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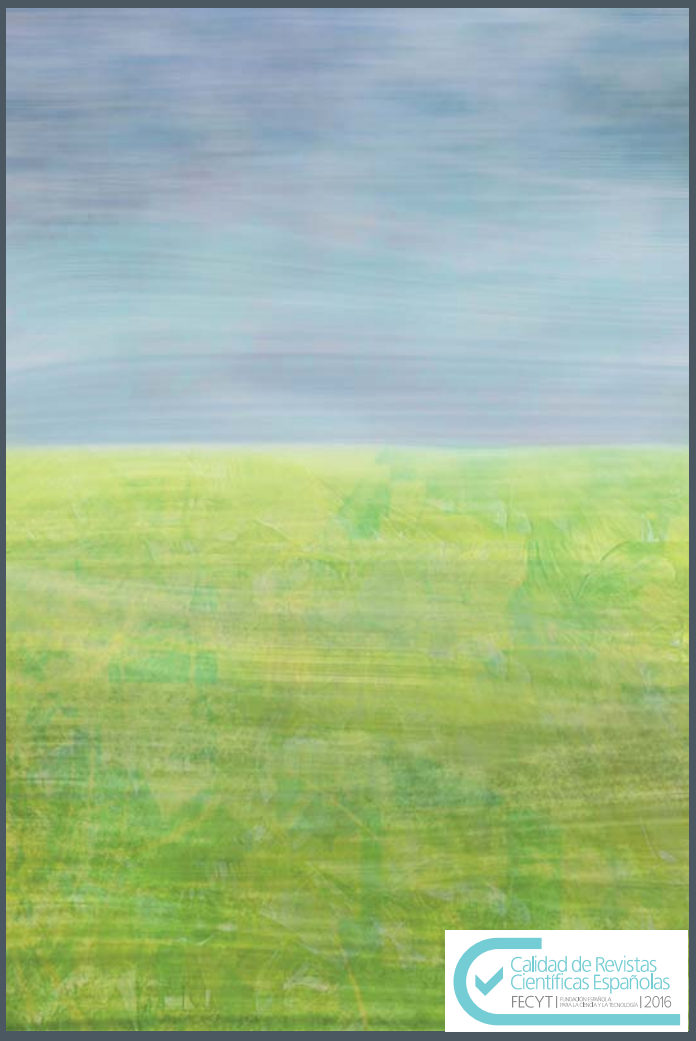

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El uso de las tabletas y su impacto en el aprendizaje. Una investigación nacional en centros de Educación Primaria

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Abstract

Numerous studies on the benefits and potentialities of mobile learning have been published in the recent years. It is a technology that acts as a catalyst for change, generating new learning opportunities in the context of XXIst century education. However, the scientific literature of the moment lacks studies that show evidence on the impact that such use has on the learning outcomes of students, providing generally unrepresentative samples that do not allow to go beyond mere speculation. This article aims to describe the results of research carried out under the Samsung Smart School program during the 2015-2016 academic year, in collaboration with the National Institute of Educational Technologies and Teacher Training (INTEF), Ministry of Education, Culture and Sports and the Autonomous Communities, Ceuta and Melilla, whose objective is to promote students learning through the integration of mobile technology in the classrooms of Spanish public schools. The research, carried out in 29 public

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primary schools, with a sample of 826 students and 97 teachers, analyses, from different instruments: (a) the approximation of students, teachers and family to mobile technology, (b) the main didactic strategies used in classrooms with these devices, and (c) the perceived impact of such use on student learning. The results, in addition to demonstrating the ease with which this technology is incorporated in classrooms, show their educational potential along with dynamic, collaborative and interdisciplinary activities, their impact on attention, motivation and classroom climate, as well as an improvement in the development of students' key competencies. Finally, the limitations of the study and possible future streamlines are presented.

Keywords: Tablets, research, learning, skills, evaluation, impact, education, mobile learning

Resumen

En los últimos años se han publicado numerosos estudios acerca de los beneficios del aprendizaje móvil. Se trata de una tecnología que actúa como catalizadora del cambio, generando nuevas oportunidades de aprendizaje en el marco de la educación del siglo XXI. Sin embargo, la literatura científica actual adolece de estudios que aporten evidencias sobre el impacto que dicho uso tiene en los resultados de aprendizaje de los estudiantes, tratándose generalmente de muestras poco representativas que no permiten ir más allá de la mera especulación. El presente artículo pretende describir los resultados de una investigación realizada en el marco del programa Samsung Smart School, durante el curso 2015-2016, en colaboración con el Instituto Nacional de Tecnologías Educativas y Formación del Profesorado (INTEF), del Ministerio de Educación, Cultura y Deporte y las comunidades autónomas, Ceuta y Melilla, y que tiene como objetivo impulsar el aprendizaje de los alumnos a través de la integración de la tecnología móvil en las aulas de los colegios públicos españoles. Las investigación que se presenta, llevada a cabo en 29 colegios públicos de Educación Primaria, con una muestra de 826 alumnos y 97 profesores, analiza, a partir de diferentes instrumentos: (a) la aproximación de estudiantes, docentes y familiares a la tecnología móvil, (b) las principales estrategias didácticas utilizadas en las aulas con estos dispositivos, y (c) el impacto percibido de dicho uso en al aprendizaje de los estudiantes. Los resultados, además de evidenciar la facilidad con la que se incorpora esta tecnología en las aulas, muestran su potencial educativo junto con actividades dinámicas, colaborativas e interdisciplinares, su impacto en la atención, la motivación y en el clima del aula, así como la mejora en el desarrollo de las competencias clave de los alumnos. Finalmente, se presentan las limitaciones del estudio y las posibles líneas de trabajo futuro.

Palabras clave: tabletas, investigación, aprendizaje, competencias, evaluación, impacto, educación, aprendizaje móvil.

Introduction

Each time, more and more students and teachers use mobile devices in diverse contexts to achieve a wide variety of learning objectives. Likewise, the main educational agents, from large institutions to schools, are gradually experimenting with support policies to significantly promote mobile learning in formal educational settings. Despite this fact and the increasing boom that the use of mobile devices is experiencing in the field of education, it is currently on the threshold of a systematic and effective integration regarding its impact on learning.

The growing interest in mobile learning around the world lies, among many reasons, in that mobile technology becomes a catalyst for change and removes barriers: information can be accessed at any time and from anywhere; therefore, it generates opportunities to learn. Within the field of education, mobile learning involves the creation of authentic learning experiences to solve real-life problems. Mobile devices are affordable, do not require start-up time, have a low maintenance and are easy to use (Myllari et al., 2011). Mobile learning is conducive to learning within context, so that students can greatly customize their learning (Chou, Bloc and Jesness, 2012), and teachers can easily update educational materials and share them with students in real time, using active learning strategies. Finally, the use of mobile devices promotes the search for content among students, the generation of knowledge networks and allows the emergence of creative and innovative educational practices.

Many countries, such as Malaysia, India, Lebanon, Finland, the Netherlands, France, Northern Ireland, or Scotland, among others, have attempted to incorporate large-scale mobile technologies, often as part of an initiative to make education more in line with the canons of the 21st century. However, such deployment is not without its challenges and, in many countries, including the United States, Turkey, Thailand or South Africa, these plans have been delayed or even canceled (Clarke and Svanaes, 2015).

Alongside these developments, the academy is trying to accurately assess the impact of mobile technology on teaching and learning. However, despite these efforts, there is currently a lack of evidence of its direct impact on learning (Fullan et al., 2014, Haßler et al., 2015, Lewin et al., 2010). These authors argue that this is partly caused by the fact that research does not take into account the context in which technology is

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used or the preparation of teachers. The work of Haßler et al. (2016), one of the most complete in recent scientific literature, analyzes 23 international studies on the use and impact of tablets in learning, the samples being insignificant, as most do not exceed hundreds of subjects. Thus, in the absence of scientific evidence of large-scale implementations, it is increasingly necessary for educational leaders to have access to impact assessments and case studies that demonstrate successful experiences with the use of mobile technologies in education with broader samples.

This article aims to describe the results of a research made under the Samsung Smart School program during the 2015-16 academic year in collaboration with the National Institute of Educational Technologies and Teacher Training (INTEF) and carried out in 29 Spanish public schools, with 826 students and 97 teachers, to improve student learning through the integration of mobile technologies in classrooms. Specifically, this article aims to analyze, from a descriptive point of view: (1) the perception of students and teachers towards the integration of ICT and, especially, mobile technology; (2) contents, didactic strategies and applications with more possibilities to be carried out in classrooms; and (3) the perceived impact on student learning.

Theoretical Framework

When we talk about the introduction of technologies in the classroom, and specifically of mobile devices, in addition to the curricular and didactic aspects, it is necessary to start from the contextual aspects; that is, those internal and external factors that affect individuals, such as their expectations, their interests or their own perception (Graham, 2011). In the last decade, we can see how different authors point out that the characteristics of current students have changed from previous generations, with different labels appearing to refer to this so-called digital generation (Oblenser and Oblinger, 2005, Tapscott 1998). According to these authors, these young people have grown up surrounded by technologies and possess, in addition to a high interest in digital media, special technological skills. Other authors point out that there is no clear differentiation between these native assumptions and digital immigrants, but there is a more complex mix of ICT skills and

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experiences. Although there are certain ICT skills developed by today's children and young people, they are largely associated with social and recreational activities and they are not able to apply them directly to learning (Bullen et al., 2009; Claro et al., 2012; Kennedy et al., 2007).

Beyond age, there are other individual and contextual factors that can influence the integration of technology, and specifically mobile devices, in the classroom. In this sense, different theoretical models, such as the Technology Acceptance Model (TAM), attempt to synthesize some of these intervening factors, such as previous experience, perception of utility, or motivation and willingness to use (Lee-Donaldson, 2011). Along the same lines, Mac Callum, Jeffrey and Kinshuk (2014) also propose their own level of digital competence or anxiety towards technology, key factors in the adoption of mobile learning. As Ciampa (2014) points out, these devices can foster a sense of curiosity, challenge, control, as well as cooperative and competitive activities, which provide improvements in motivation towards learning. This intrinsic motivation of students to perform activities in which they are enthusiastic, focused and active, has an important correlation with learning outcomes (Huizenga et al., 2009). And for this, it is necessary for teachers to have a favorable attitude towards the use of mobile technology in learning (Abachi and Muhammad, 2014), since the perception of utility, together with beliefs and the perception of competence itself, are key indicators that predict the subsequent good use of ICTs in the classroom (Siddiq et al., 2016).

In addition to the individual and contextual factors mentioned in the previous section, Mishra and Koelher (2006) in their TPACK model —based on previous approaches by Shulman (1986)— argue that it is necessary to correctly integrate technology with pedagogical knowledge (didactic and methodological strategies) and disciplinary knowledge (contents and competences) to take advantage of all the potential of ICT to facilitate the teaching-learning processes. In this sense, Gikas and Grant (2013) or Ozdamli and Uzunboylu (2014) show that mobile devices have a very positive impact on student learning along with communicative, interactive and collaborative didactic strategies. They also highlight their potential to integrate different contexts and link formal and informal learning, as well as individual and social learning (Looi et al., 2010).

At a disciplinary level, we can see numerous experiences of using mobile devices to work different contents in the classroom, and for the development of competences, both specific and transversal. Obviously,

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one of the most related competitions is the digital one. It is a transversal competence, considered key to lifelong learning (European Commission, 2007), and which, as Mohammadi (2015) reflects, can facilitate its development through the use of tablets in the classroom, as well as the development of other transversal competences, such as teamwork or critical thinking. Likewise, we find similar experiences in the development of other contents and competences. For example, different researches point out that the use of mobile devices has potential benefits for language learning (Stockwell, 2010), also pointing out some possible negative or distracting effects on learning, depending on the use made in the classroom (Sung et al., 2015).

However, as pointed out by Suárez-Guerrero et al. (2016), it is not easy to demonstrate conclusively the positive impact of these devices on the academic performance of students; however, aspects such as the impact on motivation, attention or attitudes towards learning are aspects that undoubtedly have a clear impact on student learning.

Method

This study has been carried out during the 2015-2016 academic year. Part of a larger project, the Samsung Smart School project, started in 2014 in collaboration with the National Institute of Educational Technologies and Teacher Training (INTEF), which aims to boost student learning through the integration of technology in classrooms in Spanish public schools.

Technologically, tablets, screens, and a connection equipment between these devices, as well as the software necessary to work and access the different contents, have been provided to all the centers that are part of the project. At an educational level, the project includes online and classroom training activities for teachers, advice and follow-up visits by the project team, as well as a meeting between all participant teachers.

This study was carried out under a descriptive approach, trying to understand the reality in its natural context, and interpreting the situations in a joint way between the participants and the researchers. Nevertheless, a pluralistic methodological framework has been used, which complementarily combines quantitative, qualitative and participatory techniques. These types of qualitative studies involve the use and collection of a great variety of materials and evidences, from

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questionnaires, product analysis, and individual and group interviews. The design of the research has followed these phases:

- *Preliminary Phase:* In the first phase, the methodological design of the research was made, determining the specific objectives, participants, instruments and procedures for collecting and analyzing the information. Such activities were also sequenced and planned in time.
- *Diagnostic Phase:* Once the participants were already determined, the access and contact routes were established, and an initial questionnaire was analyzed, which was administered to both teachers and students.
- *Implementation Phase:* In this central phase of the research, the content of the teaching plans and didactic sequences was analyzed, the teachers were interviewed individually and a series of focus groups were carried out, mainly with students (and to a lesser extent, with parents and teachers).
- *Final Phase:* In the last phase, the questionnaire was administered again to both teachers and students, which was analyzed by the research team. This was helpful in the completion of the situation, contrasting with the previous results, and drawing a series of conclusions and future recommendations.

Participants

The project is focused on students in 5th and 6th grade of Primary Education and has had the participation of a total of 29 public centers, from 15 autonomous communities. In this study, a total of 826 students (ranging from 8 to 12 years of age and an average age of 10) and 97 teachers participated.

Instruments

Initial and final questionnaire

This questionnaire was administered at the beginning and end of the course, it addresses the following questions: (a) biodata; (b) use and

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availability of technology; (c) perception of competence; and (d) attitudes towards technology. The initial questionnaire was answered by a total of 594 students (51% boys and 49% girls), and 70 teachers (67% female), while the final questionnaire was answered by a total of 826 students and 97 teachers.

Content analysis

This instrument was used to collect systematic information from documents already written by teachers, specifically from the tabs and didactic planning of teachers or CANVAS (Conecta13, 2015, Trujillo, 2016). A total of 29 didactic plans were analyzed. These documents include (a) key competencies worked on the project; (b) learning standards; (c) final product; (d) sequence of tasks to be performed; (e) resources available; (f) ICT tools; (g) groupings; (h) evaluation methods; and (i) the diffusion system used.

Interview

Through this instrument of dialogue, previously organized and planned, a total of 13 teachers were interviewed about their perception of the development of the project. The interviews were conducted through videoconference, they lasted approximately 15-20 minutes, were recorded and subsequently coded and analyzed. The main topics addressed in the interview were: (a) methodological and content aspects worked in the sessions; and (b) perceived impact on learning.

Focus group

Finally, a series of group interviews were conducted. In total, eight focus group sessions were held, each lasting between 40 and 60 minutes; two of them consisted of teachers (16 participants), 6 of students (41 participants) and one of family members (6 participants). The main aspects addressed in the teachers' case have been: (a) methodological aspects; and (b) perceived impact on learning. In the students': (a) use of

ICT; (b) attitudes towards ICT; (c) best-valued didactic aspects (type of activities, groupings or evaluation); and (d) perceived impact on their own learning. In the families': (a) use of ICT; (b) attitudes towards ICT; and (c) perceived impact on the learning of their children.

Procedure

In Table 1, we can observe the variables analyzed according to the instrument used.

TABLE 1. Variables analyzed according to the instruments

Instrument	ICT approximation	Content, methods and ICT	Impact
Questionnaire	x		
Content analysis		x	
Interview		x	x
Focus Group	x	x	x

Source: Own making

Mainly, information about its approach to ICT (use, availability, perception of competencies and attitudes) was analyzed through questionnaires and focus group sessions, both at the beginning and at the end of the project (October 2015 and May 2016). The didactic, methodological and content questions were analyzed from the content analysis of didactic planning, interviews and focus groups. This was an aspect that was revised progressively during the months of February to April 2016. The impact on the students' learning was analyzed through teachers and focus groups interviews, with all agents involved, during the months of March to May 2016.

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Results

Next, we present the results of each of these variables through a narrative analysis, accompanied by fragments and literal quotes, contextualized and interpreted (Gil Flores, 1993), which integrates the analysis of the questionnaires' main results.

Approaching ICT and mobile technology

In general, all students claim to have technology at home and to use it regularly, whether that is tablets, computers or mobile phones, which are especially common. However, not all children have their own cell phone, but they use their parents': "I do (have one), I use it to let them know", "They don't allow it, because they say I can make a mistake and I still don't know how to use it," "(I'm) not allowed until I'm older," were some of the statements the students gave.

Outside the academic field, these devices are usually used for playful and social purposes. Some of the utilities reiterated by the students were communication through instant messaging and social networks, downloading games, viewing multimedia content or taking photographs. As for attitudes, most of the students expressed, in a very general way, that they like to use technology, it is easy and attractive, as we see in the following conversation: "I use the mobile as if it were my life, I use it for a lot of things, I love it," "at first, it's difficult... Because you don't know how to use it and understand it, sometimes (it's complicated) but once you get used to it, that's it!" When asked if their relatives have this same perception, differences of opinion arise: "(my parents) do... my grandparents say that it's a waste of time," and they themselves justify that this opinion is due to the age difference and "because they didn't have it before." And they add: "I teach them, sometimes, although my grandmother already knows enough."

In Table 2, we can see the results of the questionnaire administered to the students before and after the experience, regarding their perception of competence and attitudes towards ICT.

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TABLE 2. Results from the administered questionnaire to the students

	% Pretest (*n* = 594)			% Posttest (*n* = 826)		
	Yes	No	IDK/NA	Yes	No	IDK/NA
Perception of competence						
Write	93	6	1	95	3	2
Participate in a chat/forum	44	12	44	50	11	39
Search the Internet	96	2	2	97	2	1
Send an e-mail	62	16	22	70	10	20
Draw	61	27	12	73	17	10
Save documents in folders	72	17	11	78	10	12
Surf the web safely	75	9	16	79	6	15
Programming	12	24	64	22	17	61
Use apps to learn	85	7	8	89	5	6
Attitudes towards ICT						
Makes it easier to learn	89	4	7	87	5	8
Makes it more interesting	93	3	4	92	3	5
Makes me able to concentrate	63	16	21	58	20	22
I like to learn new things	86	7	7	87	6	7
I prefer to work with them	77	13	10	79	12	9

Source: Own making

As we can see in Table 2, students generally perceive themselves competent for most activities, except in the case of participating in chats and forums and programming, which results are markedly lower. In the case of attitudes, all items were awarded a positive score by most students, finding the lowest values in terms of concentration. At a comparative level, the greatest differences between the results of the questionnaire administered before and after the experience are found in relation to the perception of competence, specifically the skills to draw, to program and to send emails.

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In the same way, in Table 3, we observe the results of the questionnaire administered to teachers, both in terms of their own perception of competence and their attitudes towards technology, before and after the experience.

TABLE 3. Results from the questionnaire administered to teachers

	Pretest (*n* = 70)						**Posttest (*n* = 97)**					
		%					M	%				
	M	Very	Sufficient	Few	Nothing	IDK/NA		Very	Sufficient	Few	Nothing	IDK/NA
Perception of competence	2.8	-	-	-	-	-	3.0	-	-	-	-	-
Create documents	3.6	59	40	0	0	1	3.6	58	39	2	0	1
Participate in chat/forum	2.8	20	46	23	9	2	2.9	26	41	21	7	5
Create and maintain a blog	2.6	21	29	27	17	6	2.8	27	32	23	12	6
Send an e-mail	3.7	71	26	3	0	0	3.7	72	22	1	3	2
Edit a photo	3.0	34	37	22	4	3	3.2	44	35	16	3	2
Create a presentation	2.7	27	27	29	13	4	2.9	33	32	21	11	3
Organize files and folders	3.6	66	30	1	3	0	3.6	64	27	4	2	3
Teach ethical behavior	2.6	12	44	34	6	4	2.9	20	54	17	4	5
Teach programming	1.4	1	6	10	47	36	1.8	3	8	23	28	38
Use apps in teaching	2.3	10	23	41	16	10	2.6	14	40	28	9	9
Attitudes towards ICT	3.4	-	-	-	-	-	3.4	-	-	-	-	-
Effort	3.6	59	37	3	0	1	3.5	52	45	0	0	3
Enjoyment	3.5	50	50	0	0	0	3.5	55	45	0	0	0
Comprehension	3.2	22	70	4	0	4	3.3	30	58	3	0	9
Autonomy	3.4	37	59	0	0	4	3.4	40	54	1	0	5
Collaborative work	3.3	27	67	2	0	4	3.3	34	69	2	0	4
Creativity	3.3	34	55	2	2	7	3.4	38	51	2	1	8

Source: Own making

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Generally, we can observe that teachers perceive themselves competent in most of the suggested activities, both before and after the experience (2.8 and 3.0 out of 4, respectively). Some of them scored significantly below average, although they were perceived more positively after the intervention, such as the use of applications or apps in education (from 2.3 to 2.6), or the teaching of programming (from 1.4 to 1.8).

Regarding attitudes towards ICT, the average scores of teachers obtained before and after the intervention were very similar and high (3.4 on average over 4), with a slight emphasis in both cases on the value of ICT for the effort personal and enjoyment.

Didactic strategies, contents and applications

As for the curricular areas or contents in which tablets were used, both students and teachers emphasize having used tablets in most of the subjects, such as Language, Mathematics, Natural and Social Sciences, as well as in Foreign Language, Physical Education, among others. "In my center, they're used in all areas of fifth and sixth grade. They're used in all subjects," "in the four main subjects, language, mathematics, natural and social sciences," "in my case, plastic and social," "in our case, we have a cloister that's quite involved and it works in all areas" are some of the phrases extracted from the interviews conducted to the teachers. This same data was corroborated after the analysis of didactic planning.

According to the faculty, there is a great variety of didactic strategies to incorporate tablets in the classroom, from individual activities of information search and problem solving, to collaborative activities, in group and by projects, noting that these are flexibly adapted to the teachers' methodology: "each teacher works differently, even the groupings are very flexible," "tablets also fit, and we use them to make interactive classes, tutorials, videos ..."

All this great variety of activities is also mentioned by the students themselves. Some more traditional activities: "the teacher explains and we practice... some times we do it using our notebook and other times, we do it in the tablet," "the teacher sends it by Snote and tells us to do it" (exercises, summaries, problems or letter soups), "to make cards that they send us by email, we've done math, natural science... For example, they made us calculate such plus such…" And other activities, very emphasized

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by the students themselves, more dynamic, collaborative or interdisciplinary:

> *"They told us to use the tablet to make an (video) ad for animals, so my friend and I made one. And I liked that a lot, that everyone saw it. 'Yes, that and some radio activity. 'Oh, and we also wrote some questions to do interviews (...) and we interviewed the school's teachers and the dining room monitors".*

Next, in Table 4, we can observe the type of activity and the mobile tools or applications most used in class, according to the didactic planning analysis and the interviews to teachers and students.

TABLE 4. Most used didactic activities and mobile applications

Didactic activities	Mobile applications
Information search, Gamification with QR codes, Audio recording, Video recording, Troubleshooting, Small simulations, Programming.	ABC English, Book Creator, Cine Master, Classcraft, Classdojo, Doodledroid, Duolingo, Kahoot!, Lenzo Creator, Mydomo, Noteography, Piktochart, PowerPoint, Scratch, Snote, Speaker Studio, Tellagami, Youtube.

Source: Own making

Finally, the teachers emphasize that despite having the necessary technical and didactic strategies to use tablets, the subject of evaluation is still an aspect to improve:

> *"We have a pending subject, which is evaluation. It's very difficult, even though we try to implement evaluation instruments with tablets (...) but still haven't found the point between evaluation, methodology and tablet use. (...) I think it's difficult, the evaluation itself is difficult: evaluate a production in a group, which is a lot, especially if it's to evaluate a project."*

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Impact on learning

From the analysis of the interviews and the focus group, with both students and teachers, we checked the perception they have about the impact of the use of tablets in the learning process.

First, both groups highlight in a very positive way the incidence of tablets in key aspects, precursors of the students' learning, as the attention, the motivation or the climate of the classroom. Let's look at some of the phrases mentioned by teachers: "(the use of tablets favors) the intrinsic motivation for the final result," "improves the interest in the task," "if we say that motivation has increased, logically, the results are better," "as soon as the tablets arrived, they changed the climate in the classroom. The atmosphere between them and the faculty, which was horrible, has changed an awful lot." In the same sense, the students point out: "you learn while you play... because we learn by playing," "if you do it with the book, you get confused with anything because it seems boring, but when you do it with the tablet, you learn more because it's more fun."

Other aspects perceived as beneficial by students were ergonomics, respect for the environment, or productivity. Let's see, then, a few sentences about it: "I think it's also very good because you're not carrying that many books, better for your back," "we don't spend as much paper," "you can write faster," "if we don't understand something, we can search for it on the Internet." Occasionally, some negative aspects associated with the use of tablets were also noted. In particular, related to specific technological problems or configuration: "When I'm about to summarize a Social issue, I'm downloading it and it hangs in the beginning… That's really bothering."

As for the impact of tablets on learning, the teachers especially emphasize their incidence in the development of the transversal competences, such as autonomy, initiative, learning to learn, collaboration, critical spirit, and of course, digital competition. "Before, you ordered (some task) and they did. Now, they do, they propose and they tickle you," "it gives power to autonomy," "digital competition, but other skills, learning to learn, that digital tools lend themselves to empower, because otherwise it's very difficult." According to the teachers themselves, all these results are even more remarkable in the case of attention to diversity, and especially in children with special educational needs, where tablets represent a key element for inclusion.

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Teachers also emphasize the impact of tablets on the development of more specific competences, related to the different curricular subjects or areas: "Yes, logical reasoning in math," "in three and a half months, they've been capable of creating all the products, they've lost stage fright, they've improved their writing skills," "yes, it's very palpable in language; besides, society demands it, and it goes very fast," "just like oral exposition; before, they didn't know what introduction, explanation and ending were, but now they have it very clear".

However, it seems that, in order to correctly verify the impact on the development of these competences, and hence on academic performance, more time and a more systematic evaluation process is needed, according to the new learning system: "I believe we should evaluate in the long term, because the knowledge acquired by children (now) is knowledge that lasts longer."

Discussion and conclusions

As mentioned in the introduction, this article aims to describe the development of a research carried out in a series of Spanish public schools, in order to improve the learning of 5th and 6th grade students through the integration of mobile devices in classrooms. It is a research carried out during the years 2015-2016, in 29 Spanish public schools, in 15 autonomous communities, Ceuta and Melilla, and that specifically seeks to analyze: (a) the approximation of students, teachers and families to ICT, especially mobile devices; (b) the didactic strategies, content and applications most used in classrooms; and (c) the perceived impact on the learning of these students.

Regarding the first objective, both teachers and students show a very favorable attitude towards ICT, both personally and in its application in education. Also, both groups are generally perceived to be competent in the use of mobile technology, especially in the most basic activities, such as writing, searching the Internet or sending emails, observing an improvement in their abilities after the development of this experience. These results largely coincide with the findings of similar studies such as those carried out by Domingo et al. (2016), Suárez-Guerrero (2016), or Oigara (2017).

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As for the second objective, there is a great variety of activities carried out with tablets, both at a content level and as a function of the methodological strategies or the mobile applications used. In addition to the more traditional activities, tablets have allowed the development of more dynamic, collaborative and interdisciplinary activities, highlighted by students, facilitating processes of innovation and methodological change among teachers. Finally, the faculty also emphasizes that, despite having the necessary technical and didactic strategies to use tablets, evaluation remains an aspect to be improved, coinciding in this point with the recent contributions of Haßler et al. (2016), Shen (2016) and Geer et al. (2016).

In reference to the third objective, the general perception is that the integration of tablets in the classrooms has considerably improved learning, mainly due to three aspects. In first place, it has notably improved basic aspects in the learning process, such as classroom climate, attention and motivation. Secondly, they perceive an evident improvement in the development of students' transversal competences, such as autonomy, initiative, collaboration, critical thinking or digital competence, among others. There is also evidence of a better development of specific competences, linked to areas or subjects, such as linguistic communication or math. Finally, the versatility of these tools for the development of individualized learning is also highlighted, especially for its attention to diversity being a key element of inclusion.

From this experience and the results presented, we can extract a series of strategic and didactic suggestions and recommendations for the incorporation of tablets in the classrooms. On one hand, it is important to make a decisive commitment to the introduction of technology, since today it is easily incorporated into the classroom and functions as a precursor to educational change. On the other hand, it is necessary that this technology be accompanied by an active methodology and collaborative didactic strategies, which are key for an adequate development of competences, and a flexible and inclusive learning experience.

However, as it has also been emphasized in this research, in order to correctly verify the impact on the development of these competences, and hence on academic performance, it is necessary to conduct research for a longer period of time and using other mechanisms to measure the evolution in the development of competences. This, besides being one of

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the main limitations of this project, also works to point out some of the possible lines of future work. Linking the academic results to the research process, and categorizing the centers according to their typology, could also be some aspects to consider for future work. However, despite the intrinsic limitations of any research, we believe that the contributions made in this article, which come from a relevant national research sample, can contribute significantly to the international scientific literature and enrich similar projects that have to assess the impact of using mobile devices in learning.

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