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RESEARCH

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PROMOTION OF *MOBILE LEARNING* IN EDUCATION AROUND THE LAST DECADE. A CASE STUDY IN SPAIN THROUGH A SELECTION OF CONTRIBUTIONS

Fomento del mobile learning en educación alrededor de la última década. Un estudio de caso en españa través de una selección de aportaciones

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ABSTRACT

At present, ICTs have inevitably led to the use of mobile devices in the classroom and in particular the mobile phone as an educational tool. Literature has been developed for years and educational projects and activities that promote it have been carried out. It is one of the emerging educational methodologies that has been increasing gradually, it is integrated timidly into the school and, in some cases, with certain prejudices about its use. The following paper deals with the development of Mobile Learning or Mobility Learning in the second decade of the 21st century in the Spanish State. We give an account of the scientific dissemination that has taken place, according to some authors, and specifically of doctoral theses published in recent years. We analyze support for this new educational paradigm through organizations such as Unesco, *Fundación Telefónica*, as well as through scientific meetings and International Symposiums on the prospects for implementation. We also review the most prominent data regarding the Horizon Report, focusing mainly on higher education. The methodology used in this work has been the analysis of content from the qualitative research perspective, based on the description and interpretation of the sources consulted. Finally, we offer a point of view on what is currently the educational contribution of mobile devices within the Mobile Learning methodology.

KEYWORDS: Mobile Learning – educational organizations – educational projects – mobile devices – ICT – smartphones.

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RESUMEN

En la actualidad educativa las TIC han propiciado de manera inevitable el uso de los dispositivos móviles en el aula y en concreto del teléfono móvil como herramienta educativa. Desde hace años se desarrolla literatura al respecto y se han llevado a cabo proyectos y actividades educativas que lo promocionan. Se trata de una de las metodologías educativas emergentes que ha ido en aumento paulatinamente, se va integrando en la escuela tímidamente y, en algunos casos, con ciertos prejuicios sobre su uso. El siguiente escrito aborda el desarrollo del *Mobile Learning* o Aprendizaje en Movilidad en la segunda década del siglo XXI en el Estado Español. Damos cuenta de la divulgación científica acontecida, según algunos autores, y en concreto de tesis doctorales publicadas en los últimos años. Analizamos el apoyo a este nuevo paradigma educativo a través de organismos como la Unesco, Fundación Telefónica, así como mediante reuniones científicas y Simposios Internacionales sobre las perspectivas de implementación. También revisamos los datos más destacados respecto al Informe Horizon, centrándonos principalmente en la educación superior. La metodología utilizada en el presente trabajo ha sido el análisis de contenido desde la perspectiva investigadora cualitativa, a partir de la descripción e interpretación de las fuentes consultadas. Finalmente, ofrecemos un punto de vista sobre cuál es en el momento actual la aportación educativa de los dispositivos móviles dentro de la metodología *Mobile Learning*.

PALABRAS CLAVE: *Mobile Learning* – organismos educativos – proyectos educativos – dispositivos móviles – TIC – *smartphones*.

PROMOÇÃO DO *MOBILE LEARNING* NA EDUCAÇÃO POR VOLTA DA ÚLTIMA DÉCADA. UM ESTUDO DE CASO NA ESPANHA ATRAVÉS DE UMA SELEÇÃO DE CONTRIBUIÇÕES

RESUMO

Na atualidade educativa as TIC têm promovido de forma inevitável o uso dos dispositivos móveis nas aulas e em específico o telefone celular como ferramenta educativa. Por anos se desenvolve literatura ao respeito e foram realizados projetos e atividades educativas que o promovem. Trata-se de uma das metodologías educativas emergentes que tem aumentado gradualmente, que vai se integrando na escola timidamente e, em alguns casos, com certos preconceitos sobre seu uso. A seguinte escrita aborda o desenvolvimento do *Mobile Learning* o Aprendizado em Mobilidade na segunda década do século XXI no Estado Espanhol. Mostramos a divulgação científica que aconteceu, segundo alguns autores, e concretamente em tese de doutorado publicadas nos últimos anos. Analisamos o apoio a este novo paradigma educativo através de órgãos como a Unesco, Fundação Telefônica, assim como através de reuniões científicas e Simpósios Internacionais sobre as perspectivas de implementação. Também verificamos os dados mais destacados no que diz respeito ao Informe Horizon, concentrado principalmente na educação superior. A

metodologia utilizada no presente trabalho foi a análise de conteúdo desde a perspectiva de pesquisa qualitativa, a partir da descrição e interpretação das fontes consultadas. Finalmente, oferecemos um ponto de vista sobre qual é o momento atual da aportação educativa dos dispositivos móveis dentro da metodologia *Mobile Learning*.

PALAVRAS CHAVE: *Mobile Learning* – órgãos educativos – projetos educativos – dispositivos móveis – TIC – *smartphones*.

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1. INTRODUCTION

In this section, we include, in the first place, in what situation M-Learning finds itself at the educational moment in which this analysis is approached. We have reviewed different studies published in the Spanish State regarding the implementation of this methodology in the environment of formal education. The contributions of other authors (Brazuelo & Gallego, 2011) who have worked on the publications made about Mobile Learning years ago, serve as the basis and starting point for this contribution. With the progressive establishment of portable technology and the improvement in connectivity, there is a parallel increase in experiences and publications on M-Learning, mainly in the last five years.

In the Spanish State, we distinguish authorities in this topic, among which stand out: Brazuelo and Gallego, (2011); Camacho, M. (2011); Castaño, C. and Cabero, J. (2013); Santiago, R., Amo, D., Díez, A. (2014); Santacana, J., and Coma, L. (coords.) (2014). On the other hand, abroad, we point to: Sharples, M., Taylor, J. & Vavoula, G. (2005); Laouris, Y. & Eteokleous, N. (2005); Traxler, J. (2009); Rinaldi, M. (2011).

1.1. *Mobile learning* in education

The reality of *M-Learning* would not be possible without the technological element that has expanded in a faster way, stoically taking root in today's society: the smart mobile phone. The INE report regarding the penetration of mobile telephony in Spanish households in 2009, stated that 93.5% had this service, surpassing 80.3% of households with a landline telephone. Instead, the same report in its 2018 proposal, analyzes that 97.4% have a mobile phone in their homes and 77.6% have a landline

phone. Worldwide, Unesco confirms the existence of more than six billion subscribers. At this point, the number of users who access the internet via a mobile phone is higher than from a computer. According to the ITU, the United Nations specialized agency for ICT, the number of Internet connections in the 200 biggest cities in the world will multiply by 30 in 2016. Around 2.7 billion people surf the net, of which 2.100 million do it by mobile broadband. These data support and confirm our interest in studying the introduction of mobile learning in education. Even more, if we take into account, citing data from Ofcom (independent regulator for the communication industries in the United Kingdom), that 99% of people between 15 and 24 years old (interval in which a high percentage of our students are included) have access to a mobile phone. We are talking about the highest penetration rate of any age group. In 2011, the Network Training Observatory, SCOPEO, addressed the Monograph: *M-Learning* in Spain, Portugal, and Latin America. This concluded that mobile phones (and similar devices) exert a huge influence not only on the learning paradigms but mainly on the entire repertoire of agents and related parameters. Therefore, sociological and educational issues will have to be approached at large, not just technological ones. In Spain, M-Learning was in an incipient phase in 2012, but it was on the rise in the general education field and, specifically, in the university one. The Horizon Report already in 2012 considered it one of the methodologies that would have the greatest impact in subsequent years. The studies carried out annually by the Cegos Observatory (a global consulting, training, and selection services firm that operates in more than 28 countries in Europe, America, and Asia) can serve us as a reference to contrast statistical data in relation to the training of European workers in 2013 and the methodologies used. The latest study shows that methods evolve rapidly. If in 2010 only 8% received training through the mobile terminal, three years later 35% were already trained with this modality.

As can be seen from this information we are in front of an emerging field that, from our position as art teachers, it's necessary to implement. Educationally speaking if something implies in the present, is change. Technology is destined to change educational paradigms. This is emerging as a magnificent opportunity to abandon toxic pedagogies[2], following the terminology of María Acaso (2009) and update practices consistently with social and technological development (Mascarell, 2012). It is unthinkable to conceive an Education that turns its back on the hyper-visual reality that surrounds us.

It is the demands of the Knowledge Society that impose current trends in education. This is reflected in the Bologna process which requires introducing a series of significant changes in the curricular structure, paying special attention to the ICT, and, of course, to new pedagogical strategies. The use of ICT as a transversal tool is an interesting bet as a means in the application of the curriculum in the classrooms (Botella, Hurtado, and Ramos, 2019). In the I International Symposium on

[2] Terminology that María Acaso coined to designate teaching methods that are harmful to students, which contribute to diminishing interest, motivation, and the learning result.

mobile learning that took place in Cordoba in February 2014, those considered as the ten current educational trends in the opinion of Susan Patrick (president and executive director of INACOL, International Association for Online Learning) were presented. It is verified that they conform to everything that mobility teaching entails. In fact, we pay attention to the tenth proposal:

1. Learning by competencies.
2. Personalization of learning strategies.
3. E-Folio. Study or personalized learning map.
4. Digital learning.
5. *Blended Learning* (semi-face-to-face). Control of their learning.
6. Bridges between formal and informal learning.
7. Adaptive learning to particular needs and interests.
8. Recognition of efforts-award.
9. Connecting community resources. The teacher as a "coach".
10. *Mobile Learning*. A methodology that brings together all the previous trends.

The educational repercussions of mobile learning are specified in each of the aforementioned trends. If we try to summarize and conclude what the key point is, we refer directly to the context. Vavoula and Sharples (2008) confirm that mobile learning is not only that ease thanks to mobile technologies, but also involves "processes of getting to know through conversations and explorations across multiple contexts" (Vavoula and Sharples, 2008: 1). Mobile learning allows contextualizing the process in the broadest sense. The contextualization will be carried out at different levels and, in this sense, it will be understood as a synonym of personalization of the teaching-learning process, in which the student participates directly and, in which the possibility of mobility has an extraordinary relevance. We defend this option as an ideal platform to complement training, manage knowledge, and support students, regardless of the type of modality implemented. Now, it gives way to a new scenario, without ignoring that in this way the borders between formal and informal learning begin to blur. Learning through Web 2.0 is also informal learning, now with Web 5.0, people learn through exchange and collaboration in virtual environments. It is an issue that experts on the topic do not consider a negative consequence. Jay Cross (2006), recognized worldwide as a leader in Informal Learning, highlights that informal learning is considered as more personalized. The student can choose the subject and on many occasions decides how and where to learn it. This learning can be exercised only with other people and in non-formal educational contexts. We have to be aware that a large part of knowledge acquisition situations occurs outside the academic field, informally. Why not also take formal educational actions to spaces outside the classroom, favoring learning in real contexts?

2. OBJECTIVE

This study has influenced the research to collect, analyze, and refer relevant documents about *Mobile Learning* by certain institutions and reports, which support its educational application and lead to its evolution.

3. METHODOLOGY

The methodology carried out is based on the analysis of qualitative information or content. This method involves the review of relevant literature, the extraction of information for subsequent analysis, and the evaluation of it. The result implies the collection of outstanding ideas from the documents, to express the result of the content without indeterminacies (Solís Hernández, 2003). Likewise, the description and interpretation of the literature under analysis becomes the essence of the research (Bardín, 2002).

Along this line, a significant literature prospecting has been carried out. After a previous analysis, part of the information has been discarded and the one that is more related to the aims of the work has been selected, focused on the evolution of the literature on the educational aspect of *Mobile learning* and the support of certain institutions relevant to the approach to learning in mobility.

Due to the wide extension that the proposal could cover and the evident limitations of this work, we have briefly collected the aspects of greatest interest and their evaluation.

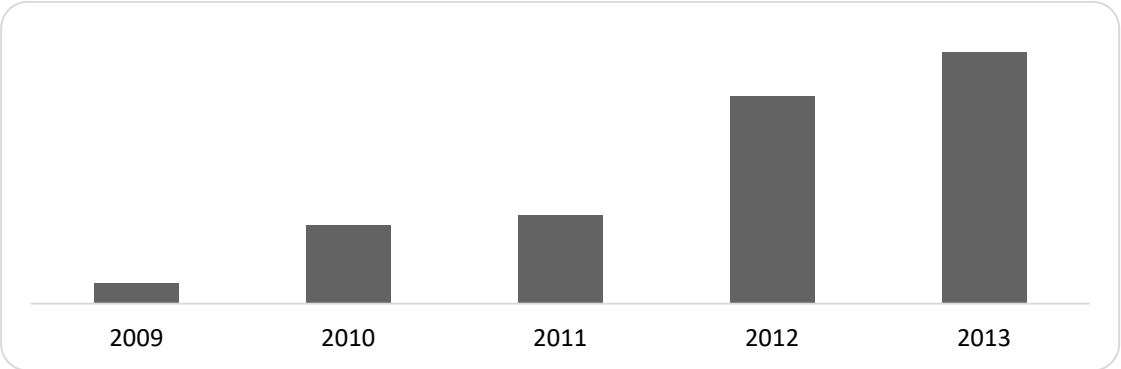
3.1. Analysis of the convergent literature in the promotion of mobile learning

a. Convergent literature in relation to the scientific production and doctoral theses defended on *Mobile Learning* in the Spanish state between 2009 and 2017.

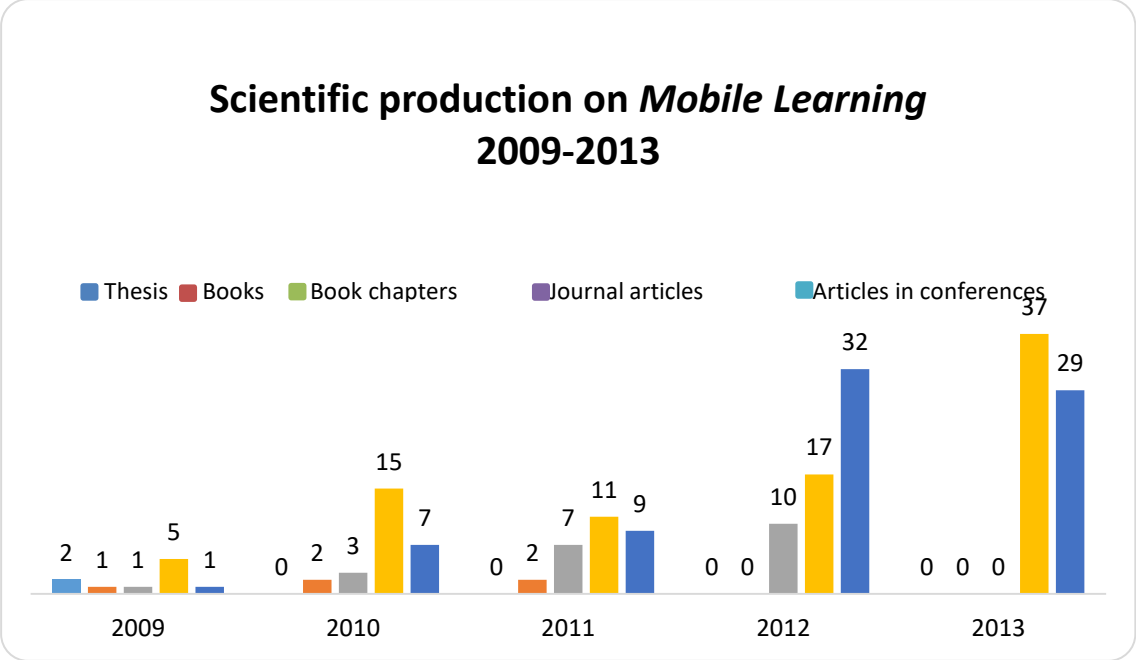
Regarding M-Learning educational experiences from the arts fields, the most significant worldwide paradoxically have been framed in areas of knowledge far from the actual education in the arts, being few the referents with scientific validity to which we can turn. However, we consider that, from the visual perspective, the production of images through the capture with the camera of mobile phones, collaborates in the learning of the visual arts. The purpose of making a critical reading and a reflective analysis of visual production, within the framework of a didactic approach, helps to promote divergent thinking from a creative point of view. Educational activities made through images generated by students, future teachers, based on social problems, are of special interest to promote the acquisition of social commitment in students as social agents. (Mascarell, 2013, 2017, and 2019).

Within the state context, Brazuelo and Gallego are some of the national reference authors who have made contributions to the methodological dissemination of learning in mobility. In 2014 they published, in Educar em Revista (Brazil), a scientific article where the situation of Mobile Learning in the Spanish State is made clear from a descriptive review study of national scientific production between 2009 and 2013. The results denote an intensified interest in the establishment of theoretical principles and experimentation for the incorporation of mobile technologies in

education. According to the authors of the scientific production, 15% corresponds to doctoral theses; 2.5% to books or *eBooks*; for book chapters 11%; 44.5% are journal articles, and 41% are articles on scientific events as conference proceedings.



Graphic 1: Evolution of the total scientific production on *Mobile Learning*, between 2009 and 2013, in the Spanish State.
Source: Brazuelo and Gallego (2014).



***Graphic* 2.** Detailed scientific production on *Mobile Learning* between 2009-2013 in the Spanish State.
Source: Brazuelo and Gallego (2014).

The inquiries made by Brazuelo and Gallego allow us to classify, in another table (Table 3), the thematic axes of scientific production in *Mobile Learning*. We verify that it is the mobile phone the technological element with which the theoretical

foundation began to be implemented in 2009; but two years later, in 2011, its use is already widely exceeded by digital tablets. In terms of developed experiences, most of them are clearly focused on apps or applications, which enjoy great social popularity, and the expansion of which has been spectacular since 2013, followed by studies focused on augmented reality.

Table 1. Thematic axes of the content of scientific production of *Mobile Learning* in the Spanish State (2009-2013).

Thematic axes of scientific production on *Mobile Learning* in the Spanish State by years	**2009**	**2010**	**2011**	**2012**	**2013**	**Total**
Theoretical foundation and divulgation	2	13	11	25	24	76
Mobile phone/ smartphone	2	4	3	3	3	14
Digital tablets/ *iPad*	0	0	2	11	11	24
SMS	0	1	0	0	0	1
Podcast	1	2	6	1	4	14
Social media	1	1	0	3	2	7
Experiences and implementation case studies Augmented reality	0	1	3	7	7	18
QR Codes	0	0	1	5	3	9
Apps	0	1	0	6	20	27
ANNUAL TOTAL	**6**	**23**	**26**	**61**	**74**	**190**

Source: Brazuelo and Gallego (2014).

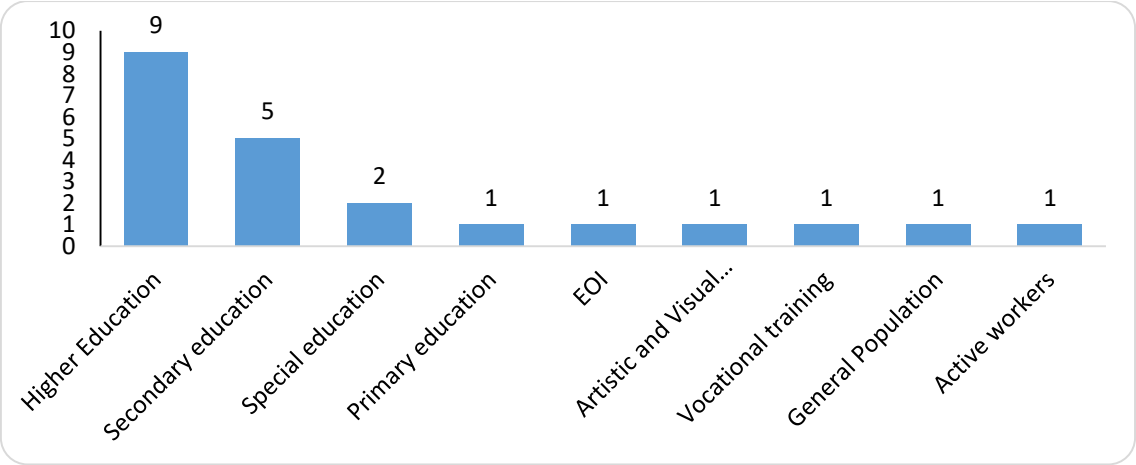
In summary, despite the progressive increase in the technological incorporation of portable devices to the educational field, we were facing an incipient phenomenon, but in constant evolution in terms of studies and research in this regard. At that chronological moment, scientific production was not proportional to the social and educational impact that this technological spill has entailed, but it did result in a path with a wide M-Learning perspective.

On the other hand, we highlight an analysis study of the doctoral research on Mobile Learning in Spain, by the authors: Hinojo, F., Aznar, I., and Romero, J., (2018). The compilation of national scientific studies, in this case, doctoral theses, on this topic related to education is of interest. The publication gives an account of twenty-two doctoral theses defended in the Spanish state between 2011 and 2017. The objective is to divulge the real impact of mobile devices on the learning of students at different educational levels. Among the results, the variety of teaching fields that are the object of interest of doctoral research in Spain, the diversity of objectives in research on mobile learning, and the methods used to obtain the information stand out.

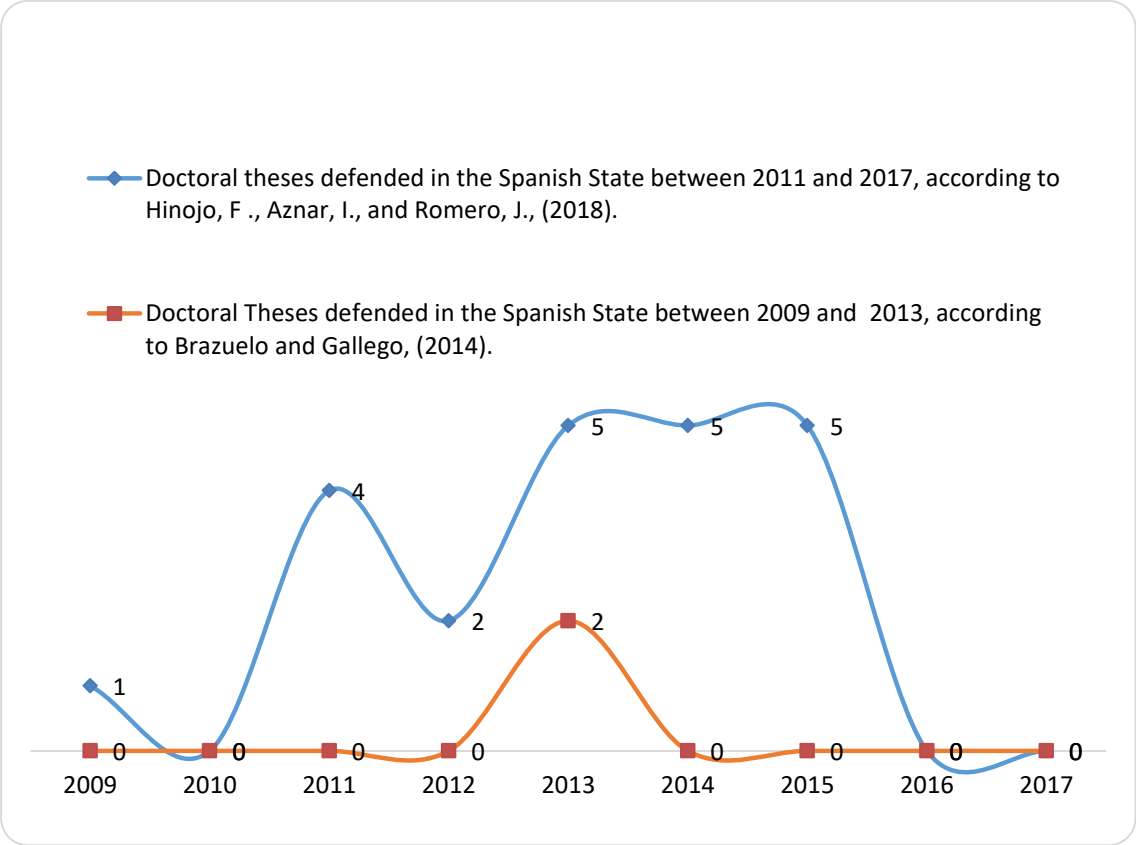
Table 2. The number of theses on *M-Learning* defended in the Spanish state between 2011 and 2017 by university of origin.

Theses defended *M-Learning* in the Spanish State	**University of origin**
3	University of Granada
2	University of La Laguna
2	University of Girona
2	National University of Distance Education (UNED) of Spain
2	University of Salamanca
1	University of Alcalá
1	Polytechnic University of Catalonia
1	Rovira i Virgili University
1	Polytechnic University of Valencia
1	University of Murcia
1	University of Alicante
1	University of Castilla-La Mancha
1	University of Valladolid
1	Complutense University of Madrid
1	University of Extremadura
1	University of Valencia

Source: Self-made, through data of Hinojo, Aznar, and Romero (2018).



Graphic 3. Application context where the doctoral theses on *Mobile Learning* defended in Spain
Source: Hinojo, Aznar, and Romero (2018)



Graphic 4. Comparison by years on the defense of doctoral theses on *Mobile Learning* defended in the Spanish state from 2009 to 2017.
Source: Self-made.

> a) the use of mobile devices improves learning, (b) *Mobile Learning* is a topic of interest in the field of educational research whose trend is increasing, (c) currently higher education is the prevalent stage where mobile learning is applied, and (d) the variability of application scenarios highlights the richness of mobile devices in educational improvement. Hinojo, Aznar, and Romero, (2018: 171).

The same authors of the study also allude to the appreciation of different lines of research about doctoral theses in our country about *Mobile Learning*: learning improvement, skills development, evaluation, user experience, game development, perception about its application, and effect of mobile devices.

The investigation of different informative actions, which in various ways take place or are recently developed in Spain, in charge of pedagogical reference institutions, will allow us an approximation to the reality of the commitment of M-Learning in the nearby educational space. Among the different events that have been held since 2014, we consider it appropriate to refer to the International Symposiums on *Mobile Learning* and *Mobile Word Congress 2015.*

Below, we provide a summary of the International Symposia on Mobile Learning of the years 2014, 2015, and 2017, to which we have attended and contributed scientific contributions.

B. II International Symposium about *mLearning* 2014

Title: Rethinking School and Learning. Mobile Learning.
Cordoba, March, 21st, 22nd, and 23rd, 2014.
Organization: Maecenas Education and Culture Foundation.

An interesting educational reference regarding the educational use of mobile devices. International personalities from the world of education with technological ties intervened. The topics addressed on methodologies such as *Bring Your Own Device* (BYOD) and *The Flipped Classroom* stand out, educational experiences in which work dynamics are inverted and work outside the classroom is promoted to allocate the time of face-to-face classes to the development of more complex cognitive processes that favor meaningful learning. The academic committee concluded by agreeing that technologies can assume the role of promoters of a change of school; however, it is not only a technological change but a methodological one. Among other contributions, they can be very effective for personalizing learning.

I. III International Symposium on M-*Learning* 2015

Title: Designing pedagogical projects for *Mobile Learning:* Keys for learning at school.
Madrid, March 13th and 15th, 2015.
Organization: Maecenas Education and Culture Foundation.

Under the motto related to the design of projects for learning in mobility in schools, the II Symposium on Mobile Learning concluded arguing the need for the school to prepare students to accommodate to the constant change in which they develop their lives: social environment, work, ... The educational world has to apply the same situation of change, among which the technological one stands out, not responding to the product but to the training it offers, promoting adaptability to a flexible and continuous-connection environment.

II. V International Symposium on *M-Learning 2017*

Title: *Mobile Learning* as a tool for the improvement of key elements in education: evaluation.
Valencia, March 31st and April 1st and 2nd, 2017
Organization: Maecenas Education and Culture Foundation.

This V Symposium has stood out for an eminently practical and applied nature of the educational use of mobile technology. The artifacts that have focused the attention almost exclusively have been digital tablets, leaving *smartphones* in the

background. It has supposed a review of the main methodologies that promote the student-centered approach, active, participatory, and productive learning. It is committed to the efficient use of digital technologies. The role of educational Apps in the teaching-learning process in mobility, and their practical incorporation in the classroom, has been recorded. Significantly, a good part of the proposed applications supports image and multimedia learning strategies to increase and promote the understanding of educational content. The visual component comes into play as a powerful facilitating resource for higher-order thinking skills.

The common thread of the Symposium has revolved around the evaluation. Interesting and innovative applications have been presented and disseminated that not only make the task easier for teachers but also try to involve and make students participate in the evaluation system itself. This is the case of the *ClassDojo* app for Infant and Elementary education levels. Lectures by Professors Russell Stannard (*the University of Warwick and the University of Westminster)* and Raúl Santiago (*University of La Rioja*) have had an impact on digital evaluation methods. On the one hand, Stannard presented his pioneering and recognized work on the interaction between teacher and student through copying screens (*print screen*), creating *podcasts,* or video tutorials, all based on the idea of interaction or *feedback*. On the other hand, Santiago provided an interesting dissertation on adaptive or personalized learning. In it, he resorts to gamification, to generate activities, the result of which he collects through representative analytics of individualized learning to motorize the formative evaluation.

Regarding the conclusions, one of the most highlighted points has been the importance of teacher training in digital skills (ICTs). It is considered an obligatory requirement to integrate them into the educational world in the near future.

Table 3. Evolution of the educational topics covered in the International Symposium on M-Learning of 2014, 2015, and 2017.

International Symposium on *Mobile Learning* (Maecenas Foundation)	**Title**
II International Symposium on *Mobile Learning,* Cordoba 2014.	Rethinking School and Learning. Mobile Learning.
III International Symposium on *Mobile Learning,* Madrid 2015.	Designing Pedagogical projects for *Mobile Learning:* Keys for learning at school.
V International Symposium on *Mobile Learning,* Valencia 2017.	*Mobile Learning* as a tool for the improvement of key elements in education: evaluation.

Source: Self-made.

c. Mobile World Congress 2015 and 2019

Barcelona, from March 2nd to 5th, 2015

Organization: *Mobile World Capital Barcelona*

This Congress, which Barcelona has hosted since 2006, encourages the city to take place four days a year in the world's leading showcase for mobile technology. In the educational field, it provides the *mEducation* program. Since 2012, *mSchool* fosters seminars aimed at the educational community, helping students and teachers to integrate mobile technologies in the classroom effectively through updated materials. According to *mSchool*, mobile technology improves collaboration and reinforces the student´s engagement, which encourages the opening of new teaching and learning pathways that favor productivity and employability. Within the *mSchool* program is the *Changing Education Together* (CET) seminar, which this year has held the second edition, focused on the responsible use of mobile devices in education and on sharing work experiences between educational centers that propose learning with mobile technology. Currently, 2019 *mSchools*, with the motto "A new way of teaching and learning". It provides material on educational experiences and applications within the *mSchools* platform on its website. At the same time, it is promoting learning with mobile technology in educational centers in Catalonia. It is in the modality of educational experiences in the classroom with digital technologies, through continuing education awards at the *European Schoolnet* in Brussels and sharing them with European educational centers.

d. Fundación Telefónica, M-Learning 2013,2014, 2015, 2016, 2019

We consider the *Fundación Telefónica* as another means of disseminating the educational use of *Mobile Learning*, contributing a good number of international experiences that promote the divulgation of this methodology.

In 2013, Curalia, the Fundación Telefónica´s portal dedicated to the selection and "curation" of content, methodologies, and activities for the 21st century, launched the "*Mobile Learning Guide*". The main objective is to promote the didactic use of *smartphones* and guide teachers and students in the search for training resources, which are numerous but are poorly organized on the Internet. They justify it by arguing that smartphones have transformed the way we perceive the world and interact in society, adding that this type of device is a didactic complement that will have a fundamental relevance in the teaching processes of the coming years.

In 2014 a publication was made that is immersed in the *Mobile Learning* Laboratory of Fundación Telefónica, entitled: "Social Laboratory. *Mobile Learning*. My mobile at the service of the community: learning and sharing beyond the classroom". The purpose is to propose educational experiences that can be transferred to the classroom, exemplifying the use of mobile technology for educational change. The intention is to promote the effective involvement of students in meaningful projects in their learning process through massive access to mobile devices among adolescents from 12 years of age.

In 2015, in Fundación Telefónica´s website, we found the section "Follow educational trends" and a section dedicated to *Mobile Learning* with a list of educational experiences collected in the form of brief interdisciplinary articles: resources, experiences, ideas to learn and teach with mobile devices in the classroom. We highlight articles dedicated to reducing de "digital gap" in rural communities.

> *Mobile Learning* technology makes sense for children who live in rural areas or areas without many resources, including electricity. A mobile learning device that can be mass-produced, at an affordable price, along with a solar cell charger, can be useful even without the actual ability to connect to the Internet. *Fundación Telefónica*, (2015).

In 2016, another contribution is presented with the title: "If you live it, you share it. How young people communicate in a digital world." A transformation or opportunity for educational change. The potential of mobile devices in the classroom to work activities is considered. They deal with online learning, creative and free use in educational projects, or working from an App. Finally, they point out that teachers are called to lead this change for continuous educational growth.

Currently, in 2019, *Fundación Telefónica* joins Unesco to co-organize and coordinate the *Mobile Learning Week*, the most important gathering on the use of ICT in education through ProFuturo, the International Telecommunication Union (ITU), and the French startup *Skillogs*. The reference topic is "Artificial intelligence in education, opportunities, and challenges for development". Especially applicable to developing countries. It is intended to help improve education and teaching through the introduction of AI, data analytics for decision-making based on *Learning Analytics* in *Big Data*.

Table 4. Summary of *Fundación Telefónica´s* activities and publications regarding *Mobile Learning.* Evolution of various years until 2019.

Fundación Telefónica Most notable publications	**Objectives**
"*Mobile Learning Guide*", 2013.	Promote the didactic use of *smartphones* and guide teachers and students in the search for training resources, numerous but poorly organized on the Internet.
"Social laboratory. *Mobile Learning*. My mobile at the service of the community: learning and sharing beyond the classroom", 2014.	Propose educational experiences that can be transferred to the classroom, exemplifying the use of mobile technology for educational change.
"Follow the educational trends", 2015.	Resources, experiences, ideas to learn and teach with mobile devices in the classroom.
"*Mobile Learning* Guide", 2016.	Transform or give opportunity for educational change. Ubiquitous and online learning. Creative and free use in educational projects.
Co-organizer and Coordinator of Unesco´s "*Mobile Learning week*", 2019.	Artificial intelligence and its ability to improve and enhance the educational field at

	the same time as sustainable development in quality education (ProFuturo).

Source: Self-made.

e. UNESCO, *M-Learning*

The United Nations Educational, Scientific, and Cultural Organization (UNESCO) assumes prospective studies as one of the five main functions of its task. Its purpose is to contribute to finding out ways of education, science, culture, and communication for the world of the future. In this regard, mobile learning or M-Learning is considered a modern method to support the learning process through the use of mobile instruments, including smartphones. According to this organization, mobile learning is becoming one of the solutions to the problems the education sector is facing. For this reason, UNESCO's program of activities is based on a growing number of joint initiatives aimed at studying how mobile technologies can contribute to the achievement of Education for All (EFA). Its associates include Nokia and the United States Department of State. On UNESCO's website, in the section corresponding to "ICT in education", "Teacher training", we find several subsections related to mobile learning. We highlight "Publications on mobile learning". It is a series of texts that, as guidelines, try to disseminate mobile learning policies. Given the importance that UNESCO gives to this method, it annually dedicates a space to it, the *Mobile Learning Week*. The last of which took place from March 7th to 11th, 2016, in Paris, under the theme: *Innovating for quality*, how to better harness the capacity, growth, and accessibility of mobile technology to ensure that all students receive a great quality education.

In UNESCO's *Mobile Learning* Week 2019, "Artificial Intelligence (AI) for Sustainable Development" has been the protagonist. With the objective of how the technologies linked to AI have the possibility of cooperating in the collection of data to improve quality and equality in this area. As challenges, it is intended to achieve:

Table 5. Challenges to be achieved by UNESCO 2019.

Develop a comprehensive vision of public policies on AI at the service of sustainable development.
Ensuring the equitable and inclusive use of AI in education
Prepare teachers for AI leaded education.
Develope inclusive and quality data systems.
Strengthen research on AI in education.
Take into account ethical and transparency issues in the collection, use, and dissemination of data.

Source: Self-made.

Table 6. Summary of the topics covered by Unesco in relation to its contribution or connection to *Mobile Learning* from 2011 to 2009.

UNESCO	Technological Incorporation allusive to *Mobile Learning*
2011	Exchange of creative ideas, use mobile technologies. Publication of the book: Educational experiences with ICT in the 21st-century classroom.
2012	Mobile learning to develop a global community. -Development of policy guidelines to help governments take advantage of mobile technologies. -Explore mobile technologies used to support teachers and professional development. (Teacher training in M-Learning)
2013	Examine learning through mobile devices as a unique and significant contribution to the achievement of the Education for all goals.
2014	Understand how mobile technologies can contribute to the training of new teachers.
2015	Harness mobile technology to improve education and accelerate learning for women and girls.
2016	The role of mobile technologies in the adoption of MOOCs.
2017	Examine how new and affordable technologies can strengthen education in emergency and crisis contexts and expand learning opportunities.
2018	Skills for a connected world.
2019	Artificial intelligence for sustainable development and education.

Source: Self-made.

f. Horizon Report 2013, 2017, and 2019 regarding *M-Learning*

This report published by *The New Media Consortium*, the Superior Center for Online Teaching (CSEV by its acronym in Spanish), and Virtual Educa, marks the educational trends in technologies in the short term. Regarding mobile devices, in 2013 they announced changes in approaches to learning concerning educational practice. Specifically, they alluded to the appeal of taking advantage of tablets or s*martphones* to connect the school curriculum with the real life of students to increase their motivation and deploy knowledge beyond the classroom.

On the other hand, in the report of the Horizon Report 2017, it indicated that the incorporation of Mobile Learning in higher education would happen in the short term, specifically in one year, even less. It justified it considering that "mobile learning or *M-Learning* allows students to access learning materials anywhere, often through multiple devices" Horizon Report (2017: 17)

> And it is that mobile devices have become portals of access and entry to personalized work and learning environments that facilitate the exploration of new topics at the pace of each user. As if that weren't enough, students can also use mobile phones to practice 21st-century skills, including communication, collaboration, and content creation. Besides, mobile devices facilitate opportunities for teacher-student interaction. Horizon Report (2017: 17)

Finally, and currently, the Horizon 2019 Report has the same forecasts on the educational incorporation of M-Learning in higher education classrooms as the 2017 report. It reiterates this, as the incorporation of M-Learning in one year or less. In this report, it is justified in reference to the current modern era of mobile learning caused by smartphones for a decade. It also refers to the fact that both students and teachers currently trust their devices as an important part of the entire learning experience. The report endorses that mobile learning today is not only focused on Apps but connectivity and learning experiences anywhere and anytime. They highlight the ubiquity as an advantage to work unlimited learning experiences in many countries through the power of mobile devices. The increased use of augmented reality (AR), virtual reality (VR), and mixed reality (MR) have enabled mobile learning to become more active and collaborative. Finally, however, they highlight the laboriousness of mobile learning experiences, of the planning and elaboration in their quality in these early stages of adoption.

Table 7. We provide this retrospective compilation summary alluding to Mobile Learning that was contemplated for its future educational incorporation in the Horizon Report from 2007 to 2019.

Retrospective Horizon Report	**Technological incorporation allusive to Mobile Learning**	**Forecast of its educational incorporation by years**
2006	The phone in your pocket	From 2 to 3 years
2007	Mobile Phones	From 2 to 3 years
2008	Mobile bandwidth	From 2 to 3 years
2009	Mobiles	In one year or less
2010	Mobile Computers	In one year or less
2011	Mobiles	In one year or less
2012	Mobile Apps	In one year or less
2013	Digital Tablets	In one year or less
2014	*Flipped Classroom* (Methodology)	In one year or less
2015	BYOD (*Bring Your Own Device*)	In one year or less
2016	BYOD, Virtual and augmented reality	In one year or less
2017	*Mobile Learning,* Adaptive Learning Technologies	In one year or less
2018	Artificial Intelligence	From 2 to 3 years
2019	Mobile Learning Analytical technologies	In one year or less

Source: Self-made.

In the last three to five years, we identified studies that claim numerous benefits in the use of mobile devices. Technological contexts generate interaction towards educational content through the touch screens of mobile devices, according to Cabero (2017), Villalustre and del Moral (2017). On the other hand, previous studies by Cubillo, Martín, Castro, & Colmenar (2014); Kamphuis, Barsom, Schijven, & Christoph, (2014); Solano, Sánchez, & Recio, (2015) bring us closer to the contributions of the improvement in collaborative learning and increased

participation of students. Regarding the results linked to new teaching-learning environments, generated by increased motivation and great interest in participating in activities, we point out Fombona and Pascual, (2017); Toledo & Sánchez, (2017); Marín & Muñoz, (2018).

In 2019, we refer to a study on the learning and effectiveness of augmented reality in children's classrooms, with 5-year-old students and the use of digital tablets. According to López, J. Pozo, S., and López, G. (2019) it is demonstrated and verified that ICTs promote the path towards the learning process. Through innovative resources, students can carry out various tasks, strengthen learning, and assimilate new curricular content. Finally, they conclude that based on the obtained results, "The use of innovative teaching resources through AR allows reaching high evaluations in qualification, active participation, autonomy, attitude, motivation, interest, attention, and in collaborative, ubiquitous, meaningful, and constructivist learning of the students", (p. 172).

The awareness of the educational community towards the implementation of *Mobile Learning* and the use of mobile devices in the classroom depends to a great extent on focusing the knowledge of future teachers towards an emerging education typical of the second half of the 21st-century with ICT. Therefore, experiences with mobile devices are necessary in the classroom, to assess the didactic potential of this technology, starting with the Teaching classrooms of the Infant degree. (Villalustre, 2020).

4. DISCUSSION

The use of mobile devices and, specifically, smartphones, is of interest at the different levels and stages of formal education, especially in higher education, as an omnipresent element in social reality. This technology enables the enrichment of training for both students and teachers, linking and absorbing different branches of knowledge, through the use of the multiple educational perspectives it offers. Educational centers are beginning to consider working along the lines of this methodology, although still in incipient forms. There are discrepancies on the part of the educational community regarding its use and its limits, issues that must be addressed effectively. In any case, it is inevitable in our present time to ignore the presence and educational power of these tools.

Organizations such as Unesco and the *Fundación Telefónica* have firmly committed to the pedagogical implementation of *Mobile Learning*, over the past years, through various projects. Among them, those aimed at providing support to the most disadvantaged communities on the national and international scene are distinguished due to their social contribution, with the premise, among others, of generating progress in reducing the digital gap. There has also been a mutual and coordinated work, especially in this last year, 2019, through the International Mobile Learning Week. The scientific community has developed and continues to gradually

develop, as indicated by the data provided, a substantial increase in trials and analysis on *Mobile Learning* as a modality of educational work. This promotion helps to shed light on the benefits and drawbacks of its integration. Also, the Horizon Report, one of the most relevant in terms of predictions on the incorporation of educational technology, has been predicting for the last decade, the omnipotent ubiquitous presence of portable technology, as a learning tool both outside and inside the classroom, and anytime, anywhere. In fact, 2020 is anticipated as the last year of its supposed educational incorporation. Recent proposals, such as Augmented, Virtual, and Mixed Reality, also contribute to the prolongation of the use of mobile devices in educational environments.

5. CONCLUSIONS

All the mentioned authors, and many others that support it, not addressed in this study for obvious reasons of space, endorse a technological reality that educators must contemplate and face in education in the 21st century. As we have seen, learning in mobility is seen as an emerging methodology that is gradually being implemented, but with discretion. The educational community, at best, is divided. Although there is some acceptance of its use, at the same time there are underlying connotations of rejection. The debate is served. Its incorporation into the classroom is, for now, through essays with educational experiences that aim to reveal its potential as a collaborative learning tool. As well as evaluate the attitudes and prejudices of teachers and students. Therefore, scientific studies that appeal to research and deepen the educational framework of mobile learning are of great interest. Delving into specific contexts and situations will shed light on appropriate use and its benefits. We are talking about a device, the *smartphone*, which has become an extension of our body. Society, today, has integrated it as one of its portable personal items, completely essential. Its absence generates anxiety, known pathologically as "nomophobia". The society of the second half of the 21st century has changed its habits, aimed at spending more time in front of mobile screens. The images that these represent and that young people consume daily, contribute to the visual imaginary linked to arts education.

Social and technological changes must be incorporated, with the appropriate adaptations, to our teaching-learning processes. A new way of teaching and learning is being developed, mediated by ICT, and its development is unstoppable. Teachers are doomed to adapt to circumstances and methodologies that involve new ways of teaching and that cooperate in enhancing the stimulation of our students, as long as they are consistent with their daily technological reality. Only in this way will we offer an education that keeps up with our times, through our pedagogical model.

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