles en el hogar. Interés formativo de las familias españolas. *Revista Española de Orientación y Psicopedagogía*, 31(1), 42-62. <https://doi.org/10.5944/reop.vol.31.num.1.2020.27286>
- Ramírez-Montoya, M.S., & García-Peñalvo, F.J. (2017). La integración efectiva del dispositivo móvil en la educación y en el aprendizaje. *RIED*, 20(2), 29-47. <https://doi.org/10.5944/ried.20.2.18884>
- Ricoy, M.C., & Fernández, J. (2013). Contribuciones y controversias que genera el uso de las TIC en la educación superior: Un estudio de caso. *Revista de Educación*, 360, 509-532. <https://doi.org/10.4438/1988-592X-RE-2011-360-125>
- Romero-Rodríguez, J.M., Aznar-Díaz, I., Hinojo-Lucena, F.J., & Gómez-García, G. (2021). Uso de los dispositivos móviles en educación superior: Relación con el rendimiento académico y la autorregulación del aprendizaje. *Revista Complutense de Educación*, 32(3), 327-335. <https://doi.org/10.5209/rced.70180>
- Ruiz, J.I. (2003). *Técnicas de triangulación y control de la calidad en la investigación socioeducativa*. Ediciones mensajero. <https://bit.ly/3JfETnH>
- Sáez-López, J.M. (2017). *Investigación educativa. Fundamentos teóricos, procesos y elementos prácticos*. UNED. <https://bit.ly/3te9c8Q>
- Salcines-Talledo, I., González-Fernández, N., & Briones, E. (2017). Perfiles docentes universitarios: Conocimiento y uso profesional del "smartphone". *Bordón*, 69, 97-114. <https://doi.org/10.13042/Bordon.2017.51445>
- Santiago, R., Trinaldo, S., Kamijo, M., & Fernández, A. (2015). *Mobile learning: Nuevas realidades en el aula*. Digital Text. <https://bit.ly/3JfVrMD>
- Traxler, J. (2021). A critical review of mobile learning: Phoenix, fossil, zombie or. *Education Sciences*, 11. <https://doi.org/10.3390/educsci11090525>
- Urrea, M.E., & Sauleda, L.A. (2020). Perfil de uso académico del smartphone del alumnado del primer curso del Grado de Maestro en Educación Infantil y Primaria. In R. Roig (Ed.), *La docencia en la Enseñanza Superior. Nuevas aportaciones desde la investigación e innovación educativas* (pp. 1352-1361). Octeado. <https://bit.ly/2XDr8wR>
- Valtonen, T., Leppänen, U., Hyypiä, M., Kokko, A., Manninen, J., Vartiainen, H., Sointu, E., & Hirsto, L. (2021). Learning environments preferred by university students: A shift toward informal and flexible learning environments. *Learning Environments Research*, 24, 371-388. <https://doi.org/10.1007/s10984-020-09339-6>
- Yáñez-Luna, J.C., & Arias-Oliva, M. (2018). M-learning: Aceptación tecnológica de dispositivos móviles en la formación online. *Revista Tecnología, Ciencia y Educación*, 10, 13-34. <https://doi.org/10.51302/tce.2018.193>