Perceptions on mobile information among undergraduates before and after Covid-19: some comparisons

Percepciones sobre la alfabetización informacional móvil entre estudiantes universitarios antes y después de Covid-19: algunas comparaciones

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Resumen

Análisis comparativo de las percepciones sobre la alfabetización informacional (Alfin) y el uso/inclusión de tecnologías móviles (MT) de los estudiantes de pregrado de Ciencias Sociales en las universidades de Granada (España) y ISPA (Lisboa) antes y después de la pandemia de Covid-19. Se siguió exploratoria socioconstructivista basada en grupos focales (mayo de 2022) con una muestra de dieciocho estudiantes de Psicología y Educación, en el último año de sus estudios. Se implementaron dos grupos focales, uno en cada país. El estudiantado de pregrado experimenta brechas significativas, especialmente en el conocimiento de la Alfin y las habilidades en MT. También perciben limitaciones actitudinales y tecnológicas en sus profesores. Además, existen diferencias en las actitudes hacia la inclusión de MT en los procesos de enseñanza y aprendizaje, según el contexto. En este sentido, los estudiantes españoles mostraron mejores habilidades y los portugueses un mayor nivel de autopercepción. Surgen algunas carencias derivadas de la pandemia de Covid-19, ya que hay un creciente cuerpo de evidencia sobre la necesidad de proximidad estudiante-profesor y las limitaciones técnicas de algunos profesores. Después de esta situación crítica, es necesaria una mentalidad abierta a la experiencia por parte de todos los interesados. Debido a la metodología cualitativa implementada, la investigación se limita a un sector específico para ser analizado (estudiantes de Ciencias Sociales pertenecientes al último año de pregrado). Las instituciones académicas, educativas y el profesorado (responsable de la formación de las futuras generaciones) deben esforzarse por comprender el alcance de la enseñanza móvil y las posibilidades de los dispositivos móviles para aumentar la motivación de los estudiantes y adquirir habilidades básicas también. Reflexionar sobre esta situación se convierte en una prioridad para optimizar los procesos de enseñanza-aprendizaje.

Palabras clave: Aprendizaje móvil. Alfabetización informacional móvil. TIC. Grupos de enfoque. Portugal. España. Covid-19. Estudios de caso.

Abstract

A comparative analysis of Social Sciences undergraduates' perceptions of information literacy (IL) and the use/inclusion of mobile technologies (MT) at the universities of Granada (Spain) and ISPA (Lisboa) before and after the Covid-19 pandemics. An exploratory socio-constructive focus group methodology was carried out based on a sample of eighteen Psychology and Education undergraduates, in the final year of their studies (May 2022). We implemented two focus groups, one in each country. Undergraduates experienced significant gaps, especially in IL knowledge and MT skills. They also perceived attitudinal and technological limitations in their teachers. Morever, there are some differences in attitudes towards MT inclusion in the processes of teaching and learning, according to the context. In this regard, Spanish undergraduates showed better skills and Portuguese ones a higher level of self-perception. Some shortages derived from the Covid-19 pandemic emerge, since there is a growing body of evidence on both the need for student-teacher closeness and the technical limitations of some teacher. After this critical situation, an open-to-experience mentality on the part of all the stakeholders is necessary. Due to the qualitative methodology, we have implemented, the research is limited to a specific sector to be analyzed (Social Sciences undergraduates belonging to the last pregraduate year). Academic, educational institutions and teachers (responsible for the training of future generations) must strive to understand the scope of mobile teaching and the possibilities of mobile devices to increase student's motivations and to acquire basic skills too. To reflect on this situation turns into a priority to optimize the teaching-learning processes.

Keywords: Mobile learning. Mobile information literacy. ICT. Focus groups. Portugal. Spain. Covid-19. Case studies.

1. Introduction

In recent years, the development of mobile technologies represents a fundamental space in higher education environments. This involves that not only the access to information and communication but also the teaching-learning processes cannot be conceived outside of mobile devices. These processes have been accelerated after the Covid-19 crisis, due to the forced adaptation to virtual teaching and the need to adopt new strategies (Chen & Tsai, 2021). However, despite this unescapable transition, there are discrepancies between the rapid social pace of adaptation to new realities and the processes of adaptation by universities.

This paper aims to analyze the perceptions of social sciences undergraduates' attitudes and processes of adaptation, concerning the inclusion of mobile devices in teaching-learning processes, in the context of higher education. For this purpose, a qualitative approach based on a focus group methodology was implemented.

One cannot ignore that today´s access-to and management-of the information is unavoidably linked to the main features of the ICT (Information and Communication Technologies): connectivity, immediacy, and ubiquity. These elements have a significant impact on the way that teachers implement their methodologies and relate to information (Crompton & Burke, 2018). Mobile technologies have been integrated into higher education-learning processes with a very significant level of acceptance. This is not only because they make learning environments more attractive and motivating, but because of their usefulness. Both aspects are due to a natural process of technological development and the urgency of implementing new means and resources (Krouska et al., 2022; Yun et al., 2022). There is no doubt that an exponential increase in the use of mobile devices for academic purposes does emerge. This seems to have a positive impact on the teaching and learning processes. In this vein, both undergraduates and teachers could greatly benefit from the possibilities these devices and their applications may offer. Moreover, the pandemic crisis highlighted the relevance of ICT in teaching and learning processes, the importance of including resources and means for normal academic development, and the inclusion of technologies as a significant part of classrooms. Likewise, it brought to light the limitations faced by teachers, students, and families in the development and inclusion of technologies, the need for training, and the search for strategies for rapid adaptation to possible contextual needs. Various studies have focused on this issue (Naresh, 2020); Ali & Maksum, 2020; Salas-Rueda et al., 2022, Aidoo et al., 2022). Their perspective on the situation during the pandemic crisis, the slow adaptation in the inclusion of technologies in teaching and learning processes, and the limitations faced by both teachers and students, have served as a reference and starting point for the commencement of this study. The choice of two contexts for the following study is due to the intention to include research that considers a transnational perspective, while also examining the situation before and after the pandemic. The inclusion of two different contextual realities aims to consider the differences that may arise between two countries that share common aspects but have significant particularities. Understanding how the pandemic has impacted the development of both areas can illuminate future strategies, programs, and resources that are not confined to a single context, but are applicable to numerous settings

We must consider that this approach qualitative methodology based on focus groups (from the perspective of undergraduates in their last year) is almost non-existent, particularly when undergraduates belonging to two different countries are compared. However, this approach may allow us, both to carry out an analysis of the current moment and to draw a panorama for the future. We cannot forget that these undergraduates are about to finish their academic studies and start their professional activity. Moreover, they live together with technologies and perceive the generational gap and the deep divergences between their conception of attractive methodologies and their professors' attitudes, methodologies, and comprehension of reality. Thus, the following specific objectives were proposed:

- O1. To analyze undergraduates' perceptions of the inclusion of mobile technologies in teaching and learning processes.
- O2. To determine the value that students place on information and mobile literacy in the post-pandemic context.
- O3. To establish a comparison between two samples of undergraduates belonging to two different contexts and countries (Portugal and Spain) to determine similarities, divergences, and needs.
- O4. To analyze the perceptions of this sample of undergraduates on the integration/generalization of mobile technologies in the academic setting, before and after the Covid-19 health crisis
- O5. To describe the needs that undergraduates perceive concerning the digital-mobile device academic adoption.

2. Literature review

We are facing a period of profound changes in mobile technologies. Mobile devices have many features and apps that bring ease and usefulness of use, thus gaining ground in terms of preference for use even in academic settings. Its usefulness for access and management of information cannot be called into question. Whitin the last decade the context, perception, and acceptance of devices for access, communication, and dissemination of information have changed greatly. As a consequence, there has been an increase in the number of studies related to mobile technologies, most of them of a quantitative nature. On the contrary, qualitative methodologies –especially using instruments such as the focus group– have been rather scarce. In fact, focus groups and other tools such as interviews have been mainly used as a complement to quantitative studies. The qualitative methodology of focus groups offers the opportunity to gather very precise information, thanks to the direct interaction of feedback (Plank et al., 2014). The voices of the subjects become more present and visible through the data collected from the discussion groups. Although traditionally other qualitative methods have yielded data of interest, Guest et al (2017), Mohajan (2018), and Coe et al. (2021) highlight that focus groups have a contrastive and complete character of the information sought. The immediate contrast of information has advantages over other traditional methods. One cannot ignore that depending on the type of study and the objectives pursued, different methodologies can be chosen. Some information is more likely to be collected and contrasted through discussion groups (Acocella & Cataldi, 2020).

One of the first works implemented by the focus group as a methodology for analysis and case studies in reference to the inclusion of devices in academic contexts is that of Latham and Gross (2013). Its objective was to measure the perception of the level of informational competence in first-year undergraduates. Given the limitations that students perceive about their level and needs, the authors propose broader training, through specific courses, such as complementary activities or materials. Although this study does not yet contemplate the mobile as the main tool, it does describe its growth in acceptance and use.

The digital divide and the perceptions of students focus the attention of different studies. Thus, great change is produced by ubiquity and connectivity (anywhere and anytime) (Baran, 2014; Huang et al., 2014; Martin et al, 2013). In this sense, the case study by Huang et al. (2014) stands out for highlighting the relevance of the ubiquity and immediacy of access to information in today's academic contexts. The controversy that the use of mobile devices in classrooms can involve is due to the limitations of the devices. His quantitative-qualitative study underlines the effectiveness, involvement, and optimization of results in students who use laptops. Also, in the cooperative character and gamification, in this case, through jigsaws.

Farley et al. (2015) conducted research with undergraduate and graduate students from Australia on the use of different mobile devices for academic purposes. Through the practice of *bring your own device* (BYOD) the authors verified, both in the quantitative study and in the focus groups carried out, the preference of the students to use mobile devices for all academic purposes. They propose a set of improvement measures for access and use. In a similar vein are Moore et al. (2015) and Sung et al. (2016), who contrast the advantages of using technologies and mobile applications in contrast with the traditional approach to higher education. For its part, Ng (2016) combines in its analysis both quantitative methodology (closed questionnaire) and qualitative methodology (focus group) to study the incorporation of innovative technologies and methodologies in the acquisition of communicative strategies and skills.

Of great interest is the work of Mullins (2017), who investigates the role of the university as an agent for the gaining of skills in information using mobile technologies, and the involvement of libraries, students, and teachers. Although the use of specific applications developed for this purpose leads to an increase in information skills, significant limitations are found in access to information, use of library resources, and critical thinking. Instruction and the development of strategies and applications become necessary.

Milenkova and Manov (2019) highlight, through their qualitative analysis based on the focus group, the need for a transition to digital and mobile higher education, even in an incipient period. It becomes a priority to adapt teaching-learning models to increase student motivation and adapt to new scenarios. The generation gap continues to be one of the most prominent difficulties encountered. In a similar vein, Kearney and Maher (2019) analyzed the attitude of preservice teachers regarding the use of mobile devices compared to professional support networks for teachers. The perspective of the data obtained, through the focus group, is privileged since it includes teachers who are in their last period of academic training and, at the same time, starting the teaching work. The research highlights that there is still a long way to go and multiple challenges to solve.

Among them, it is necessary to underscore the digital divide and the lack of means. The works of Ng (2016), Wong (2021) and Kearney et al. (2020) offer a similar methodology, exploring in the pre-pandemic period the role of technologies in the access and processing of information, as well as the critical attitude towards the different sources of information in an era of true over information. Similarly, Udenze and Oshionebo (2020) used semi-structured open interviews and focus groups to analyze the role of collaborative Whatsapp among undergraduates and in the relationship between teachers and students. They underlined the usefulness of its implementation due to the perception of ease of use and its usefulness, in continuity with the fundamental principles of the TAM model.

Using an analogous methodology, Marques and Pombo (2021) analyzed the impact of mobile device use in academic classrooms, although in relation to gamificacion and augmented reality. The adoption of games in higher education contexts becomes a motivating and innovative tool. It is a step further in the management of communication and access to information. A greater commitment to training and adequacy is required. However, this case study underlines that, after an adequate period of training, teachers feel predisposed and prepared for the implementation of this tool. It also guarantees not only motivation but also optimization in the achievement of skills. Pinto et al. (2021) used the focus group as an instrument to analyze the perceptions of information and documentation of students before and during the Covid-19 crisis. They concluded that there had been changes in the methodology of higher teaching-learning processes, but multiple improvements were still needed. The digital gap, regarding mobile technologies, is still much accentuated. Zou et al. (2021) reached similar conclusions, although they were more focused on mobile teaching through gaming applications. In the same vein, Pinto et al. (2021) concluded that the impact of mobile has increased during the pandemic crisis. However, teachers are still reluctant to the implementation of mobile technologies for academic purposes.

One of the most recent research projects was carried out by Hossain (2022), who combined quantitative methods and the qualitative technique of focus group, emphasizing the relevance of attitudes, needs, and basic skills. Although motivation and reinforcement are key factors, training that reduces the generation gap and prepares students in general and specific skills becomes a more far-reaching factor.

Different studies followed similar methodologies (Liu et al., 2022; Matsiola et al., 2022; Mingyue et al., 2022). However, we found no studies that carried out an analysis of undergraduates in the last year, comparing them from two countries by means of focus group.

3. Methods

This section outlines the instruments, participants, and methods of analysis employed.

3.1. Participants

The sample was collected among undergraduates of the last semester of Psychology and Education at the Ispa-Instituto Universitário (Lisbon) and the University of Granada. Two sessions were held at both sites during May 2022.

The participants had to meet some basic requirements: be studying the last semester of the degree, have completed at least one internship period or be in an internship period; committed to actively participating in research; acceptance of pre-established rules (sincerity, respect for the turn of speech and opinion...); and consent to be recorded and use their interventions (anonymously for research purposes).

A non-probabilistic and convenience sample was selected, in which 9 + 9 students voluntarily participated (Table 1).

Participants ID	*Gender*	*Institution*	*Age range*
ED1	F	University of Granada	20-25
ED2	M	University of Granada	20-25
ED3	F	University of Granada	20-25
ED4	M	University of Granada	20-25
ED5	F	University of Granada	20-25
ED6	F	University of Granada	25-30
ED7	M	University of Granada	25-30
ED8	F	University of Granada	20-25
ED9	F	University of Granada	20-25
PS1	F	Ispa-Instituto Universitário	30-35
PS2	F	Ispa-Instituto Universitário	40-45
PS3	F	Ispa-Instituto Universitário	20-25
PS4	M	Ispa-Instituto Universitário	20-25
PS5	F	Ispa-Instituto Universitário	20-25
PS6	M	Ispa-Instituto Universitário	20-25
PS7	M	Ispa-Instituto Universitário	20-25
PS8	F	Ispa-Instituto Universitário	20-25
PS9	F	Ispa-Instituto Universitário	20-25

Table I. Data and participant ID

The sessions took place with a temporary margin of one week since there was no risk of interfering

with the results or sample bias. Three researchers participated in the activity. The first, carrying the script and serving as moderator, the others observed and intervened at specific times. The script was followed strictly. In case of diverting the conversation, the researcher-moderator redirected the dialogue. Each of the two sessions lasted ninety minutes. The first fifteen minutes were dedicated to explaining the activity, the relevance of this type of study, and the methodology that was going to be used. They were asked for consent again to be recorded (audio) and for the observer researcher to take some notes. All participants were informed about the study and signed an informed consent form certifying their willingness to participate.

3.2. Focus group

Focus group methodology was used to meet the posed objectives. It is a technique that aims to collect data resulting from the interaction of a group on a topic presented by the researcher (Morgan, 1993). In practice, focus groups seek to collect data from the interactions generated in the group discussion, recognizing the active role of the researcher in stimulating this discussion, understanding that the participants who make up the groups have some common characteristics relevant to the topic under discussion (Morgan et al., 1998). For Dannes et al. (2018), "focus groups are confidential group discussions using for open-ended questions that promote interaction in order to explore participants' perspectives and experiences in a structured but relaxed atmosphere" (p. xiii). Focus groups can be combined with other research methods and occur at different stages of research, namely at the initial stage (e.g., to generate questions for a questionnaire), at an intermediate stage (helping to interpret the results obtained in a questionnaire), or at a final stage (promoting the discussion of results obtained with participants, a discussion which may lead to new insights (Silva et al., 2014).

In the present study, the main advantage of this qualitative methodology lies in the access to the voice of those involved in getting information that is spontaneous, immediate, direct, and generated in a creative and stimulating way for participants since the method itself stimulates their reflection and their involvement in the subject under study (Danner et al., 2018).

3.3. Procedures

In order to develop the design of the focus, a specific review of the literature was carried out, focusing on the intersection of the following subjects: mobile technologies, higher education, teaching methodologies, and qualitative research, Covid/post-Covid. Considering the last vector, those investigations that used the focus groups were selected. We start from the presentation of the script previously implemented at the University of Granada among undergraduates of the Education and Information degrees.

The first draft of the focus group contained 10 items. This scheme was reviewed by a panel of experts composed of four members of which two belong to the area of education, one to the areas of psychology and information sciences, and an expert from the areas of health and information sciences.

After a first review and after checking the viability and applicability of the instrument, a detailed review was carried out to adapt it to two elements: the context of undergraduates of the Ispa-Instituto Universitário of Lisbon; and the inter-academic contrastive study (Lisbon-Granada). In this first draft of the new version, the items that made up the semi-structured group interview scheme were reduced to nine. In the same way, the order of the last two items was changed, since this produced a final reflection by the participants in which the global impressions would be collected.

In order to confirm the viability of the instrument, we carried out a pilot test with one volunteer student who is finishing her undergraduate studies at Ispa-Instituto Universitário, within the area of psychology. After an interview, in which the object of study was explained and feedback was requested on the questions asked, in content and form, the following aspects should be highlighted:

1. Items 1 and 2 are difficult to separate because the content of one leads directly to the other.
2. Item 4 directly explains the problematic nature of the comparison in the use of technologies before and after the pandemic crisis. This is due to the formulation, based on the term difficulties, which entails confusion.
3. Item 9 asks students to classify the level of competence in the use of mobile technologies. To do this, a qualitative scale of 1-4 is used. The piloting student proposes to change to scale 5 since they are more accustomed to qualifying in that range of scores.

Given the observations, the researchers participating in this test phase proposed:

1. Leave items 1 and 2 separate, despite their thematic uniqueness. Each one has enough entity to offer data of interest, as seen in this first test interview.

2. Reformulate item 4. Difficulties are eliminated to highlight the possible changes that have occurred between technological use before and after the pandemic.
3. The level of competence of the teaching staff, perceived by the students, expands its scale, to go from 4 to 5 (1. Very little; 2. Little; 3. Medium; 4. Suitable; 5. Very suitable).
4. Regarding items 6 and 7, we suggest their unification. They relate to the same question and measure very similar criteria.

The final version of the questionnaire was reviewed by the rest of the experts, reaching a consensus on the fundamental aspects: the ability to obtain quality information from the interviewees, clarity, and adjustment to the time foreseen for the discussion groups.

From the results of previous research, an open focus group interview scheme was obtained:

1. Did you use your mobile device in classes for academic purposes? How did you use it (taking notes, searching for information, etc.)?
2. What means did you use (programmes, resources, platforms)? Did you use a mobile device, tablet, laptop, etc. (try to indicate if you use one or all of them, and which one(s) you use most)?
3. As a student, which level of technological competence do you have?
4. What level of technological competence do you think you have as a student?
5. What changes did you find in the use of mobile technologies before and after Covid-19?
6. Have teachers used mobile applications in their lessons? Give an example of an app that was used.
7. Do you think that teachers are prepared and adapted to teach using mobile devices? What level of technological competence do you find in the teaching staff?
8. Finally, please rate the level of competence of teaching staff in the use of mobile technologies in the teaching and learning process.
9. Comment on some proposals and suggestions you would make to your institution to improve teaching in the current circumstances (things you feel are missing or important).

3.4. Content and data analysis

The focus group lasted about ninety minutes and was conducted by the two researchers with the help of a another one with experience in conducting focus groups. The focus group was recorded with an audio recorder and transcribed after that in its entirety. The content was explored by using a logical-semantic method (Krueger & Casey, 2000; Morgan, 1993; Silva et al., 2014), a categorization approach combining thematic, structural, and frequency analyses. More precisely, it consisted of, first, systematic data processing, in which we took an inventory of all the keywords or concepts mentioned at least three times throughout the focus group to identify significant units. These units were then clustered into various subthemes based on their thematic concomitance (thematic analysis) before being organized and categorized according to their meaning analogies and following a hierarchical classification that goes from the particular to the general (structural analysis). Finally, due to this process, the main themes were identified according to their frequency of occurrence (frequency analysis).

Data analysis followed the next procedure:

1. Transcription of the recordings made during the focus groups. Process of adaptation to a format, susceptible of being analyzed.
2. Coding and categorization of data.
3. Identification and refining of the obtained categories.
4. Interpretation of information.

In order to warrant the rigor of the information and the results obtained, four experts in the field, belonging to different areas, carried out the coding and categorization. The experts belong to the areas of Information, Psychology, Education, Information applied to Health, and Anthropology. On the other hand, the QDA Miner software was used to contrast the information and ratify the results. The fundamental topics were displayed in different verbatim tables.

4. Results

Following research´s general objectives and the script developed for the focus group, results were distributed according to the research scheme. This ensures consistency and ease in structuring results.

4.1. The use of mobile device in classes for academic purposes (taking notes, searching for information, etc.)

The incorporation of devices in classrooms is considered an unavoidable reality. It is also stated that after the pandemic crisis its presence in the academic field has been evident. There is no possible alternative proposal in the face of a

fact that is not only a reality but is also inevitable due to the evolution of events.

	Portugal		*Spain*	
	Programmes	Devices	Programmes	Devices
Classes	Word PPT Adobe Reader Word Pad Zoom GoogleDrive	Laptop Tablet	Word PPT Adobe Reader GoogleDrive Intercom Scoop Drive Living Drive Word Pad	Laptop Tablet Mobile Pizarra Digital
Academic work	Word PPT Adobe Reader Word Pad Slideshare Drive Zoom	Laptop Tablet/mobile (for specific apps)	Laptop Mobile Tablet	Word PPT Adobe Reader Word Pad Zoom GoogleDrive Scratch Scoop

Table II. Use of mobile devices, aplications and software for academic purposes

Both groups involved in the focus group showed similar responses (Table II). However, the use of mobile devices seems more frequent in the classrooms of Spanish undergraduates, as evidenced by expressing that “the mobile is useful when the teacher wants to do some activity” (ED6). On the other hand, “there are different attitudes, depending on the age and knowledge that the teacher has” (ED7). In the case of Portugal, it was shown that “above all, the laptop is used” (ID1, ID3, ID5), since “it is more comfortable and more practical to take notes” (ID5), mainly due to the “size of the screen, the keyboard, etc.”. In any case, the quick search for information and access to it was shown in both groups as easier through the mobile. This is due to the characteristics of this (ubiquity, immediacy, and connectivity), but above all, thanks to the familiarity of use by the students in their daily lives. In the question presented to the students, they highlighted a significant condition in the inclusion and use of mobile devices in the academic field: the attitude of the teaching staff. In connection with this, the following attitudes were expressed (Table III).

The generation gap continues to prevail as a significantly exclusive factor. Although two different perspectives are perceived among the students, an attitude of little receptivity is manifested on the part of the older teachers: “In class, they tell me, 'Don't think about taking out your device to talk to your classmate. If you want information, go to the library” (ED9). In this sense, both groups of students coincide significantly, since in the case of Portugal, it was agreed that “when you use the mobile device in class, the teacher thinks it is to distract you, to talk to someone else and never to work on class things” (ID3).

Portuguese students	*Spanish students*
Prohibition of use	More tolerance towards its use
Punctual and sporadic use	Employment for specific tasks
Specific activities	
Applications or utilities in the classroom in subjects that require it (e.g., information technologies; ICT, etc.)	Positive or rejection attitude, depending on age (generation gap)

Table III. Comparison between Spanish and Portuguese undergraduates, concerning teachers’ atittudes towards the use if technologies

However, and although most participants agreed on age as a key factor in the motivation for use. Therefore, the students show divergent positions: “Sometimes some teachers are surprised that we do not have some applications installed or do not know how to handle them” (ED6). In addition to age, as a determining factor, the area of specialization of the teacher also seems to play an important role in the motivation for the use of mobile devices in the classroom.

In any case, there is little training on the part of an important sector of the teaching staff in the areas of humanities and social sciences: “I taught my teacher that there was an app for pronunciation and devicetic correction, and she was surprised” (ED4).

On the contrary, and as may seem logical, the areas related to technologies coincided with an almost generalized motivation on the part of the faculty. However, it was precisely the students in physical education who expressed both the greater use and knowledge of apps by teachers, as well as the motivation and invitation to use them in teacher training classes.

In general terms, it was considered that mobile devices have a great utility for the advantages they offer. And the students considered that it is something that has also been present among the teachers. In any case, it is considered a necessary and very appropriate instrument in the current context in which we find ourselves since it “helps me to seek information quickly” (ED3).

In addition, and as indicated “if the wifi in the center goes wrong, I can use data on the mobile device”

(ED1). On the other hand, we can also "make video calls between students, create workgroups with which to interact and use many applications" (ED8).

While the student body has advanced, even more, it has important gaps to face the challenges that arise: "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, teachers still have more limitations" (ID5). Therefore, it is highlighted that "you have to learn to use the mobile as another tool in the classroom" (ID1).

4.2. Means used: programmes, resources, platforms; type of device (mobile device, tablet, laptop)

Results showed significant changes in perception of both periods. As we can see, after the normalization of the results obtained, there is a qualitative change between both moments (Figure 1). On the one hand, and as underlined in the table, laptops continue to rise with the monopoly of use. They are perceived as the most complete work instrument in the classroom and outside it. However, the mobile device plays a key role in the search and dissemination of information. "Since the information is in the cloud, it is easier to enter directly into our mail or drive and download the document or share it" (ED10).

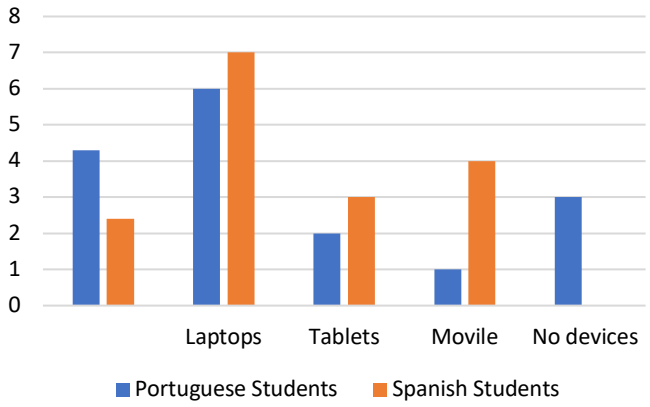

Figura 1. Use of devices for academic purposes

In addition, the number of tools has increased in terms of their competence. Others seem to have lost validity in favor of more up-to-date ones. Similarly, online work has not only become a priority due to the inertia created during the Covid-19 pandemic: "we had to get used to last year that some had to stay at home because of quarantines and others could get together. So, we work online with a drive, with a video call or with zoom" (ED7). In addition, its practical character for remote and mixed work (with members of the group present and others, at home) has been evidenced: "now, none of us can say that we can not stay, because we connect and work wherever we are" (ED8). The need for reinvention, the closeness of the participants to their working life as teachers, and the greater contact with mobile devices have led to a broader knowledge of applications, and new software.

In this sense, it could be said that the pandemic has served as a turning point in the optimization of technological skills in general and mobile in particular. "Of course, with the pandemia and with so much contact with mobiles, what one did not discover, was shared by another. A lot of information was passed through the group and pages and apps were shared that were easy to install and use" (ED5).

4.3. Perceived level of technological competence among undergraduates

After the normalization and categorization process of the answers, some results were obtained (Table IV and Figure 2).

	Portugal	*Spain*
Self-perception about the competence level	Low level-medium to low level Proficiency in basic programs only Little satisfaction with the level of competence Average motivation for the acquisition of new skills	Medium-low level Ability to acquire new skills Proficiency in basic programs only Little satisfaction with the level of competence Average motivation for the acquisition of new skills
Specific uses and applications	Information management Microsoft Office Data processing Presentations Online work Digital Editing Programs	Microsoft Office Presentations Online work Digital Editing Programs Virtual and augmented reality resources and programs Gaming apps Video-tutorials (creation and dissemination)

Table IV. Self-perceptions on skills and specific uses of devices, apps, and software

As we can see, there are certain differences between both groups of students. On the one hand, the self-perception that students from Portugal have about their level of technological competence in the academic field is superior. On the other hand, in the case of Spanish students, a low competence is perceived, based on the fact of

"using only those programs that we need" (ED1), without expanding the interests "to learn other things or investigate in different applications or software" (ED2).

Although a level of competence of great acceptability is perceived, in the case of Spanish students, this is considered perfectible and at a disadvantage with respect to that of other degrees that include more its use: "something more level we do have, but I think that other careers have much more, at least when looking for information" (ED7).

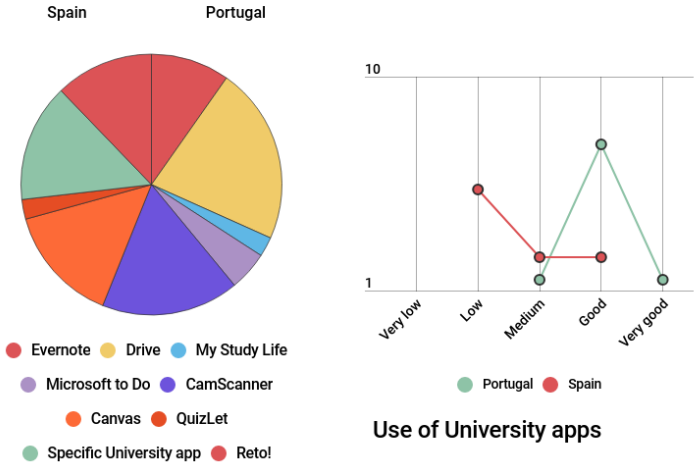

Figure 2. Self-perceptions on mobile literacy skills

4.4. Changes in the use of mobile technologies before and after Covid-19

In general terms, undergraduates showed significant changes between the pre- and post-pandemic crises. We offer a synthesis of the main changes highlighted in the different areas involved in the teaching-learning processes, in reference to tools and instruments (Table V).

In general terms, an increase in the use of mobile devices that is perceived as necessary emerges. Thus, it is stated that "before we hardly used and now, we have to use it yes or yes" (ED3). In general, mobile devices, mainly laptops, are an essential part of teaching-learning processes today. "It is not possible to understand the faculty and the classes without the computer. In that, we have totally changed" (ED8).

In addition to that, "you can no longer work without a computer or a mobile. They have all the tools we need" (ED4). Previously, it was just another instrument. But today, after the pandemic crisis, "we have the inertia; we have become accustomed to being with computers or mobile devices and we do not know how to work if they do" (ED9).

	Before		*After*	
	Portugal	*Spain*	*Portugal*	*Spain*
In the classroom	Laptops Word PPT Adobe Reader Word Pad	Laptops Computers (computer classroom) Mobile Word PPT Adobe Reader Word Pad	Laptops Word PPT Adobe ReaderWord Pad PDF GoogleDrive	Laptops Mobile Tablet Electronic Blackboard Word PPT Adobe Reader GoogleDrive Inercom Scoop Drive Living Drive Word Pad Zoom (platform)
For academic works	Word PPT Adobe Reader Laptop	Word PPT Adobe Reader Slideshare Electronic Blackboard softwares Computer Tablet/mobile (searches)	Drive Word PPT Adobe Reader Zoom (platform Computer Mobile (searches) Tablet	Drive Living Drive Word PPT Adobe Reader Word Pad Zoom (platform) GoogleDrive (platform) Scratch Scoop Computer Mobile (searches) Electronic Blackboard Tablet
Presentations	PPT Movie Maker Popplet Laptop Mobile	PPT Prezi MOVAVI Movie Maker Popplet Camtasia Laptop Mobile Tablet	PPT Genialis PowToon Canva Laptop Mobile (docs in the cloud)	PPT Prezi MOVAVI Movie Maker Vismi Genialis PowToon Emaze Canva Laptop Mobile (docs in the cloud)
Search for information	Chrome Mozilla Firefox Reference managers Laptop Mobile	Mozilla Firefox Chrome Mobile Laptop Tablet	Chrome Mozilla Firefox Scholar Google Library Apps Reference managers Mobile Laptop	Chrome Mozilla Firefox Scholar Google Reference managers University app WPA Mobile Laptop Tablet

Table V. Comparison of undergraduates' perceptions before and after the pandemic crisis

4.5. Teachers´use of mobile applications (Student´s perceptions on teachers)

Undergraduates perceive some changes with respect to the use of mobile technologies in the classroom (Table VI). Some applications are used by teachers. However, age continues to be perceived as a key factor in the inclusion of mobile

technologies in classrooms. And therefore, applications are also conditioned by this factor.

	Portugal	*Spain*
Generic apps	Evernote Drive Mendeley	Intercom My Study Life Microsoft To Do UGR general app Ex Libris Library Mobile (UGR) Reto! (EF)
Exclusively gaming apps	Kahoot Ad hoc applications	Kahoot SuperTeacher tool Classgraft Quizlet Quiziz Ad hoc applications

Table VI. Perceptions on mobile technologies use in the classrooms

As previously stated, undergraduates in Spain perceive a greater integration of apps in classrooms for academic purposes. On the one hand, there are different exclusive gaming applications for them. This is not the case if we consider the prospect of Portugal. Yes, there has been a specific gradual increase, but "always depending on the age of the teacher" (ED5), although this "is not the only factor, because there are young teachers who still do not know what an app is, and others, of a certain age who are aware" (ED2). Similarly, the area of specialization and the predisposition on the part of the teacher is seen as crucial factors.

Since the pandemic, undergraduates consider that a sector of the teaching staff has developed greater creativity in the classroom thanks to the use of applications. "It's amazing how some teachers have even created apps for their subjects" (ED6), although it is still pointed out that "they are a minority, and these are teachers who like the subject very much or have a lot of motivation" (ED8). In the case of the Portuguese students who participated, they included a smaller number of apps, and were always, conditioned by "the preparation and knowledge on the part of the teacher" (ID6), although it is also highlighted that "there is a greater awareness, perhaps because they have seen that there is no other way than to catch up with the new generations" (ID5).

Regarding the motivation to introduce mobile technologies in the classroom, students have highlighted the following aspects in relation to their perception of teachers. In relation to the level of motivation, they perceived respect for the introduction of applications in the classroom for academic purposes (Figure 3).

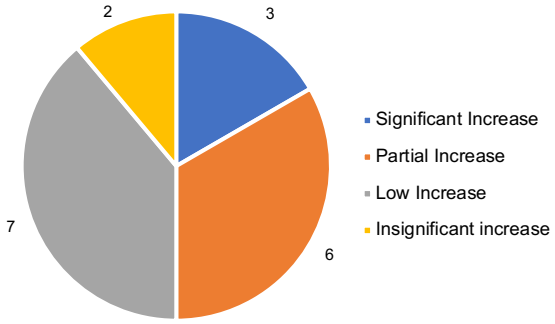

Figure 3. Perceptions on teachers' motivations when using mobile apps for academic purposes

	Portugal	*Spain*
Concerning to predisposition	• Ignorance and little intention of change • Positive attitude on the part of the teaching staff • Fear that the student does not know how to distinguish academic uses from personal uses • Concern about distraction • Total banning of its use by older teachers • Inclusion of mobile activities by very few teachers	• Unknowledge and little intention of change • Increase of a positive attitude by part of the teaching staff (perceived by students of higher grades). • Fear that the student does not know how to distinguish academic uses from personal uses • Concern about distraction • Total banning of its use by older teachers • Generalization of use by certain teachers.
Concerning to perceived level of training	• Average level • Higher level of preparation is perceived in younger teachers • Generational gap. Older teachers lack real motivation and preparation to face new challenges (ID1/ID3/ID5/ID7) • Relevant change after the pandemic crisis • More training by a larger number of professors (ID9)	• Medium-low level • Generation gap • Differences between areas • Technological and scientific versus humanities (ED1/ED2/ED6/ED8) • "Increased interest from middle-aged teachers" (ED2) • "'Elderly' teachers show no interest in its use" (ED5) • "Dogmatism" in methodologies prevent their inclusion in the classrooms

Table VII. Undergraduates' perceptions on teachers' mobile literacy skills

4.6. Teachers´ level of technological competence (student´s perceptions on their teachers)

Undergraduates highlighted a series of determining factors in this regard that evidenced a certain greater predisposition, but in very discreet terms still. Despite the motivations that were perceived for this purpose, it should be noted that there is no clear perception of an adequate training process that allows this adaptability.

Regarding the inclusion of technologies and the preparation of teachers for it, the students interviewed highlighted the following aspects (Table VII). They appear in descending order, from the most prominent and most agreed statements, to the most exceptional (in the case of textual or approximate quotations, the informants are identified).

4.7. Teachers´ levels of competence in the use of mobile technologies in teaching (student´s perceptions on their teachers)

It includes the assessment of the perceived-by-students levels of competence of teaching staff. Relevant differences were found between Portuguese and Spanish students (Figure 4). The latter described greater limitations in the teaching staff. On the other hand, in the case of Portuguese students, there was the perception of high level on the part of teachers in terms of the predisposition and preparation for the use of mobile devices in the classroom. However, we must indicate that these are perceptions with a paradoxical component: Spanish students showed, throughout the focus group, greater mastery, and implementation of programs, devices, and applications (see items 1-5). This is to the detriment of Portuguese students. However, when it came to expressing perceptions about teachers' use and preparation, the scores were very divergent.

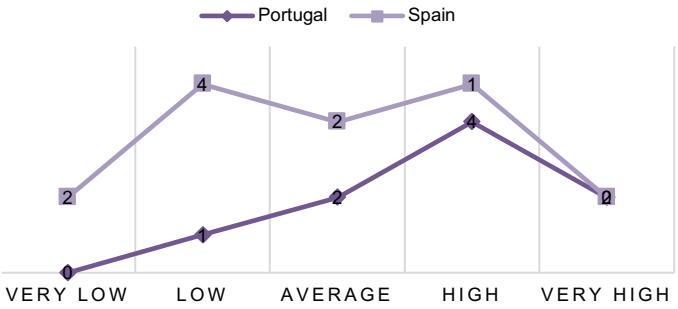

Figure 4. Objective assessment of perceived level of the teaching staff by the student

4.8. Proposals and suggestions

This section summarizes students´ proposals and suggestions to improve teaching and learning processes (Table VIII).

	Portugal	*Spain*
Academic needs (general)	• Mixed education system • Training at all levels (teachers-students) • Resources • Greater number of specific and compulsory training modules in digital-mobile skills • Interactive apps by the academic institution	• Specific and compulsory subjects or modules of training in digital-mobile competences Investment in technologies and resources • More hours of practices • Informative pills in the form of videos • Discord • Interactive apps Virtual and augmented reality resources and programs • Gamification apps • Educational video games
Perceived needs in teachers	• Specific training • Motivation • Optimization in the use of technologies • Positive attitude towards the use of mobile technologies • Change of mentality • Creation of digital useful contents	• Teacher training • Interest and involvement • Update • Simple and short PDF • Charts and concept maps • Synthetic contents • Combination of master classes with mobile resources • Videos-tutorials and classes prepared by teachers and students (visualization in apps) • App to facilitate evaluation • Theoretical-practical classes

Table VIII. How to improve the teaching-learning process

That there is an attachment, though partial, to traditional teaching methods, despite the technological irruption imposed by the pandemic crisis, was evident. Thus, undergraduates consider that "Covid has not served much, because most want to be left alone and continue to teach their classes as before: I speak, and you listen" (ED7). Although there has also been an interest in receiving training. As one of the participants indicates, "I do not know if it is out of necessity, or because they have realized that they must enter the technologies, but some of my teachers are still training. They say they need more preparation" (ED1).

Regarding their proposals, some participants stressed that the most effective for meaningful and effective teaching was: "alternating the use of master classes, with the use of new technologies and changes in scenarios" (ID7). In this way, "all students would be given the opportunity to work well and therefore achieve better results" (ED6). Similarly, the pandemic crisis showed that a "mixed education" (ID2) that combines "the advantages of face-to-face and online teaching" (ID3) is possible and effective. In fact, the pandemic demonstrated at the time that the combination of both "is the most practical scenario" (ID8). The reluctant attitude to the use of mobile technologies is not only found in a sector of the teaching staff.

Some participants in the focus group have been reluctant to use mobile technologies as a fundamental part of the teaching-learning process, at least, as a main part of the methodology: "the truth is that as a future teacher, I would not want to use technology alone in class, because it can create addition in children. I prefer that they discover and observe for themselves" (ED7).

In summary, it is observed from the different contributions that teaching cannot exists without the use of mobile devices, which have come to stay, and therefore, are part of the methodology to be applied.

5. Discussion and conclusions

Results underscore that the use of mobile devices has increased in academic contexts due to several factors. This research confirms that the impact of the pandemic crisis has exerted an important influence on the inclusion of mobile technologies in higher education. However, students seem to perceive that this is a slow process. It is often conditioned by several factors, like age, need, or attitude. Despite undergraduates do prefer laptops, mobile devices have been increasing, concerning academic purposes. This is mainly due to their usefulness, accessibility, and ease of use.

There is an increasing number of studies related to mobile device technologies and their inclusion in the teaching and learning processes. Most of them consist of quantitative research. Few qualitative studies, based on the focus group methodologies, were found. In any case, some were found and there are some convergences between our research and other relevant analysis, despite this study representing some innovative elements we should consider. Different approaches emphasized the importance of ubiquity, connectivity, and immediacy. In this vein, we should consider the research by Martin et al. (2013), Yueh-Min Huang et al. (2014), Baran (2014), and Farley et al. (2015), since they presents convergences with our study. Undergraduates who participated in the two focus groups highlighted the three basic properties of mobile learning. Similarly, they underlined the digital divide as a factor of distance and concern. Also highlighted the disadvantages and problems of introducing mobile devices in the classroom, as well as the reluctant attitude on the part of some teachers. Despite the temporal distance, we found similar concerns. We find very significant similarities, as is also the case of Huang et al. (2016) and Ng (2016) who emphasize that mobile literacy is linked to information. Faced with an unstoppable process, the most practical thing is an adaptation of the tools.

Mullins (2017) presented an interesting aspect that converges with our study: the role of academic institutions in the acquisition of informational and mobile skills. To this end, it took into consideration the inclusion of mobile devices in higher education processes. However, in our case, two factors contribute to qualifying this statement: the comparison between two international realities and the changes that have been analyzed before and after the pandemic. There we find a process of evolution and a significant contribution and a relevant divergence. However, Mullins (2017) also considered the role of the library in this regard. In a line of great similarity is the research of Kearney and Maher (2019), Ng (2016), Wong (2021), and Kearney et al. (2020). However, both studies are pre-pandemic, so they do not include aspects that should now be considered for the significant aspects in a post-pandemic period. The irruption of the health crisis has come to accelerate processes that were already underway.

After that, both our research and that of Mullins (2017) find that the transition to digital and mobile higher education is still in an early stage.

The same is collected by Udenze and Oshionebo (2020), and Marques and Pombo (2021). Again, as an added value to this research, we can point

out the comparison of two different national and cultural realities, which provides many elements. However, in the case of Udenze and Oshionebo (2020), there is a combination of quantitative-qualitative methodologies that must be taken into consideration.

It is of great interest is the work of Pinto et al. (2021), as previously indicated, although this is limited to a group of undergraduates in its last year of studies. Although there are convergences, in our case, we add the value of international comparison. Both Pinto et al. (2021) and Zou et al. (2021) conclude, as in this research, that there is still a lot of reactivity towards a broader inclusion of mobile devices in classrooms. Similarly, the digital gap remains a key element. In addition, the research we presented expressed the relevance of Covid-19 to accelerate the processes that were already underway.

Bäcklund et al. (2022) and Hafour (2022) state that mobile devices have become a key part of teaching-learning processes during the pandemic. However, in the case of a sector of teachers, it only became a transitional tool as a solution for the moment of crisis. In any case, their usefulness, and the fact that they have become tools that are here to stay have been evidenced. In this sense, this research presents numerous convergences. On the one hand, it concurs with the usefulness and the permanence of mobile technologies in teaching. On the other hand, there are also similarities in the attitudes of teachers in practice: since they lack references in the use of mobile devices in learning contexts, it conditions their possible widespread use.

In general, studies that implement quantitative methodologies continue to be necessary. Among the tools, even the focus group has little presence. In the case of mobile technologies, and more specifically, in the social sciences undergraduates in its last year, many limitations are still perceived.

The pandemic crisis has shown changes, due to the need of -and the advantages offered by- mobile devices. The growing number of applications, as well as the ease of use, immediacy, and ubiquity, have contributed greatly to the awareness of the usefulness of mobile devices in higher academic environments.

Regarding the processes of comparison, relevant differences emerge in the perceptions of the students regarding the predisposition and preparation of teachers in mobile competences. Portuguese students use fewer applications and software but have a greater self-perception of skills. For their part, Spanish students perceive themselves with a low level of skills, even though their inclusion is higher.

The inclusion of mobile devices, although experiencing a very significant growth process -even more after the pandemic crisis- is still in an early stage. This unstoppable process has many advantages and possibilities.

In relation to the implications derived from our analysis, we can highlight that training activities involving the entire educational community are needed. On the one hand, there is a generational gap among teachers that should be considered. The constant technological evolution means that the need for adaptation is ongoing. Similarly, students need training in basic digital literacy, as significant gaps exist in the use of specific software and applications, which are becoming increasingly essential in educational processes. Therefore, it is necessary to return to the students to assess their needs and, based on these, establish specific and appropriate training activities

In sum, we have tried to explore the experiences of two groups of academic students of Social Sciences. After the analysis, some proposals are highlighted:

- Students still have the need to optimize their informational and mobile literacy skills.
- The analysis of the inclusion of mobile technologies in teaching and learning processes in higher education should be deeper.

Concerning future studies, this research opens new lines of work that may increase the interest of the scientific community:

1. A qualitative and comparative study between different social science degrees that, in addition, includes the two different realities we have considered.
2. It could be of interest to expand this sample in order to include postgraduate and PhD students.
3. Moreover, it would be crucial, for further researches, to combine both qualitative and quantitative methodologies. For this purpose, we may includ the tools that we have already implemented and that have shown reliability

The academic institutions and, in particular, both teachers and librarians, must become really aware of the importance of mobile devices in teaching processes because mobile devices arrived to remain in the academic field. You cannot give up a fact that is evident on a day-to-day basis – and this reality has been evidenced after the pandemic experience. Motivation continues to be a key factor: to achieve a positive attitude in the

student body and meaningful learning; and also, to allow an effective connection between students and teachers. In this regard, the inclusion of these devices can be considered a key piece.

Availability of data and materials

The datasets supporting the conclusions of this article are included within the article and its additional files:

https://drive.google.com/drive/folders/1XxzJe-jFfe8D2GnMNjbsH2-1YqLfOWn6i?usp=share_link

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