

PAPER

Factors That Influence Teachers' Willingness to Adopt Mobile Technologies: Challenges and Opportunities

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ABSTRACT

In today's digital age, the integration of digital technologies into the educational process has become a priority. The objective of this study is to analyze the conditions under which technology can support teachers in the design, implementation, and evaluation of teaching-learning (E/A) processes. This study specifically sought to answer the research question: "Can a self-evaluation tool help teachers' guide and design mobile learning activities?" by emphasizing the criterion of effectiveness. Through a qualitative analysis within the framework of the educational design research (EDR) methodology, a series of focus groups were carried out and classified by teachers' levels of experience, from beginners to experts. These groups provided detailed insights on the perception and use of mobile devices in education, specifically on the use of a self-assessment tool that supports teachers in designing activities with mobile devices. The results indicated a generally positive perception of mobile technologies in education, although variations in adoption and perception were observed depending on the teacher's level of experience. The mobile self-assessment tool was also commended. The findings support literature on mobile learning and teacher support tools, emphasizing the importance of teaching training and the transformative potential of mobile devices in modern pedagogy.

KEYWORDS

teacher professional development, mobile learning, educational technology, teachers' perspective, mobile-learning

1 INTRODUCTION

Digital technologies have become an omnipresent element that is reshaping various aspects of life, including education. Mobile devices, along with the 'mobile learning' methodology, are one of the most dynamic components of digital education, enabling more flexible and personalized learning [1, 2, 3]. In response to this evolving educational researchers [4] have critically examined the integration of self-assessment tools in classrooms, emphasizing the crucial role these tools play

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in empowering teachers to effectively navigate and utilize mobile learning environments. Their research highlights the significance of user-friendly, pedagogically sound tools that support continuous teacher development and the improvement of learning experiences through technology.

Incorporating digital technologies into education has significantly transformed teaching and learning landscapes. One aspect at the forefront of this evolution is mobile learning, which has become increasingly important in creating adaptive and personalized educational experiences. Recent research studies provide comprehensive insights into how mobile learning can be implemented effectively across different educational settings.

[5] delve into this topic with their development of the ASYMPTOTE Learning Environment, which is tailored for adaptive, synchronous, and mobile online education. This framework specifically supports diverse learning speeds and styles, enhancing accessibility and flexibility in learning processes. It represents a significant step toward addressing the varying needs of students in a dynamic educational environment.

Expanding on the notion of student-centered learning, [6] investigates self-regulated and mobile-mediated learning within blended tertiary education environments. Her study highlights how mobile technologies empower students by supporting self-regulated learning strategies, thereby promoting higher engagement and autonomy in learning activities. This underscores the potential of mobile learning tools to reshape traditional educational paradigms into more student-focused models. Further exploring the teacher's perspective, [7] focuses on the acceptance of mobile learning technologies among educators. Their findings emphasize the critical role of teacher training in mobile self-efficacy and the acquisition of 21st-century skills. This study suggests that the effectiveness of mobile learning implementation heavily depends on teachers being adequately prepared and confident in using these technologies.

Lastly, [8] provides a broader view by examining the status of mobile learning. Their empirical research offers vital benchmarks for the integration of mobile learning and identifies key factors that influence its success in the regional context. This study serves as a valuable resource for educational policymakers aiming to optimize mobile learning strategies within similar educational systems.

The integration of mobile devices into classroom settings necessitates not only the provision of the necessary technologies but also comprehensive training for teachers to ensure effective adoption and integration into teaching practices [9, 10, 2]. This necessity stems from the overarching need to fully understand teachers' attitudes, perceptions, and competencies regarding mobile technology use within educational settings. While prior studies have extensively explored the benefits and challenges of mobile learning from students' perspectives [11, 12, 13], a deeper investigation into teachers' experiences remains critical for a holistic understanding of mobile learning's impact [13, 2].

For this purpose, a tool was designed to address these challenges and facilitate more effective integration. It is a self-assessment tool created to assist teachers in designing, implementing and evaluating the use of mobile devices in the classroom [10]. This tool aims not only to enhance teaching efficiency with mobile devices through reflection and analysis but also to enrich students' learning experience with meaningful and integrate digital technology activities using pedagogical strategies. The tool enables teachers to self-assess themselves in relation to the seven key elements (see Figure 1) within the context of mobile learning [10, 14, 15].

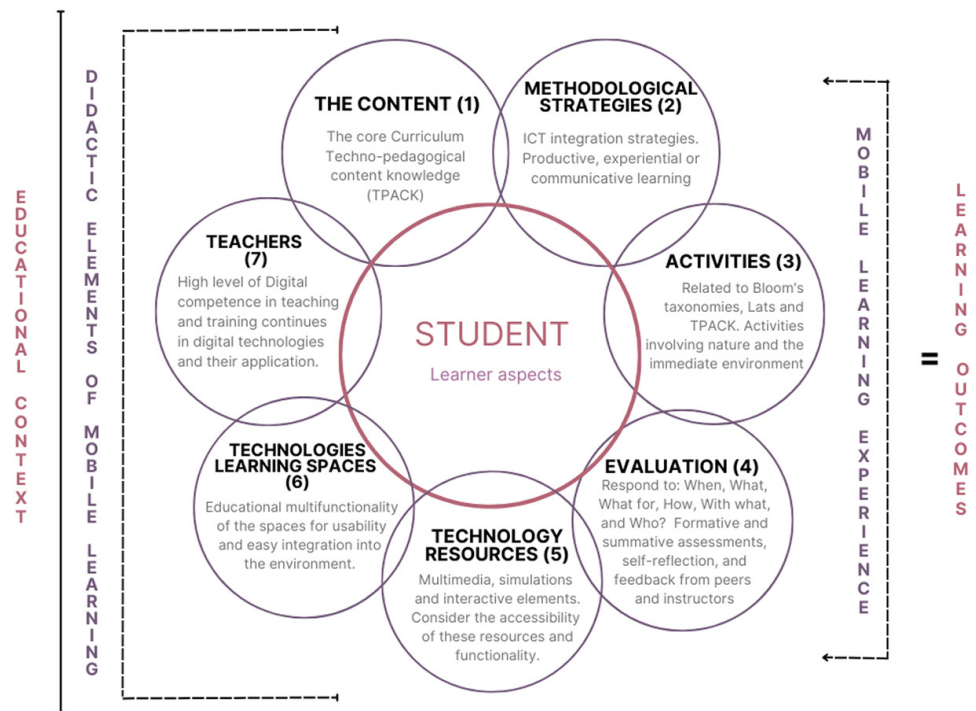


Fig. 1. The self-assessment tool comprises didactic elements for the use of mobile devices

The proposed self-assessment tool aims to assist teachers in creating mobile learning activities. However, assessing its effectiveness goes beyond mere functionality. It is crucial for this tool to facilitate the development of activities that not only incorporate technology but also promote meaningful, independent, and critical learning. Effectiveness, defined as the capability to achieve a desired outcome, has become a standard for evaluating educational interventions [16]. In the realm of mobile learning, a vital component of digital education, effectiveness encompasses not only students' acquisition of digital skills but also the enhancement of their learning processes [17]. Teachers also gain confidence and autonomy in using the tool, enabling them to design high-quality activities [18, 19]. Therefore, when evaluating the self-assessment tool, we must consider not only its practicality but also its potential (effectiveness) to bring about positive changes in teaching. The primary aim of the research is to examine how technology can assist teachers in developing, implementing, and assessing teaching-learning (E/A) processes. The key research question is: Can a self-assessment tool support teachers in guiding and creating mobile learning activities? This question seeks to determine the broader impact of the self-assessment tool on guiding and designing pedagogical activities within the mobile learning context. To ensure their effectiveness in the educational setting, educational tools must align with teachers' pedagogical and curricular requirements, surpassing more technical solutions [20, 21].

2 METHODS

2.1 Research design

This study is a component of educational design research (EDR), which is an educational adaptation of the well-recognized design-based research (DBR) [11] methodology, employing a qualitative analytic approach. The methodology known

as EDR, as described by [22], shares core characteristics with the DBR methodology. These principles include iterative design, expert cooperation, and empirical data analysis, as outlined by [21, 22]. Crucially, while EDR encompasses a range of methodological approaches, our study places a strong emphasis on qualitative methods to deeply explore the educational phenomena under investigation. Iterative design involves creating prototypes, conducting subsequent testing, and repeating these cycles to incrementally improve the suggested approach. The inclusion of specialists, such as teachers, in the collaborative process is crucial to guaranteeing the accuracy and applicability of the proposed solution. The use of qualitative empirical data analysis serves the purpose of assessing the efficacy of a solution and offering feedback to facilitate ongoing enhancements. The overall objective of the research is to analyze the conditions under which technology can support teachers in the design, implementation, and evaluation of teaching-learning (E/A) processes. To address this general objective, research has been structured into the various EDR phases mentioned above, each with specific objectives and associated research questions seeking to respond to specific aspects of the overall objective. In this paper, special emphasis is placed on Phase 3, with the “specific objective” that focuses on designing, implementing, and evaluating an educational intervention using mobile technologies to improve teaching and learning processes. Linked to this goal of phase 3, the “research question” is addressed: can a self-assessment tool help teachers guide and design mobile learning activities? This question seeks to determine the effectiveness (broader impact) of the self-assessment tool in the orientation and design of pedagogical activities in the context of mobile learning. Through the focus group technique, qualitative data were collected that provide insights into the teaching experience in relation to the self-assessment tool and its impact on the design and implementation of mobile learning activities.

In Figure 2 below, you can see the phases and the instrument's implementation process that have been applied following the methodological model for the research. For this paper, the data the final phase 3, “Effectiveness criteria (broader impact), from the ‘Focus Group’ are treated and analyzed as phase closure and research”.

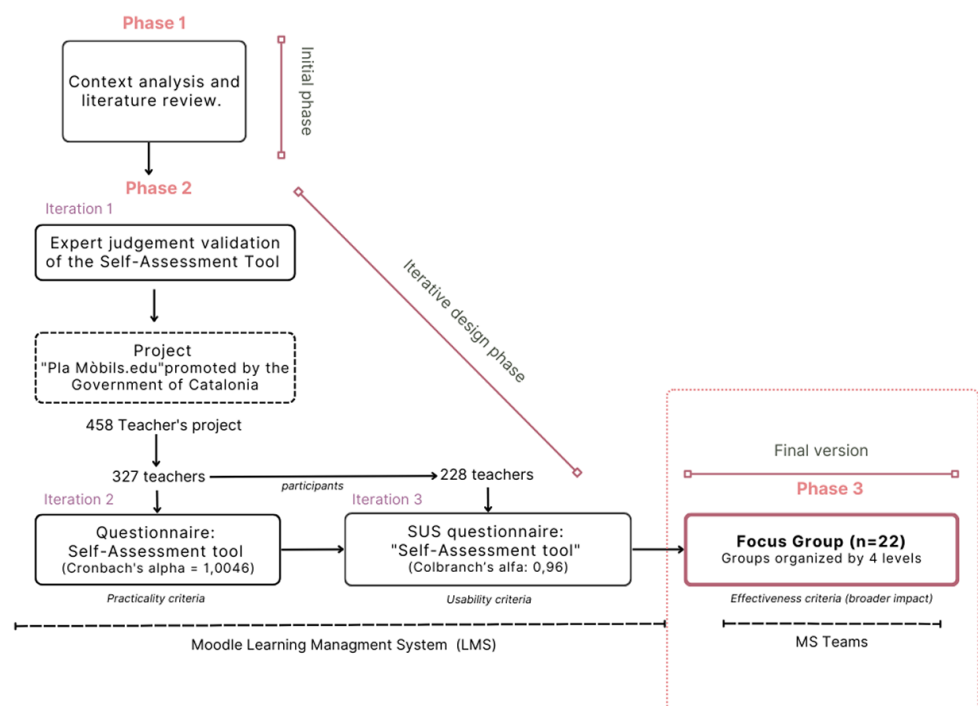


Fig. 2. The phases and the instrument's implementation process

This study employed a rigorous methodology that consisted of numerous phases (see Figure 2) and consecutive iterations to investigate the pedagogical aspects of using mobile devices in educational settings. The methodological sequence was delineated as follows: a specific focus on the progression from Phase 2 to Phase 3 and on the examination of data gathered during these pivotal periods of the study.

The transition to Phase 3 is determined by analyzing the data gathered from self-assessment and utilizing this data (from Phase 2) to establish focused groups that delve deeper into pedagogical methods, including mobile devices. Crucial elements of this transition include:

- Competence-level selection: Participants in the focus groups are chosen based on the competence levels determined in Phase 2. This ensures that conversations are enriched by a variety of viewpoints, encompassing a broad spectrum of experiences and expertise in the educational use of mobile devices.
- The focus groups concentrate on specific thematic areas that have been previously recognized as crucial for the successful integration of mobile devices into teaching and learning. The domains encompassed in this context include the utilization of mobile devices for educational purposes, the corresponding teaching skills, the didactics of mobile learning, and the unique assessments of the “Pla Mòbils.Edu” initiative.
- Phase 3 of the data collection process focuses on gathering qualitative data through conducting focus groups. By integrating mobile devices into their instructional practices, this approach enables a deeper understanding of teachers’ experiences, perspectives, and challenges.

2.2 Participants

The selection of the teachers for the study was conducted based on specific criteria. They were required to have utilized the self-assessment tool and completed the usability questionnaire in phase 2 of the research within the framework of the pedagogical innovation project named “Pla Mòbils.edu” (Edu/1464/2019, 27 May) [23], which was initiated by the department of education of the government of Catalonia (Spain). The group comprised 327 teachers from 62 educational institutions, spanning various educational levels. The breakdown of participation by educational stage is outlined in Table 1.

Table 1. Educational stage of participating teachers

Educational Stage	Teachers (n)	%
Early Childhood Education (3 to 6 years)	20	6.1%
Initial Cycle of Primary Education (6 to 8 years old)	33	10.1%
Middle Cycle of Primary Education (8 to 10 years old)	37	11.3%
Ciclo Superior de Educación Primaria (10 a 12 años)	68	20.8%
Compulsory Secondary Education (12 to 16 years old)	169	51.7%
Total	327	100%

The inclusion of 327 teachers from a wide range of educational stages and institutions ensures a diverse and comprehensive sample, representative of the broader teaching community in Catalonia. This extensive participation facilitated a robust analysis across different educational contexts, providing valuable insights into the adoption and integration of mobile technologies in teaching.

Of the 327 teachers, 228 chose to continue their participation in the subsequent phase of the research. Subsequently, the candidates were categorized based on their performance in the self-assessment tool [20, 24], their gender, and their educational stage. A total of 22 participants were chosen at random to form the four focus groups. This selection was done to ensure that each group had an equal representation of the four levels of expertise (beginning, intermediate, advanced, and expert) as measured by the instrument. These participants were distinct from the original sample of 228 teachers. Figure 3 displays the distribution of instructors who took part in the focus group, emphasizing the wide range of teacher variety.

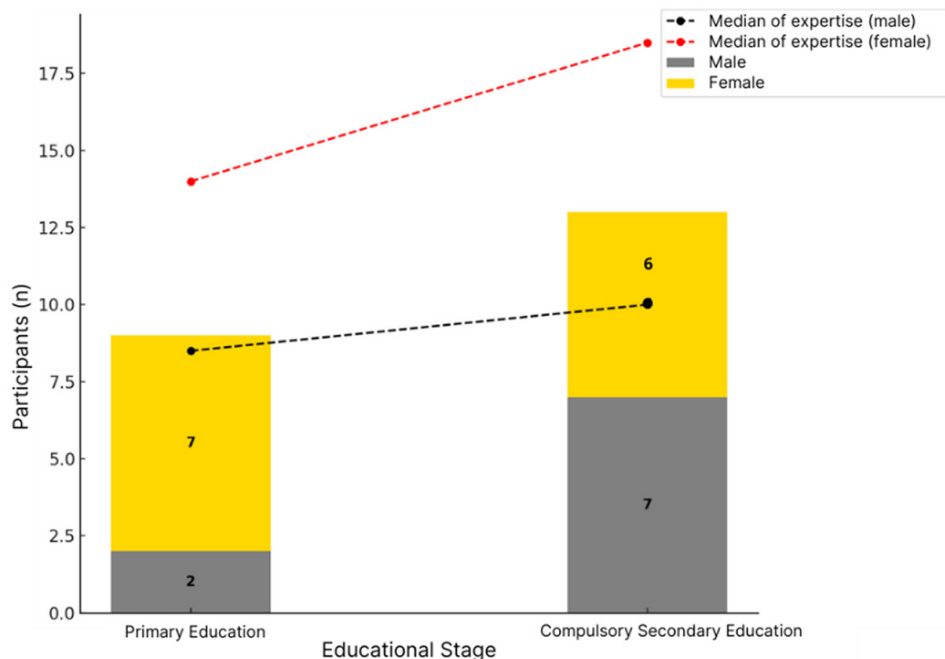


Fig. 3. Distribution of the instructors of the focus group

The deliberate selection of 22 teachers for the focus groups was based on achieving a balanced mix of expertise levels, educational stages, and genders to ensure that the discussions reflected a broad spectrum of experiences and perspectives on mobile learning. This methodical approach allowed for an in-depth exploration of the qualitative dimensions of mobile technology integration within the educational process.

Out of the entire sample, there were nine male participants and 13 female participants, indicating a modest majority of females, particularly in the “primary education” stage. In terms of educational level, there are 13 teachers in the “compulsory secondary education” category and nine instructors in the “primary education” category. The trend lines represent the median values of years of experience, which range from three to 30 years, with an average of 13.8 years. Women have a slightly higher median of experience than men in both stages.

Finally, we would like to emphasize that when we contacted teachers to invite them to participate freely and voluntarily in the study, we stressed the importance of accepting the terms outlined in the informed consent. This step was crucial to ensure compliance with current data protection regulations, specifically Regulation (EU) 2016/679 of the European Parliament and Council, dated April 27, 2016, known as the general data protection regulation (GDPR), as well as Organic Law 3/2018, dated December 5, 2018, on the protection of personal data and guarantee of digital rights in Spain.

2.3 Instrument

A focus group, also known as a discussion group, is a qualitative data collection technique that involves a group of people in a targeted discussion on a specific topic or set of topics. It is designed to gain insights into the views, beliefs, attitudes, and experiences of participants regarding a particular topic. Focus groups benefit from group interaction, as discussions among participants can generate new ideas and perspectives. This technique is especially useful when seeking to explore the diversity of opinions and experiences within a given group [25, 26].

In the context of research with the objective of designing, implementing, and evaluating an educational intervention using mobile technologies to enhance teaching and learning processes, the utilization of focus groups in the final phase is crucial. This method offers profound insights into how the self-assessment tool influences and assists teachers in creating and executing mobile learning activities. To address the research question, “Can a Self-Evaluation Tool Help Teachers Guide and Design Mobile Learning Activities?” it is imperative to gather qualitative data that uncovers teachers’ perceptions and experiences. The interactive and cooperative nature of focus groups creates a conducive setting for teachers to exchange their experiences, obstacles, advantages, and opportunities related to using the self-assessment tool in the realm of mobile teaching and learning. The distribution of the focus group is illustrated in Figure 4.

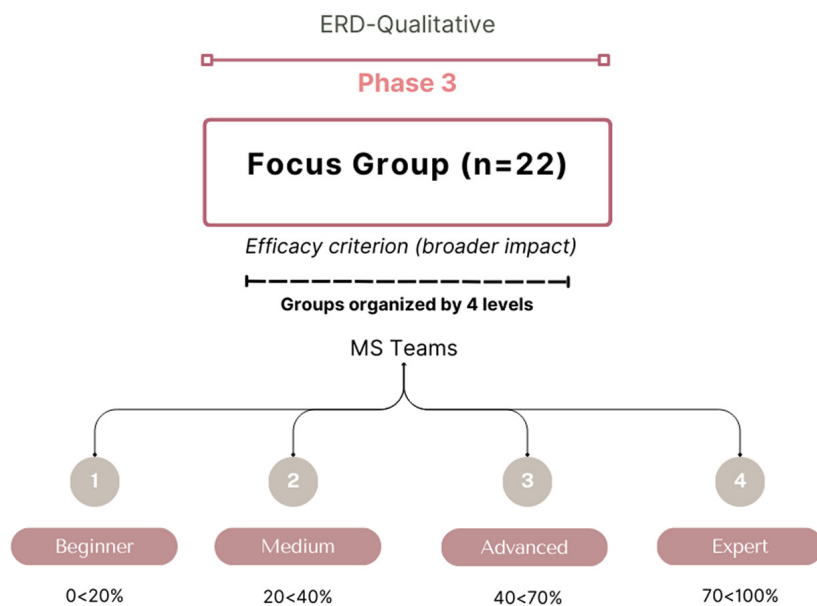


Fig. 4. Distribution of the participants of the focus group

The four focus groups were conducted using the official video-conferencing tool of Rovira i Virgili University, MS Teams. Below is the breakdown of the four focus group categories and the specific purposes that each aimed to address.

- Use of mobile devices in the classroom: Identify how teachers incorporate mobile devices in the classroom, the key educational applications and purposes for their use, and understand the benefits they perceive from integrating this technology into the teaching-learning process.
- Competencies of teachers in utilizing mobile devices: To enhance teachers’ competence and skills in using mobile devices, investigate the sources from which they

- acquired these competencies, pinpoint areas for additional training, and recognize the challenges they encounter integrating them into their teaching practices.
- Self-evaluation tool for designing activities in mobile learning: Assess the effectiveness of the self-assessment tool and consider its impact on designing and implementing educational activities on mobile devices. Additionally, explore teachers' willingness and perceptions regarding the potential reuse of the self-assessment tool in future teaching practices.
 - Innovation project on mobile devices "Pla Mòbils.edu": The aim of this project is to understand teachers' perceptions of the teaching innovation project "Pla Mòbils. Edu," initialized by the Department of Education. The study seeks to identify the advantages they have recognized, pinpoint areas for potential improvement, and grasp their perspective on the long-term viability and sustainability of the project.

Table 2 details the distribution and purpose of the questions asked during the focus groups. This breakdown aims to ensure a clear understanding of the dimensions explored and the specific objectives of each segment of the discussion.

Table 2. The distribution and purpose of the questions of the focus group

Criteria_Labels	Purpose
Use of mobile devices	<ul style="list-style-type: none"> • Q1. Establish the background and experience of the participants.
Competences of teachers with the use of mobile devices:	<ul style="list-style-type: none"> • Q2. Determine the frequency of use of mobile devices in the classroom. • Q3. Know the main uses of mobile devices in the educational context. • Q4. Identify the perceived advantages of the use of mobile devices in education. • Q5. Assess the level of competence in the use of mobile devices. • Q6. Identify key mobile-related skills acquired. • Q7. Know the sources of training and learning on mobile devices. • Q8. Determine the need for further training. • Q9. Identify challenges and difficulties in the educational use of mobile devices. • Q10. Assess the perception of effectiveness in the use of mobile devices. • Q11. Know the most commonly used tools and applications.
Self-Evaluation Tool for the Design of Activities in Mobile Learning	<ul style="list-style-type: none"> • Q12. Determine whether teachers have previous experience with similar self-assessment tools in the context of mobile activity design. • Q13. Evaluate the perceived usefulness of the features proposed in the self-assessment tool for the design of activities with mobile devices. • Q14. Identify which of the elements proposed in the tool are considered to be more challenging or difficult to implement by teachers. • Q15. Know the main difficulties and challenges facing teachers when designing educational activities with mobile devices. • Q16. Assess teachers' perception of the alignment and ease of integration of the self-assessment tool into their daily pedagogy and practices. • Q17. Determine whether the tool has encouraged motivation and innovation in learning new methods, techniques, or teaching aspects related to mobile learning. • Q18. Evaluate the willingness and perception of teachers to reuse the self-assessment tool in future teaching practices. • Q19. Evaluate teachers' perceptions of the potential utility and benefit of the tool for a wider teaching audience. • Q20. Get concrete examples of mobile learning activities designed by teachers, offering a practical view of their implementation. • Q21. Know the transformations and changes perceived in the teaching-learning process as a result of the implementation of the mobile application.
Innovation project on mobile devices "Pla Mòbils.edu":	<ul style="list-style-type: none"> • Q22. Assess the overall satisfaction and perception of the "Pla Mòbils" project. • Q23. Know the main perceived benefits of the project. • Q24. Identify areas for improvement or project challenges. • Q25. Determine the perception of project continuity and sustainability.

Through these questions, we aim to gain a comprehensive understanding of the current status of integrating mobile devices into teaching practices. This includes exploring the level of adoption, pedagogical practices employed, teacher competencies developed, and challenges encountered in this process.

It is essential to note that the collection and processing of data in this investigation have been carried out in compliance with current regulations on the protection of personal data. The ‘Basic Guide for Researchers on Personal Data Protection’ of 2020, provided by the Office of Coordination and Advisory on Security and Data Protection of the University of Rovira and Virgili (URV), has been followed. This guide offers guidance and instructions to ensure compliance with Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016, as well as Organic Law 3/2018 of 5 December, on the protection of personal data and the guarantee of digital rights.

3 RESULTS

This section contains the results of the concluding Phase 3, which are associated with specific goal 2. This goal focuses on developing, executing, and assessing an educational intervention that utilizes mobile technologies to enhance teaching and learning procedures. The following Tables 1–4 present the results of the focal groups carried out with the participants in four groups, based on their scores from the self-evaluation tool, each lasting one hour [4, 10]. The data is presented in the following categories: 1) Use of mobile devices; 2) Teachers’ competences with mobile device use; 3) Self-evaluation tool for the design of mobile learning activities; and 4) Educational project ‘Pla Mòbils.Edu.’

In relation to category 1 ‘Use of mobile devices,’ Table 3 identifies how teachers incorporate mobile devices in the classroom and how they perceive their integration into teaching and learning processes.

Table 3. Category 1 of the focus group: Use of mobile devices

Item 1	Key Ideas
Focus Group 1: Beginner	<ul style="list-style-type: none"> • Teachers consider using mobile devices on a daily basis. They point out the “Chromebook” as a device. • The reasons for use are for gamification, interactive presentations, solving real problems.
Focus Group 2: Medium	<ul style="list-style-type: none"> • They affirm a frequent use of mobile devices, together with an integration of technology in teaching, and highlight the use of tablets and Chromebooks. • They use the devices for information search, recordings, usefulness in mathematics, programming, and for the design of academic content.
Focus Group 3: Advanced	<ul style="list-style-type: none"> • They determine the frequent use of mobile devices, whether Ipads, Chromebooks or any other device for mathematics, robotics, physical education, among other subjects. • Use of tablets instead of books. • Use of mobile devices for specific tasks, for communication, and adaptation to the needs of the group.
Focus Group 4: Expert	<ul style="list-style-type: none"> • They claim to have a daily and essential use in their teaching, making a pedagogical use and management. • They consider mobile devices as a powerful tool. • They have sufficient experience in technologies and make a systematized use of mobile devices in the center.

In relation to category 2, competences with the use of mobile devices in education, Table 4 identifies how they perceive themselves with mobile devices, identifies areas for further training, and discerns the challenges they face in their pedagogical use.

Table 4. Category 2 of the focus group: Teachers' competencies with the use of mobile devices in education

Item 1	Key Ideas
Focus Group 1: Beginner	<ul style="list-style-type: none"> • Need for constant training as they express improvements after training. • Teachers feel the need to establish clear rules for integration. • Difficulty in planning and selecting materials as they need to spend a lot of time. • Evaluation is still a challenge. • They determine advantages with Mobile Learning versus traditional learning.
Focus Group 2: Medium	<ul style="list-style-type: none"> • Teachers feel that training and self-learning are essential for teachers to keep up with technology trends. • Although teachers are in constant training in the use of technology, they perceive that there is a gap between them and the students. Students may be more familiar with mobile devices, but they do not necessarily have an in-depth knowledge or proper use of it. • The ability to monitor and control what students do on their devices is a challenge highlighted by teachers.
Focus Group 3: Advanced	<ul style="list-style-type: none"> • Adaptation and evolution in the use of mobile devices. • Evaluation as the main challenge. • Appropriate integration of mobile technology in teaching.
Focus Group 4: Expert	<ul style="list-style-type: none"> • Teachers consider mobile devices as another tool in their practice and see their integration as essential. • Training has helped to reflect and improve, but the educational environment in general has also contributed to professional growth. • Integration is seen as natural given the prevalence of technology in society, but it must be done with care and reflection.

In relation to Category 3 tools for the design of activities using mobile devices, three teachers' perceptions of the effectiveness of these tools and how they could influence the design and execution of educational activities with mobile devices. Additionally, it explores teachers' willingness to reuse the self-assessment tool in future teaching practices (see Table 5).

Table 5. Category 3 of the focus group: Self-assessment tools for the design of activities using mobile devices

Item 1	Key Ideas
Focus Group 1: Beginner	<ul style="list-style-type: none"> • Teachers found the self-assessment tool useful as a checklist to evaluate and improve the design of their activities. • Evaluation was identified as one of the most challenging aspects of designing activities with mobile devices.
Focus Group 2: Medium	<ul style="list-style-type: none"> • Teachers believe that it would be beneficial for other colleagues to have access to the tool. • Positive evaluation of the feedback provided at the end of the completion of the tool.
Focus Group 3: Advanced	<ul style="list-style-type: none"> • Teachers value the self-evaluation tool not only as a checklist, but also as a guide for reflection and continuous improvement. • There is an emphasis on the need to integrate the tool with other pedagogical practices and teaching strategies. • They identify how the tool has helped them identify specific areas for improvement in their activity design. • They consider that they have improved and their score would be much higher.
Focus Group 4: Expert	<ul style="list-style-type: none"> • Similar previous tools with another similar but not specific Mobile Learning tool. • They value positively the "checklists," as they consider them exhaustive and useful for reflection and design. In addition, they believe that these can be useful not only for them, but also for their students. • Availability of the tool in an open way for everyone, as they consider it concise and effective. They also appreciate that it is not tedious and provides a clear understanding of whether an activity is competent or not.

In general terms, the highlighted tool is discussed:
Similar previous tools:

- Participant: “I had no knowledge of this particular topic; well, I’ve never had one for mobile devices. On other topics, if, within the network of basic competences, there is a tool that serves to validate whether a proposal or a teaching unit is competential or not. But from Mobile Learning, not exactly.”

Assessment of the tool:

- Participant: “I like these checklists very much. The one we did specifically for mobile was very comprehensive and inspired me.”
- Participant: “Through self-assessment, I was able to identify certain aspects of my activities that were missing, for example, I realized that I was not considering student diversity in my activity design.”
- Participant: “I too. These seem to me a good idea to take everything into account. And then be aware of everything we have achieved so far.”
- Participant: “The tool has given me a more structured perspective on how to plan and evaluate my activities.”

Availability of the tool:

- Participant: “Of course. I think so because first it is concrete and goes more to the grain than the others we have. It’s very specific.”
- Participant: “I think it would be beneficial to open the tool to the educational community, which we talked about, for all teachers who want to use it in the design of activities with mobile devices.”

Auto feedback:

- Participant: “Yes, because now you do it yourself with these checklist tools we have. You deduce from what’s missing and you notice what you must improve, it’s great, and even if he says, ‘Look, you could improve this’ and he gives some examples.”
- Participant: “Exactly. Always look for points to improve; there is always.”

Design challenges:

- Participant: “For me, the teacher, because when you try to do an activity, you do it yourself, but anyone else must be able to do it. Then it is very difficult to put in writing what the teacher really needs to do.”
- Participant: “I always find it challenging to evaluate activities, especially when it comes to mobile activities.”

Innovation and motivation:

- Participant: “At its time, when we passed it, as we were not yet confined, it made us reflect in advance and look, mentally already prepared us for what was coming, didn’t it?”
- Participant: “Totally. I’ve seen wonders from teachers who say this would not move even with wheels and super fluidly digitally when it’s necessary. Really, humans are the necessity.”

And finally, in relation to category 4, educational Project, 'Pla Mòbils.EDU,' Table 6 identifies teachers' perceptions of the teaching innovation project, advantages, and improvements identified, such as the viability and sustainability of the project in the long term.

Table 6. Category 4 of the focus group: Educational Project 'Pla Mòbils.EDU'

Item 1	Key Ideas
Focus Group 1: Beginner	<ul style="list-style-type: none"> • Change in the perception of mobile devices from adversaries to allies in the educational process. • Challenges associated with the regulation and integration of mobile devices in the educational environment.
Focus Group 2: Medium	<ul style="list-style-type: none"> • Change of vision and adaptation to the new methodology that incorporates technology. • Knowledge of the potential of technological tools and the need to adapt to the new ways of searching and learning. • Need for additional training, especially in evaluation and adaptation of digital competencies.
Focus Group 3: Advanced	<ul style="list-style-type: none"> • Need for training in data protection and security. • Challenges of training the center with different educational levels and stages. • Need for exchange and learning spaces between teachers working with mobile devices.
Focus Group 4: Expert	<ul style="list-style-type: none"> • Value of putting in writing and structuring ideas related to the use of technology. • Importance of sharing and explaining technological practices and projects with the center. • Need to consider students, families and the university in educational projects related to mobile devices.

Each level has unique characteristics and priorities regarding your training needs and your familiarity with mobile devices. Figure 5 below outlines the main results obtained from the four focus groups and the progress in the perception and use of the self-assessment tool.

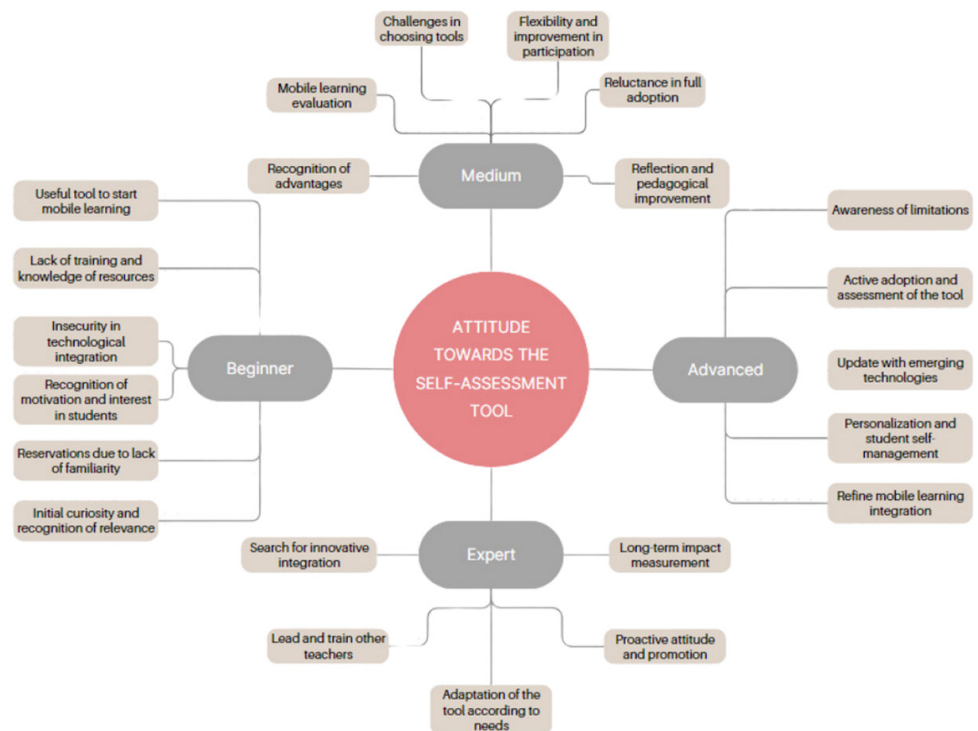


Fig. 5. Outline of focus group results

Beginner educators aim to develop essential competencies for using technology. Their primary focus is on the management and utilization of mobile devices in education, with a specific emphasis on their functionality. Intermediate educators, on the other hand, are already familiar with technology and are looking to adapt their teaching methods. They recognize the importance of transitioning from traditional approaches to methods more suitable for the digital age. Advanced educators proficiently use technology and actively seek to share knowledge and insights with others. They also address specific challenges, such as managing mobile devices. Expert educators have a comprehensive understanding of integrating technology in the classroom. They delve into advanced topics such as privacy, security, and teaching strategies tailored for mobile devices. Moreover, they emphasize the importance of collaboration among institutions and the connection between educational levels, such as schools and universities.

4 CONCLUSIONS

The findings from the data obtained through the focus groups are presented below, providing a holistic understanding. The central purpose of this research was to analyze how a self-assessment tool could assist teachers in the multifaceted teaching-learning processes associated with the use of mobile devices. In relation to the overall objective of the study, the findings suggest that optimal conditions include tools such as the self-assessment presented. Thus, responding to the central question of phase 3 of the research: can a self-assessment tool help teachers' guide and design mobile learning activities? Teachers indicate that self-assessment can guide them in the design of pedagogical activities and can be a valuable tool for evaluating and reflecting on their practices. This tool not only provides structure and guidance for teachers but also has the potential to improve effectiveness in the design and implementation of mobile learning activities, aligned with the specific objective of Phase 3 of the research. Through the detailed exploration of teaching perspectives, we can conclude from the different criteria of the focus group that:

- Use of mobile devices: The integration of mobile devices in the educational process is not just a technological issue also a deeply pedagogical one. Merely using technology does not ensure an enhancement in the quality of education; it is the pedagogy supporting that use that dictates its success or failure. This conclusion underscores the primarily aim of the research: to comprehend how and why teachers incorporate mobile devices into their teaching.
- Competence of teachers with mobile devices: Beyond technical proficiency, there is a hidden need for pedagogical training in the use of mobile devices. Mastering a tool does not automatically ensure its effective implementation in the classroom.
- Mobile learning activity design self-assessment tool: The perceived value of the mobile activity design self-assessment tool highlights the importance of providing teachers with resources to help them reflect on their practice and adapt it to current demands. For teachers, the tool has been effective in its purpose, and they not only consider it valuable in terms of self-assessment and reflection, but also see its potential as a shared resource for the educational community. This perception underlines the importance of providing teachers with practical tools that respond to current demands in the educational field, especially in the context of mobile education. Each level of mobile learning experience presents its own challenges. Beginners a lack of training and resources and feel insecure about how to integrate technology into the classroom. Middle-level teachers focus on

how to choose the right tools and how to effectively evaluate mobile learning. Advanced individuals face challenges related to keeping up to date with emerging technologies and how to effectively integrate them. Finally, experts face more advanced challenges, focusing on how to lead and train other teachers and how to measure the long-term impact of mobile learning. Despite the challenges, there are also perceived benefits at each level mainly see the motivation and interest of the students. Middle-level teachers value flexibility in teaching and learning and note an improvement in student participation. Advanced educators appreciate the personalization of learning and the promotion of student self-management. Experts see a complete transformation of the educational process, with deeper and more meaningful learning.

These findings also highlight how the adoption of mobile technologies in education can significantly contribute to the achievement of SDG 4 (quality education) by facilitating access to inclusive and quality education for all. Strategic use of mobile technologies, supported by an effective self-assessment tool, can help overcome geographical and socio-economic barriers, providing equitable learning opportunities. The integration of these technologies also aligns with SDG 9 (industry, innovation, and infrastructure) by promoting educational innovation through the development of resilient digital infrastructures. This approach not only prepares students for the challenges of the future but also promotes the adoption of innovative pedagogical practices among teachers. Furthermore, the study underlines the relevance of SDG 10 (reducing inequalities), demonstrating that mobile technology can be a powerful tool for reducing inequality in education. Teachers can contribute to a more inclusive and equitable educational environment by personalizing learning and adapting educational resources to each student's needs, ensuring that no one falls behind. The conscious implementation of mobile technologies in the educational process, therefore, not only improves the quality of education but also promotes equality, inclusion, and innovation, which are fundamental aspects of global sustainable development.

In the conclusion of our study, we addressed the question of whether there a consensus on the usefulness of self-assessment tools in the design of mobile learning activities, considering the perspectives of teachers at different stages of digital competence. Our findings suggest that the perception of the usefulness of these tools varies significantly depending on the level of experience and competence of teachers with mobile learning. Teachers evaluate these tools at different levels of competition.

- **Beginner:** Teachers in the early stages of adopting mobile learning perceive the self-assessment tool as extremely useful. It provides a structured guide and an essential reference framework for starting to integrate mobile learning into educational practices.
- **Medium:** At this level, the tool is considered a valuable resource that facilitates reflection on pedagogical practice and promotes continuous improvement. It enables teachers to identify both their strengths and areas of development, enriching their approach to mobile learning.
- **Advanced:** While the tools have their usefulness for teachers with an advanced level of competence, their function is transformed into a resource to refine and enhance the integration of mobile learning in the classroom. Educators at this level often have well-defined goals and strategies, but they use the tool to confirm or adjust their pedagogical approaches.
- **Expert:** For experienced teachers, the tool remains beneficial, but there is an interest in adapting and customizing it to their specific needs. These teachers have a

clear vision of their educational goals and perceive opportunities to improve or customize the tool, thus maximizing its relevance and effectiveness.

These findings underline the importance of self-assessment tools as flexible and adaptable supports in the design of mobile learning activities. They also emphasize the need to customize these tools to meet the diverse needs of teachers at different stages of their professional development, ensuring their relevance and effectiveness in promoting mobile learning in the classroom.

Through the focus groups, teachers, regardless of their level of experience, recognize the value of mobile technologies in the classroom. This perception is in line with the findings of [26], which argue that mobile technology can enhance the learning experience by offering opportunities for personalized teaching and collaborative learning. One notable discovery is the variation in the adoption and perception of mobile tools based on the teacher's experience level. Novice teachers seek structure, while experienced teachers seek opportunities to lead and share [27]. These differences align with Rogers' [28] theory of technological adoption, which suggests that individuals progress through various stages in their adoption of technology, from awareness to integration, and ultimately innovation. Furthermore, the self-assessment tool, the focus of this study, received overall positive feedback. This is consistent with the literature emphasizing the significance of self-assessment and reflection in the teaching process [25, 29, 30]. As we transition to the "middle" level, there is a diversification in technology use. Teachers not only utilize mobile devices for specific tools but also for pedagogical methodologies such as project work. Here, technology is perceived not only as a supplementary tool but as an essential element in certain pedagogical practices. The 'Advanced' and 'Expert' levels showcase a complete and systematic adoption of technology. Teachers view mobile devices not only as pedagogical tools but also as essential tools for management and communication in the educational realm. At this stage, it aligns with the Substitution Augmentation Modification Redefinition (SAMR) theory proposed by [31], where technology can revolutionize educational practices to completely redefine them.

Innovation project on mobile devices "Pla Mòbils.edu": The positive feedback on the innovation project "Pla Mòbils.Edu" [13], promoted by the Department of Education in Catalonia, Spain, within the research is framed, suggesting that structured and well-designed initiatives are essential to effectively integrating technology into education. This reinforces the initial idea that training and continuous support are crucial. Teachers have received follow-up, training, and technical support. They have expressed the need for more opportunities and spaces to share experiences and ideas.

In summary, the analysis also highlights the importance of training and institutional support in the adoption of technologies. At the most advanced levels, teachers mention institutional projects and specific training, emphasizing the need for a systemic approach for effective technological integration [32, 33].

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