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# Pre-service Teachers' Perceptions of Acceptance of Mobile Technologies in Teaching-Learning Processes. A Case Study

## Percepciones de Maestros en Prácticas sobre Aceptación de Tecnologías Móviles en Procesos de Enseñanza-Aprendizaje. Un estudio de caso

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**Abstract**: The pandemic crisis highlighted the need for a technological and digital transformation of the university, a process that has already begun and that has marked a before and after in the incorporation of technologies in the teaching-learning processes. On the other hand, teachers in training are a privileged group as they are at the end of their training process, in contact with active teachers and will be pillars of social training. For this reason, this study aims to analyze the perceptions of trainee teachers at the University of Granada on the acceptance and inclusion of smartphones in teaching and learning processes, as a result of the Covid-19 pandemic crisis. A qualitative methodology (focus group) was implemented with a sample of 16 trainee teachers belonging to the area of social sciences. The results showed an incorporation of technologies in future teachers, the need for the implementation of smartphones, as well as mobile literacy for students and teachers. In the same way, generational differences, the relevance of motivation and perception in usefulness and ease of use of devices are highlighted. It is concluded that there is a need for training actions in teachers and educational centers to provide an effective response to social and educational needs. For this reason, universities, educational institutions and teachers must strive to understand the scope of mobile teaching and the possibilities of smartphones in increasing motivation and the acquisition of basic skills. Future studies are needed to broaden the scope of analysis to different areas and contexts

**Keywords**: Mobile teaching, Teachers in training, Qualitative research, Focus group, smartphone.

**Resumen**: La crisis pandémica evidenció la necesidad de una transformación tecnológica y digital de la universidad, proceso ya iniciado y que ha supuesto un antes y un después en la incorporación de las tecnologías en los procesos de enseñanza-aprendizaje. Por otro lado, los maestros en prácticas suponen un colectivo privilegiado en tanto que se hallan al final de su proceso formativo, en contacto con docentes en activo y serán pilares de la formación social. Por ello, este estudio pretende analizar las percepciones de los maestros en prácticas de la Universidad de Granada, sobre la aceptación e inclusión de smartphones en los procesos de enseñanza-aprendizaje, a raíz de la crisis pandémica de la Covid-19. Se implementó una metodología cualitativa (focus group) con una muestra de 16 maestros en prácticas perteneciente al área de ciencias sociales. Los resultados mostraron una incorporación de las tecnologías en futuros docentes, la necesidad de implementación de smartphones así como la alfabetización móvil de estudiantes y profesores. Del mismo modo, se subrayan diferencias generacionales, la relevancia de la motivación y de la percepción en utilidad y facilidad de uso de los dispositivos. Se concluye la necesidad de acciones formativa en docentes y centros educativos para dar una respuesta eficaz a las necesidades sociales y educacionales. Por ello, la universidad, instituciones educativas y maestros, deben esforzarse por comprender el alcance de la enseñanza móvil y las posibilidades de los smartphones en el incremento de la motivación y la adquisición de competencias básicas. Se precisa realizar estudios futuros que amplíen el ámbito de análisis a distintas áreas y contextos.

**Palabras-Clave:**: Enseñanza Móvil, Maestros en prácticas, Investigación cualitativa, Grupo Focal, Dispostivo movil inteligente.

## 1. Introduction

The broad technological evolution, the indispensability of internet access, and the immediacy, both communicative and in accessing information, have brought about a radical change in the way we relate socially and with information. To a large extent, the development of mobile technologies has contributed to these changes, becoming a matter of prime importance in education, especially higher education. Today, information access, communication, and teaching-learning processes cannot be conceived of without smartphones. These processes have been accelerated by COVID-19, which forced a change to virtual teaching (Chen & Tsai, 2021). Undoubtedly, this situation has led to changing attitudes towards the necessity. Similarly, various limitations have been evident, including generational gaps, lack of resources, and the need for instruction. Therefore, discrepancies exist between rapid social adaptation to new realities and the adaptation by universities.

Information access and management are conditioned by three significant characteristics: connectivity, immediacy and ubiquity. The widespread use of smartphones has significantly affected higher education learning not only because they make learning environments more attractive and motivating but also because they have educational value (Krouska et al., 2022; Yun et al., 2022). Increasingly precise smartphone applications contribute to task optimization, making smartphones a useful tool for teaching This fact has been intensified as a result of the pandemic crisis. There is an exponential increase in the use of smartphones for academic purposes, with a positive impact on teaching-learning processes (Wali & Omaid, 2020; Batch et al., 2021).

Smartphones affect educational theory and practice, linking information, social intercommunication and pedagogical methodologies. Mobile devices act as an ally for motivation and have become a necessary component in classrooms. Various authors emphasise the relationships between motivation, the use of mobile technologies and effectiveness in learning (Pinto et al., 2020; 2021; Park et al., 2021; Latham et al., 2022).

The general objective of this research is to analyse through a qualitative methodology (i.e., focus groups) the adaptation and inclusion of smartphones in teaching, focusing on the perceptions of preservice teachers towards the inclusion of smartphones in classrooms and the perception they have of their teachers (i.e., the university professors who taught classes in their postgraduate training and teachers who were their mentors during internships). Thus, preservice teachers and teachers responsible for training future teachers are the objects of this study-

This is a novel approach, as there are still few publications on the topic. A qualitative methodology is better suited for this study, providing data difficult to obtain with quantitative method. In addition, comparing smartphone use before and after the pandemic provides significant data for the scientific community aspects before and after the pandemic crisis yields results that can provide significant data for the scientific community. It is essential to note that qualitative techniques in general, and focus groups in particular, have not yet achieved widespread adoption. Finding research that integrates the variables considered in this context, such as preservice teachers, mobile teaching, and qualitative analysis (through focus groups), is a challenging task. Likewise, regarding the impact of the COVID-19 pandemic, there is little research

comparing the use of smartphones in classrooms by preservice teachers before and after the pandemic (Rosli et al., 2022).

Additionally, the Technology Acceptance Model (TAM) – with its two dimensions of perceived usefulness and perceived ease of use (Al-Rahmi et al., 2022) – can be considered a valuable tool for understanding the adoption of smartphones. This model helps evaluate how users, in this case, future teachers, perceive the ease of using these devices (Habes et al., 2022). This approach is essential not only for analysing the attitude of preserve teachers about using smartphones in teaching but also for understanding the role of smartphones in education in general. In this way, the specific objectives of this study are as follows:

OE1. To understand the perceived usefulness and use of smartphones by preservice teachers.

OE2. To analyse the use of smartphones for academic purposes.

OE3. To identify the resources available to the university and the library for mobile learning.

OE4. To understand the changes that have occurred because of the COVID-19 crisis regarding mobile teaching.

OE5. To analyse the detected needs regarding the implementation of smartphones in teaching.

### *1.1. Literature Review*

Three main thematic areas have been identified: the technological acceptance model (TAM), mobile teaching and smartphone technologies.

*Technological Acceptance Model*

Davis first developed TAM (Technological Acceptance Model) in the late 1980s (Walker et al., 2020). The theory is based on two dimensions: perceived ease of use and perceived usefulness. The former is defined as «a measure by which the use of technology is believed to provide benefits to the person using it» (Hsu Chang, 2013, p. 215). The latter is based on the belief that using the system would be easy (Davis, 1989, p. 320). Perceived ease of use has a direct impact on the perception of usefulness. The investment in time and effort becomes a guarantee of motivation, success and effort optimisation (Walker et al., 2020; Buabeng-Andoh, 2021). Both aspects involve three fundamental axes: attitude (towards use), adoption (of use) and current use of technology (García-Martínez et al., 2019; Kumar et al., 2020; Wong et al., 2022). Attitude describes the set of perceptions before adopting technology, and adoption defines the materialisation of technological use. After a positive perception, the tools are incorporated. Various studies have echoed this issue, emphasising the importance of motivation (Adov et al., 2018; Al-Emram et al., 2020). Social use, interaction and ease of access are key to understanding the acceptance of mobile technologies (Chahal, & Rani, 2022; Wong et al., 2022).

*Mobile teaching and TAM*

Regarding the combination of TAM and the use of mobile technologies, various authors have highlighted the applicability of TAM to understand the integration and adoption of devices in higher education (Zhonggen & Xiaozhi, 2019; Chahal & Rani, 2022). The positive impact of the perceived ease of use on the overall perception of the advantages of its integration is emphasised.

The keys of the TAM model (perceived usefulness and perceived ease of use) would become useful elements for measuring both acceptance and implementation. The advantages of smartphones are interconnected with the perception of usefulness, perceived ease of use, and accessibility. Mobile education is based on the concept of mobility, understood as the possibility and ability to access information, establish communication, or avail various services through the use of smartphones. Al-Emram (2020) adds a characteristic: on the go. This property, along with connectivity, implies the ubiquity and immediacy of smartphones. The use of smartphones has contributed to optimizing teaching and learning processes in general and at the higher education level in particular.

*Preservice teachers and technological acceptance of smartphones*

The development of mobile teaching is contingent upon the role of educators in the acceptance and integration of technologies. Thus, preservice teachers serve as a significant indicator, situated between recent postgraduate university teaching and imminent professional teaching practice. One of the initial studies applying the TAM model to preservice teachers was conducted by Valtonen et al. (2015), during a still nascent period. The model developed by Nikou and Economides (2017) applies TAM to smartphones, emphasizing motivation and interest in technological acceptance. Additionally, this model is combined with the Self-Determination Theory of Motivation (SDT) (p. 84).

Annamalai (2018) employed focus group techniques to analyze smartphone usage among preservice teachers. Despite some reservations within certain sectors, advantages were found in its implementation. Kearney & Maher (2019) examined the interest generated by smartphone use among students and preservice teachers, highlighting the pivotal aspect of preparing future educators in technology. Similar lines of inquiry were pursued by Ata & Cevik (2019) and Sánchez-Prieto et al. (2019). Gunawan et al. (2020) conducted an online focus group with teachers on the implementation of smartphone applications in teaching during the Covid-19 pandemic lockdown, demonstrating the utility of specific applications. Alubthane (2021) also implemented the focus group to measure smartphone acceptance among preservice teachers, underscoring the digital divide and the challenge of distinguishing between academic and social contexts.

The pandemic crisis underscored the utility of smartphone devices in teaching and learning processes. Recently, Hafour (2022) conducted research through focus groups, grounded in the ACRL framework, comparing a sample of preservice teachers with experienced professors. Motivation emerged as a conditioning factor. Asio et al. (2021) emphasized the effectiveness of focus groups in analyzing attitudes and training of preservice teachers in the context of the pandemic crisis. Trninic et al. (2022)

highlighted the relevance of focus groups for «the ability to collect empirical material necessary for the subject of the research» (p. 6).

In summary, no research based on focus groups was found that compared pre- and post-Covid attitudes among preservice teachers in the social sciences regarding the use of mobile phones in teaching and learning processes.

## 2. Method

This section outlines the focus group instrument utilized, the selected sample, its implementation, and the analysis method.

To measure preservice teachers' perceptions regarding the incorporation, usage, and competencies in mobile education (ME) during their training period, a qualitative methodology based on the use of focus groups was employed. While widely used, this method remains innovative in scientific research, particularly in its application to the social sciences. Its utility lies in capturing elements that may not be achievable through quasi-experimental quantitative methods due to the interactions and dialogue that occur among participants.

The focus group design was informed by a specific literature review in specialized databases (ProQuest, ERIC, WoS, Scopus), focusing on the intersection of keywords such as mobile technology, smartphone, higher education, preservice teacher, teaching methodologies, and qualitative research. Studies that utilized focus groups and served as a basis for developing our focus group script were selected (Table 1).

**Table 1.** Synthesis of Studies Informing the Focus Group Script.

| Authors | Year | Title | Methodology | Item (script of this research) |
|---|---|---|---|---|
| Savros Nikou & Anastasios Economides | 017 | Factors that influence behavioral intention to use mobile-based assessment: A STEM teachers' perspective. | Mixed | Item 1[a] |
| Nagaletchimee Annamalai | 018 | How Do We Know What is Happening in Whatsapp: A Case Study Investigating Pre-Service Teachers | Qualitative: focus group | Items 1 y 2 |
| Mathew Kearney & Damian Maher | 019 | Mobile learning in pre-service teacher education: Examining the use of professional learning networks. | Qualitative | Items 3-4 |

| Authors | Year | Title | Methodology | **Item** (script of this research) |
|---|---|---|---|---|
| RidvanAta & Mustafa Cevik | 019 | Exploring relationships between Kolb's learning (2019) styles and mobile learning readiness of pre-service teachers: A mixed study. | Mixed | Items 8-10 |
| José Carlos Sánchez-Prieto | 019 | Exploring the unknown: The effect of resistance to change and attachment on mobile adoption amongs econdary pre-serviceteachers | Mixed | Items 9-10 |
| Marwa F. Hafour | 020 | The effects of MALL training on preservice and focus group in-service EFL teachers' perceptions and use of mobile technology. | Qualitative: focus group | Item 10 |
| Johan Backlund, Hugo, Martin; Ericson, Kerstin | 021 | Pre-Service Teachers' Experiences Of The Transition From Analogue To Digital Learning During The Covid-19 Pandemic | Qualitative: focus group | Items 3-5-7-9 |
| María Pinto, David Caballero, Dora Sales, Alicia Segura | 021 | Belief in importance of information literacy abilities among undergraduates | Qualitative: focus group | Items 3-5-7-9 |

The focus group sessions were conducted following ethical guidelines, ensuring participant confidentiality and obtaining informed consent. The discussions were recorded, transcribed verbatim, and subsequently subjected to thematic analysis. The iterative process involved coding and categorizing emerging themes, fostering a comprehensive understanding of preservice teachers' perspectives on mobile education.

**Table 2.** Semi-Structured Interview Components.

| **Script of the semi-structured interview** | | |
|---|---|---|
| Motivation in Smartphone Use and Perceived Utility (OE 1) | Use of Platforms, Programs, Devices. | Perceived Utility. |

| **Script of the semi-structured interview** | | |
|---|---|---|
| Academic Use of the Smartphone (OE 2) | Perceptions of Teachers and Practicing Teachers Regarding Its Use. (considering that pre-service teachers are on both sides). | Academic Utilities Inside and Outside the Classrooms. |
| University-Library Resources and Mobile Learning (OE 3) | Adaptation of Universities and Their Libraries to Changes Resulting from the Inclusion of Smartphone Technologies and their Generalization. | Apps, Training, Guidance, and Coordination Between Teachers and Librarians. |
| Post-Covid-19 Health Crisis and Smartphone Utility (OE 4) | Pre- and Post-Covid-19 Crisis Evaluation in the Acceptance and Inclusion of Smartphones. | |

The script was designed to thoroughly explore the perceptions, experiences, competencies, as well as perceived barriers and facilitators among preservice teachers regarding mobile education. The semi-structured format allowed flexibility to delve into specific aspects emerging during the focus group sessions.

### *2.1. Sample and implementation*

The sample consisted of preservice teachers, postgraduates in Education from the University of Granada, during the academic year 2021-22. Participants needed to meet basic criteria: being a postgraduate in the field of Education and currently undergoing the practicum. Additionally, methodological guidelines included a commitment to actively participate in the research, adherence to pre-established norms (such as sincerity, respecting turn-taking, opinions, etc.), and consent to anonymous recording for research purposes.

A non-probabilistic convenience sample was selected, and 16 participants voluntarily took part in two focus groups, comprising 9 and 7 preservice teachers concluding their practicum, respectively. The participants, aged between 23 and 30, had pursued postgraduate studies in various specialties, including Physical Education, Foreign Language, Computer Science, Humanities, Arts, and Natural Sciences.

Two focus group sessions were conducted at the Faculty of Education on March 7 and 12, 2022, involving two researchers. The first researcher facilitated the session, following the script, and the second researcher observed and intervened when necessary. The discussions adhered strictly to the script, with the moderator redirecting the conversation if needed. Each session lasted 75 minutes, with the first 15 minutes dedicated to explaining the activity, emphasizing the significance of such studies, and outlining the employed methodology. Consent for audio recording and observational note-taking by the second researcher was reconfirmed during this period.

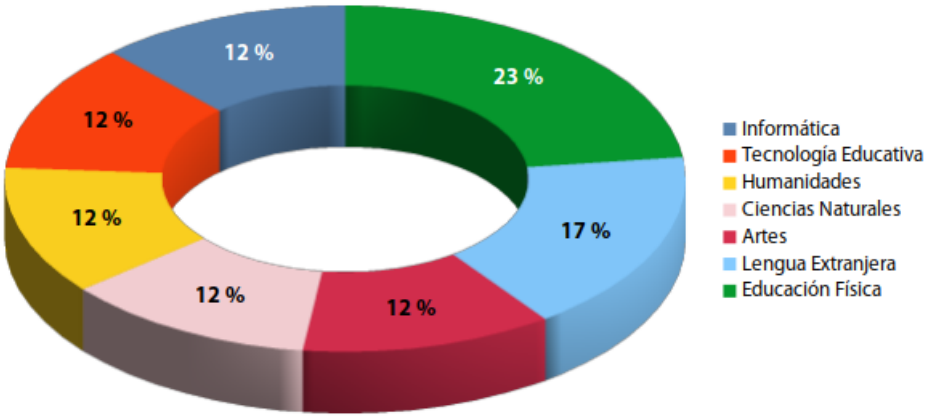


**Figure 1.** Distribution of Selected Specialties in the Sample.

### *2.2. Data analysis*

For data analysis, the following procedure was followed: transcription of recordings into an analysable-readable format; data coding; identification of thematic areas; and subsequent interpretation of the information. To ensure consistency and rigor in the results, two procedures were employed. Firstly, three experts from the fields of education, linguistics, and information technologies conducted the analysis, categorization, and interpretation. Secondly, the QDA Miner software was used to break down categorizations and refine or validate results. The most prominent topics were presented in various verbatim tables.

## 3. Results

The results were organized following the focus group script to address the specific research objectives: motivation for and towards use; academic utilities of smartphones and apps; university and library resources for smartphone teaching; evidence of usefulness after the pandemic experience; needs and proposals.

### *3.1. Motivation in the use of smartphones and perceived utility (OE1)*

*Use of Platforms, Programs, Devices*

The integration of mobile devices in higher education is linked to the perceived utility of their incorporation and the motivation derived from their use. The pandemic crisis highlighted that mobile technologies are here to stay, emphasizing both the quantity of available resources and the need to adapt to new social and academic demands (Pinto et al., 2021). Similarly, it revealed that the adaptation processes are not at the level of current needs and the speed of changes, although academic institutions have made multiple resources available (Table 3).

**Tabla 3**. Uso de plataformas, programas, dispositivos.

| | Platforms | Devices | Programmes |
|---|---|---|---|
| Teachers in training | Talent SLM | Laptops | Word |
| | Canvas SLM | Computers | PPT |
| | NEO LSM | Smartphone | Prezi |
| | Moodle | Tablet | MovieMaker |
| | Blackboard | | Adobe Reader |
| | Schoology | | Word Pad |
| | Edmodo | | Canvas |
| | Twiducate | | Slideshare |
| | | | Software for interactive whiteboard |
| Teachers | Canvas SLM | Portátiles | Word |
| | Moodle | Smartphone (search) | PPT |
| | Blackboard | | Adobe Reader |
| | Twiducate | | Slideshare |
| | | | Software for interactive whiteboard |

*Analysis of Competence and Attitudes Toward Technology Use*

There is a consistent use of applications, devices, and software by preservice teachers, reflecting a self-perceived improvement in digital and mobile competence for various reasons. The participants express

> a habit of searching and finding what they need at any given moment (ED 5).

It is perceived that practicing teachers are more constrained by the tools and resources provided and required by educational institutions, while preservice teachers demonstrate a broader search for instruments. The generation gap continues to be seen as a distinctive factor, as expressed:

> It's not the same for someone who has just started as a teacher as for someone who has been teaching for thirty years and doesn't know how to find information on a mobile phone (ED 17).

This distinction appears to have been accentuated after the pandemic crisis. The evidence of generational difference has also manifested in the relationships between teacher-tutors of preservice teachers and the future teachers themselves, who have been

> questioned by their supervisors when they wanted to use an app, and were told that it's not serious (ED 10).

Regarding the level of competence among preservice teachers, the participant sample highlighted disparity based on various factors. (a) Age: the generation gap

remains a significantly excluding element. (b) Motivation for use: participants show divergent attitudes,

> with some expressing surprise when colleagues lack certain apps or do not know how to use them (ED 16).

And (c) Area of specialization in the field of Education. According to responses, areas such as Arts and Humanities demonstrated a lower level of competence. Similar observations were made for foreign languages:

> I showed my teacher that there was an app for pronunciation and phonetic correction, and she was surprised (ED 14).

However, Physical Education, Educational Technology, and Computer Science revealed a higher level of competence.


**Figure 2** . Attitudes Before and After the Pandemic Crisis.

*Perceived Utility*

Regarding perceptions of teachers, participants expressed that the motivation on the part of the teaching staff for using smartphones in the classroom did not meet their expectations. However, there is a perceived change, driven by the forced adaptation to technological use during the last two years of the COVID-19 crisis:

> We have to acknowledge that at least now they ask us to download some questionnaire or do some activity with the smartphone. (Having a smartphone in class) was almost as serious as cheating on an exam (ED 8).

It is important to note that the teachers participating in this study have experienced several years of regular in-person teaching at the university pre-pandemic, during the pandemic crisis, and in the post-pandemic period. Therefore, it is emphasized that

> now they send us many documents and articles via smartphone and ask us to download them in class. Before that was unthinkable (ED 4).

In general, there is a perceived shift in the use of smartphones for academic purposes.

### *3.2. Academic use of smartphones (OE2)*

*Perceptions in Practicing Teachers and Preservice Teachers*

Participants were asked to describe both self-perceptions of the utilities and perceptions they had about the teaching staff, based on their training experience and practicum.

**Table 4**. Synthesis of Perceptions Regarding Smartphone Use.

| Perceptions on the teacher´s adaptation to mobile technologies | Perceptions on the teacher´s in training adaptation to the use of mobile technologies in the classrooms |
|---|---|
| Better atittudes | Generalization of use for academic purposes |
| Increase of technological skills | Combined and complementary use of devices (smartphone-laptop; smartphone-tablet; tablet-laptop) |
| Evidence of insufficient adaptability | Increased attention in the lessons |
| Generational gap (teachers-young teachers/teacher interns | Increase in the distinction of uses (academic in university; social, outside the classroom). |
| Relationship between greater and lesser use and areas of specialization | Gaps in access and information management, despite connectivity/ubiquity and immediacy |

In general, smartphones were considered to offer significant advantages. They were seen as a necessary and highly suitable tool in the current context, as they

> help to search for information quickly (ED 3).

Additionally, participants mentioned,

> if the Wi-Fi in the school is bad, I can use mobile data (ED 12).

On the other hand, they also mentioned,

> we can make video calls among students and create workgroups (ED 3).

Despite the increased use and competence in using smartphones, participants also described certain limitations in information management, despite the advantages of ubiquity and connectivity:

> training in sources and how to distinguish good ones from those that are not useful should be increased (ED 7).

Regarding Perceptions of Teachers the participants emphasized that

> there is much work to be done. The teacher doesn't understand that we have an age. We have done everything with smartphones since we were little. Teachers have lived in another era, and they don't understand that everything has changed. Some younger teachers use it, but they are few (ED 5).

The greatest divergence was found in one of the collected statements:

> the teacher thinks that using the smartphone in class will make us more distracted. And some think that good information cannot be found on the internet. In part, we struggle to find the correct information because no one has taught us (ED 12).

There is a widespread feeling that teachers are at the beginning of the path toward true adoption of smartphone teaching. Preservice teachers still have significant gaps to address:

> we have a long way to go. We only know how to handle what interests us or what we need. But if we are like this, imagine how the teachers are (ED 13).

> Thus, ´we have to learn to use the smartphone as a teaching tool´ (ED 1).

*Academic utilities in and out of the classroom*

The participants' responses (preservice teachers and teachers) about the uses of mobile devices in and out of the classroom are summarized in Table 5.

Once again, the educational specialization areas emerge as a relevant factor in smartphone use. It was perceived that preservice teachers attach greater importance to the use of applications, both inside and outside the classrooms.

Regarding perceptions of the teaching staff, despite the transformations observed after the pandemic crisis, it is emphasized that

> teachers make little use of mobile devices because they have little mastery. They have improved somewhat during the pandemic (ED 14).

It is emphasized that this is a mistake because it is possible to return to the starting point, i.e., a situation similar to the pre-pandemic era in the use of smartphones and technological competence in general, and even increase the pre-existing gap.

In a similar vein, Hamidi & Chavoshi (2018) indicate that the understanding of the two central factors of the TAM model is comprehended through self-efficacy. Similarly, Aharony & Gur (2019) applied the TAM model to the implementation of smartphones in classrooms. Sitar-Taut & Mican (2021) and Camilleri & Camilleri (2022) conduct various analyses, grounded in the TAM model, on the acceptance of smartphones and their utility during the pandemic, as well as the impact for subsequent generalization.

Specialised educational areas relevant factors in smartphone use. Student teachers were perceived to attach greater importance to using mobile applications inside and outside the classrooms.

**Table 5**. Academic Utilities of Smartphones.

| | | |
|---|---|---|
| Mobile uses in the classroom | Teachers in training | WhatsApp groups for teachers in training |
| | | Apps for interactive whiteboard |
| | | Educative apps |
| | | Créate educative and multimedia contents |
| | | Search for information |
| | | Difusión of contens |
| | | GammificatioU+006e |
| | Teachers | WhatsApp groups |
| | | Apps for interactive whiteboard |
| | | Search for information |
| | | Take pics and film clips for academic purposes |
| | | Gammification |
| Mobile uses outside the classroom | Teachers in training | Interpersonal communication (instant messaging and WhatsApp groups) |
| | | Búsqueda de Informacion |
| | | Bureaucratic-administrative applications |
| | | Social networks |
| | | Information search |
| | | Creation and dissemination of content |
| | Teachers | Interpersonal communication (instant messaging and WhatsApp groups) |
| | | Bureaucratic-administrative applications Information search |
| | | Social networks |

Regarding perceptions about the teaching staff, and despite the transformations perceived after the pandemic crisis, it is emphasised that

> teachers make little use of mobile devices because they have little expertise. They have improved somewhat during the pandemic (ED 14).

It is emphasised that this is a mistake because it is possible to return to the starting point, that is, to a situation like the pre-pandemic period regarding the use of smartphones and technological competence in general, and even increase the pre-existing gap.

### *3.3. University-library resources and mobile learning (OE3)*

Adaptation of universities and their libraries to changes resulting from the inclusion of smartphone technologies. Adapting to a digitised university governed by current technological needs has been observed (Figures 3 and 4).

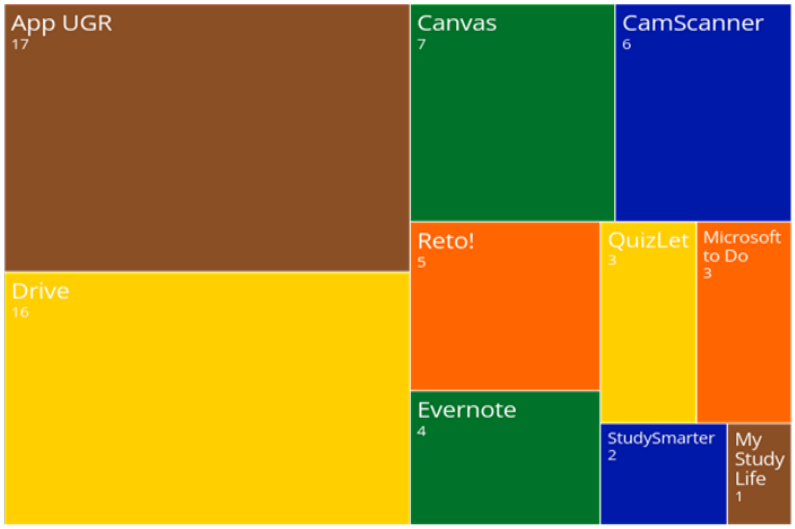


**Figura 3.** Adaptation of universities and their libraries to changes. Most used apps.

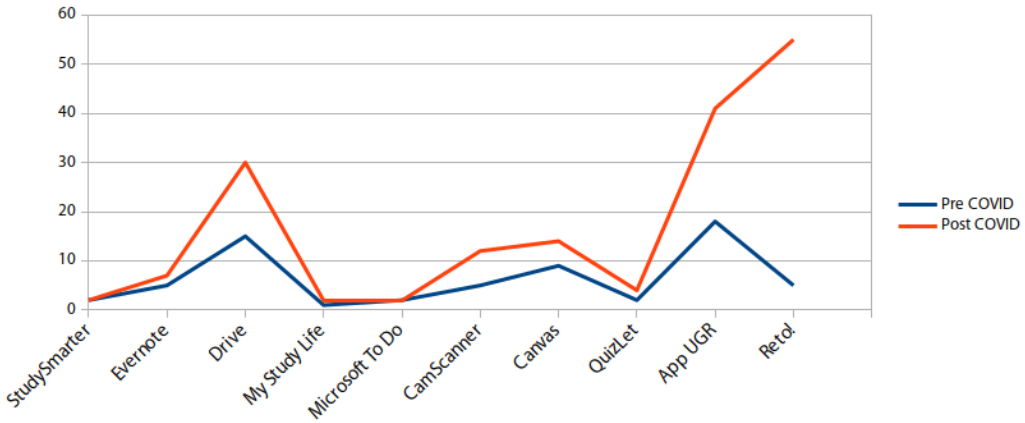


**Figure 4.** Evolution in the use of apps after the Pandemic.

The participating student teachers reported a gap between the speed of changes at the social level due to the pandemic and the degree of implementation or development of technologies at the university. This was even more pronounced in the case of smartphone technologies. 'As one participant stated,

> Yes, there has been a lot of progress. There was no plan B. The step had to be taken' (ED 2).

> The pandemic forced teachers to use mobile technology in the classroom (ED 5).

However, participants insisted that it is necessary to persevere with these changes because

> this might stay here until another crisis comes. We had to learn from what happened (ED 12).

Mobile applications, training, guidance and coordination between teachers and librarians becomes a prioririty.

The aspect in which the participants show the greatest weakness is the perception of libraries, their role, and the function of librarians:

> I don't really know what a library is currently for. You can find everything on the internet (ED 2).

There is a lack of knowledge about the possibilities offered by both libraries and librarians:

> I only go to the library to study because it's quiet and you can work well (ED 7).

Deficiencies are perceived. As one participant emphasised,

> Libraries offer few services to students (ED 12)

another stated,

> libraries do not help students search for source (ED 8).

Participants discussed the importance of libraries in the development of activities. Student teachers with a background in humanities showed a more positive attitude towards the library and its staff:

> When we go to look for some books, the librarians always guide us (ED 4).

In general, the participants only used library applications for their final degree products. Techniques and strategies to choose quality sources are needed. Some participants said that they knew about some of the mobile applications offered by their university, including ones focusing on self-learning, time management and process optimisation. Others mentioned that they had to find appropriate mobile applications on their own:

> I discovered most of them myself, researching on Google or asking my colleagues. They are not the ones the university offers. I had to find my way (ED 10).

Other participants stated that they have access to a variety of online learning resources offered by the university and its libraries (Table 5). However, regarding their use, some participants indicated that

> it depends on the teacher and the subject, a greater mastery of the apps and resources made available by the university is seen (ED 2).

**Table 6**. Training, guidance and coordination between teachers and libraries.

| University (libraries) | Libraries |
|---|---|
| StudySmarter | Citation Generator |
| Evernote | Ex Libris Library |
| Drive | Mobile (Ugr) |
| My Study Life | Mendeley (desktop app/Progressive) |
| Microsoft To Do | |
| CamScanner | |
| Canvas Estudiantes app | |
| Quizlet | |
| App general de la UGR | |
| Reto! (EF) | |

### *3.4. Post-COVID-19 health crisis and smartphone utility (OE4)*

The process of adapting to the changes introduced by COVID-19 and the positive aspects regarding the use of smartphone technologies were described. Regarding adapting to the COVID-19 context, it is considered that there was an acceptable adaptation of the educational community. The use of smartphones contributed to optimising learning when in-person teaching was impossible.

In comparing smartphone use before and after the pandemic, the participants noted some transformational aspects. These changes are summarised in Table 7.

Although laptops are still considered the most complete educational tool post-pandemic, smartphones play an increasingly important role in searching for and. On the one hand, laptops continue to dominate the use. They are considered the most complete working tool in and outside the classroom. However, the smartphone plays a role in searching for and disseminating information. As one participant explained,

> Since the information is in the cloud, it is easier to directly enter our email or the drive and download the document or share it (ED 10).

Online work became a priority during the COVID-19 pandemic:

> We had to get used to some having to stay at home due to quarantines. We worked online with drive, video calls or Zoom (ED 7).

The role of smartphones in distance education is evident (with some group members present and others at home) is evident:

> None of us can say that we cannot meet because we can connect and work wherever we are (ED 8).

In this sense, the pandemic was a turning point in optimising technological competencies, particularly smartphones. As one participant explained

> with the pandemic and so much cmmunication through the smartphone, what one could not find, another did . A lot of information passed through the group (ED 5).

The differences are mainly based on greater smartphone use in classrooms and a better attitude among student teachers. Generational gaps, motivation and preparation continue to be fundamental factors.

**Tabla 7**. Aceptación e inclusión del Smartphone. Evolución tras la crisis pandémica.

| | **Before the Pandemic Crisis** | | **After the Pandemic Crisi** | |
|---|---|---|---|---|
| | *Software/apps* | *Devices* | *Software/apps* | *Devices* |
| In the classroom | Word<br>PPT<br>Adobe Reader<br>Word Pad | Laptops<br>Computers<br>SmartPhone | Word<br>PPT<br>Adobe Reader<br>Word Pad<br>PDF<br>Google Drive<br>Inercom<br>Scoop | Laptops<br>SmartPhone<br>Tablet<br>White blackboard |
| For academic purposes | Word<br>PPT<br>Adobe Reader<br>Word Pad<br>Slideshare<br>Programas de Pizarra Digital | Computers<br>Tablet / SmartPhone (search) | Drrive<br>Living Drive<br>Word<br>PPT<br>Adobe Reader<br>Word Pad<br>Zoom (platform)<br>Google Drive (platform)<br>Scratch<br>Scoop | Computers<br>SmartPhone (search)<br>White blackboard<br>Tablet |
| For presentations | PPT<br>Prezzi<br>MOVAVI<br>Movie Maker<br>Popplet<br>Camtasia | Laptops<br>SmartPhone<br>Tablet | PPT<br>Prezzi<br>MOVAVI<br>Movie Maker<br>Vismi<br>Genialis<br>PowToon<br>Emaze<br>Canva | Laptops<br>SmartPhone (docs in the cloud) |
| Information search | Mozilla Firefox<br>Chrome<br>Internet Explorer<br>Gestores de información: Mendeley, Zotero | Laptops<br>SmartPhone<br>Tablet | Mozilla Firefox<br>Chrome<br>Google Scholar<br>Managers<br>App de bibliotecas<br>App de Universidad<br>Mendeley WPA | Laptops<br>SmartPhone |

### *3.5. Needs and proposals (OE5)*

The focus group also requested self-perceived preferences and needs and those perceived among the teaching staff. In this case, it was evident that there is an attachment by a sector to traditional teaching methods, despite the technological influx imposed by the pandemic.

**Table 8.** Needs and proposals.

| | Needs | Proposals |
|---|---|---|
| Needs perceived by students on themselves | PDF brief and simple.<br>Gráphics and mind maps.<br>Informative pills in clips<br>Discord.<br>Interactive apps .<br>Summarized contents. | Resources and software of virutal and augmented reality.<br>Combine master lessons and smartphone resources.<br>Gamificación apps.<br>Educative videogames.<br>Videos-tutorials and lessons prepared both by teachers and students (visualization in apps). |
| Needs perveived in teachers | Training.<br>More investment in technologies and resources.<br>Greater involvement of the teachers in training.<br>Increase hours of practices.<br>Apps to ease the assesment. | Magister lessons.<br>Traditional resources.<br>Theorical-practical lessons.<br>Face to face lessons. |

Student teachers expressed the importance of increasing knowledge of mobile technologies among teachers, particularly older ones. ´Therefore, the current number of practice hours are perceived as insufficient. Similarly, there is still inertia:

> The pandemic hasn't helped much because most teachers still want to give their classes as before: 'I talk and you listen' (ED 7).

Student teachers proposed increasing the use of digital educational resources to motivate student learning. They considered that schools should have interactive, augmented reality, and application resources that adapt to the new profile of future students. Only then can society's needs be met.

Regarding the needs perceived among teaching staff, they emphasised improved technological training:

> I don't know if it's out of necessity or because they have realised that they have to use technology one way or another, but some of my professors are still training. They claim to need more preparation (ED 1).

Participants proposed a methodology that

> alternated lectures with new technologies and changes of scenarios. In this way, everyone would be given the opportunity to work well and achieve better results (ED 6).

Thus, among the most relevant proposals, the use of mobile applications, flipped lessons and augmented reality stood out. However,

> training is needed, especially the appropriate and enjoyable use of the smartphone for learning purposes (ED 5).

Although there is still a long way to go in incorporating smartphones in the classroom, advancements can be seen in certain areas. One area is awareness:

> It is essential that both teachers and students focus on mobile technology (ED 6).

Training remains the weakest aspect, as indicated by one participant,

> Teachers remain unprepared for using smartphone technology in the classroom (ED 4).

## 4. Conclusions

The data from this study show that the pandemic resulted in an increased use of smartphones in education. The analysed sample highlights that smartphones have become an effective ally in education. Student teachers can offer unique perspectives. They are at the beginning of their teaching practice, with a broad capacity for observation of the teaching staff in practice, and their university training stage is recent. Regarding attitude, this study found that the pandemic changed the perspective of the teaching staff regarding smartphones and their applications in the classroom. Student teachers, in contrast, maintained positions like those before the pandemic. The crisis confirmed the importance of smartphone use for learning optimisation. In both cases, the pandemic served to reinforce the need for training.

The results obtained in our analysis are similar to those of Aharony and Gur (2019), Sitar and Mican (2021) and Camilleri and Camilleri (2022). Thus, three factors influence the effective use of smartphones: preparation, motivation and generational gap. According to the studies, the generational gap tends to be overcome with motivation. These recent studies also converge with our analysis of the privileged position of student teachers and true barometers to measure trends and needs. The novelty of our research is its comparison between student teachers and the teaching staff. Regarding incorporating smartphones into the classroom, there was a change in attitude after the pandemic, but it is still perceived as insufficient. Significant proposals were made for implementing smartphones and mobile applications. Annamalai (2018) and Kearney and Maher (2019) highlighted, like our study does, gaps in training for teachers and librarians. Similar findings were found by Ata and Cevik (2019) and Sánchez-Prieto et al. (2019), who used a mixed-method methodology compared to our exclusively qualitative research. Gunawan et al. (2020) and Alubthane (2021) also highlighted that following the pandemic, classrooms started incorporating smartphones in class, indicating a partial change of attitude after returning to face-to-face teaching. These studies also emphasised generational gaps in preparation and motivation for instruction and used TAM as a reference for their analysis. In our study, teachers did not fully respond to the high expectations regarding mobile teaching.

Similarly, Bäcklund et al. (2021) and Hafour (2022) showed that smartphones had become important for teaching during the pandemic. However, some teachers only considered smartphones as a transitional tool for times of crisis, although their utility was evident and are here to stay. Hafour (2022) highlights greater motivation among teachers than among student teachers. This represents a significant difference from our study. Generational conflict and attitudinal, motivational and inclusion differences in mobile devices are highlighted in numerous studies (Alubthane, 2021; Bäcklund et al.; 202; Asio et al., 2021; Pinto et al., 2021).

Although qualitative research has shown the validity of smartphones in education and provided data that are difficult to obtain with other methodologies, there is still a shortage of studies based on qualitative methods. The focus group, despite its difficulty in execution and analysis, is not yet a generalised technique. It is difficult to find studies combining the variables considered in this study: student teachers, mobile teaching and qualitative analysis (i.e., focus groups). Similarly, no studies have compared the use of smartphones in classrooms by student teachers before and after the pandemic crisis. In line with the objectives set out in this research, we present the following conclusions:

- Student teachers perceive a correlation between motivation, the use of smartphones in classrooms and the level of preparation. The participant group showed the advantages of these devices and their applications for optimising teaching.

- The basic structures of TAM continue to be a reference for measuring technological acceptance, in this case, mobile technology. There is a direct relationship between motivation and effectiveness in the search for training (OE1).

- Smartphones are used in classrooms for various purposes. Their application has considerably increased. The most relevant uses continue to be the search for information, the creation of groups, the dissemination of content and the completion of assignments. Motivation and generational differences were important for incorporating smartphones (OE2).

- Significant changes have occurred in recent years in terms of universities and libraries acting as preparation spaces for teachers. These changes have translated into improvements in infrastructure, resources and training. However, they are still insufficient. The pandemic crisis highlighted limitations (OE3).

- During and after the pandemic, there was a need to adapt to the new scenario of non-face-to-face teaching. Student teachers are more competent than teachers in using mobile technologies in class (OE4).

- Regarding needs and proposals, participants highlighted the development of learning applications, gamification and augmented reality as important educational objectives. Emphasis was also placed on including learning capsules, simple and motivating resources and specific training for practising and student teachers. Regarding

limitations, this research has a small sample (N=16) and focuses on a specific context (trainee teachers). Consequently, even though the focus group methodology is based on limited groups, and the object of study is student teachers, this is a limited sample. Therefore, an expansion of groups and degrees is proposed for future work to carry out a contrastive analysis between different university sectors. Likewise, it opens the perspective of comparing intern teachers with those who are already in the teaching profession.

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