

***Introducing Mobile Learning Into the Primary School Curriculum:
A Case Study of the Continuous Pedagogical Use of Mobile Devices***

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Abstract

The present paper is a brief overview of an innovative educational program in Primary Education regarding the pedagogical use of mobile devices in teaching. The program adopted Puentedura's (2010) SAMR model, which is based on Bloom's Revised Taxonomy, and proposes four levels of integration of digital applications into teaching practice. The program, which was implemented at the same time as a continuous intra-school training program, aimed at the integration and pedagogical utilization of portable devices (tablets) in the teaching of all the basic subjects of the Primary School for a very long period of time in order to contribute to the transformation of the educational process. The experiences from the first phases of the program demonstrate that the learning process was significantly enriched and strengthened, 21st century skills were cultivated and developed, while the professional development of teachers and the active participation of students were enhanced. These conditions therefore led to the change of previous attitudes of teachers and students towards the specific technological medium.

Keywords: Educational Innovation, Mobile Learning, Digital Applications, Primary Education

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Introduction

In the modern digital age, many researchers talk about the educational use of mobile devices (Fokidis, 2019; Sanders & George, 2017; Meletiou Mavrotheris, Papanastasiou & Christou, 2019; Haßler, Major & Hennessy, 2016; Camilleri & Camilleri, 2020) since their presence in educational systems has been continuously increasing in recent years. However, although mobile devices seem to be included and used more often in school classrooms, the duration of their use (mainly in Greece) seems to be short or for a specific period of time, the teaching subject or application that is usually used is defined while an appropriate pedagogical framework for mobile learning is absent. In an effort to effectively integrate mobile devices into teaching, as modern ICT, this innovative program was carried out. The innovation of the program lies in the fact that for a very long time a multitude of digital applications were used in all the basic subjects of the Primary school within a defined pedagogical framework. The purpose of the program is to actively contribute to the transformation of traditional teaching practice, leading to the acceptance of new constructive learning approaches directly intertwined with the social reality of the time we are going through.

Methodology

Pedagogical Framework of an Innovative Program

The use of mobile learning in teaching is a process that develops within a pedagogical context and is not meant to be arbitrary (Camilleri & Camilleri, 2020). The basic consideration on which the specific program was based, as well as the educational activity that was implemented at the same time to support it more effectively, is the fact that the pedagogical dimension must determine the educational use of mobile devices. For example, when teachers identify an exciting, new app the first thing they should do is think about how that app can be used and contribute to their overall educational goals for the subject they want to teach. Directly related to this consideration, Puentedura's (2010) SAMR model is considered, which is based on Bloom's Revised Taxonomy. According to the model, four levels of integration of digital applications are proposed: a) the Substitution Level, b) the Augmentation Level c) the Modification Level and d) the Redefining Level. As the levels progress, mobile devices become more and more essential for teaching while the focus is placed on the student himself/herself as his/her creative involvement also increases.

More specifically, the first two stages of the SAMR model represent improvements of existing ways of working. Digital technology is not necessary to carry out the learning task, but mobile devices are a digital medium for learning, which can enhance learning. At the third level, the first step of crossing the traditional way of teaching with the transformation of the classroom through mobile devices is observed. Mobile devices have the potential not only to enhance the learning activity, but also to significantly modify it. An illustrative example is the creation of a blog by the students, in which they open their "work" to a global audience. At the fourth and final level mobile devices are used for activities that were previously impossible to perform. An example could be the collaboration of students or class groups to create a documentary, utilizing sources outside the school environment with the use of multimedia tools and applications. This video can then be "uploaded" to the class blog where relevant comments can be received and/or exchanged, acting as feedback. The essential differentiation of this level is that now the mobile device and ICT in general have the role of "Partner" of a student-centered education. Students acquire the necessary skills and master the expected goals of each activity driven by the challenge of creating a complex result.

Technology allows and enforces the cooperation and communication of students with each other, especially in the context of a social constructivist perspective, while the questions that are raised or the comments that arise are in an authentic context and are highlighted mainly by the students themselves /three (Puentedura, 2012). The research carried out in the framework of the program aims to evaluate the effect of this framework: a) on the attitudes and perceptions of the teachers regarding the teaching of Primary school subjects with the use of mobile devices b) on the teaching practices of the teachers with the use of mobile devices.

Elements and Structure of Innovative Program

The specific innovative program, which was developed in the context of a two-year doctoral research (2021-2023), was implemented during the school year 2021-2022 (October 2021-June 2022) in a public 12/semester Primary school in Greece. Although the program followed a systemic approach to the integration of mobile devices in the school unit (principal, teachers, parents, education consultant, local agencies, etc.), 6 of the school's teachers, who were the teachers of the three largest classes of the elementary school (4th, 5th, 6th-6th grades), 96 students, who were the students respectively of these classes as well as the parents of the specific students. For this effort, the school was equipped with 11 Android-type mobile devices (tablets). During the entire duration of the program, continuous in-school training was simultaneously implemented by the researcher (her dual role) in order to familiarize the teachers with the mobile devices on a technological and pedagogical level. The program for the integration and utilization of mobile devices in teaching as well as the educational activity was decided to be divided into three phases (see Diagram 1).

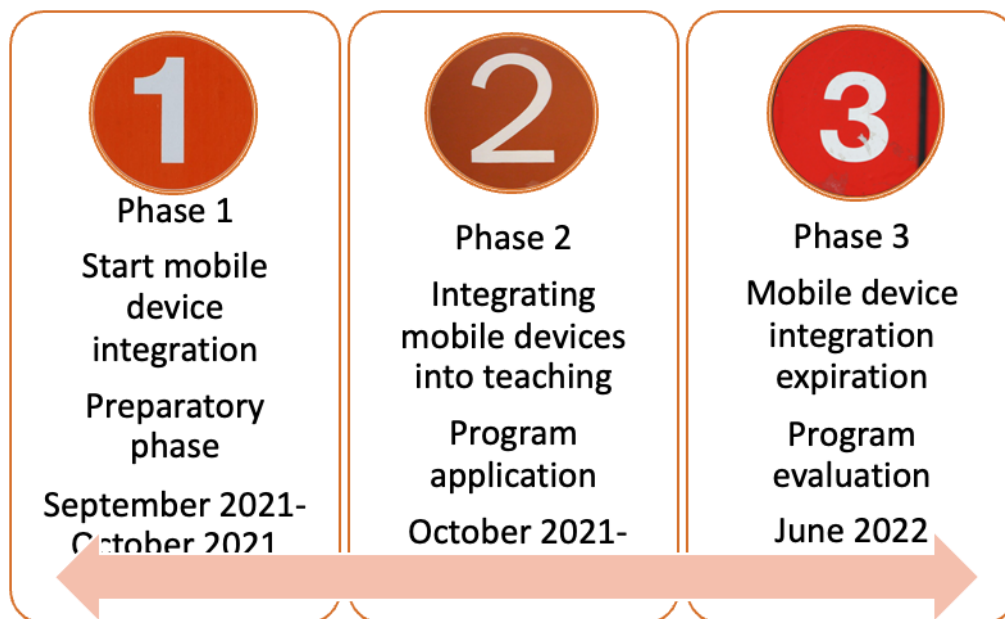


Diagram 1: Phases of program implementation

Phase 1: The first phase of the research concerned the beginning of the *integration of mobile devices* in the school unit and was conducted at the beginning of the school year (September-October). Before the start of the program, a general and detailed briefing was held for all involved members (principal, teachers, students and parents, education consultant) regarding the purpose, goals and context of the program, the actions that were expected to take place in the future (e.g. teaching using portable devices) but also the educational activity that would accompany the implementation of the research program. In relation to the training program, in the first stage, all teaching staff were trained (4 two-hour training sessions) aimed at a) all

school teachers, and not only those who integrate mobile devices into their teaching, get to know the theoretical framework that is behind mobile learning b) to familiarize themselves with mobile devices as a technological means c) to know their educational possibilities but also techniques of integration into teaching and finally d) to be informed about a number of applications that can be connected to the AP of the courses Elementary school. Finally, during the first phase information forms were given to the parents/guardians as well as the children, where they were informed about the actions that were going to be implemented in the school in the near future. The forms also requested the written consent of the parents/guardians for any questionnaire completion by students, audio recording or even video recording in any phase of the implementation of the program.

Phase 2: The second and longest phase of the research started at the end of October 2021 and lasted until the beginning of June 2022 and concerned the *implementation of the program*. In this phase, the principal of the school, the 6 teachers and the 96 students of the three largest classes (4th, 5th, 5th) were involved (directly involved). In particular, throughout the second phase, the teachers were asked to implement a variety of pedagogical activities or even entire teaching scenarios with specific teaching objectives and expected learning outcomes in various teaching subjects in which they effectively incorporated the new modern technologies and were strengthened by the use them as predicted by the SAMR model.

The inclusion of such an activity could be done at the beginning, in the middle or even at the end of the teaching scenario. This kind of activity/s aimed at the highlighting of previous knowledge, at the introduction of new knowledge, to function as a central activity for the consolidation of the new knowledge but also as an activity for evaluating/highlighting the new knowledge respectively. The focus has always been on the student, with the aim that through the cultivation of digital skills, the students will become creators of their own knowledge. The applications or digital tools that were included in the learning process were selected with specific criteria such as the age group of the children it is aimed at, their free use, the safe environment (e.g. absence of advertisements) but also the pedagogical purpose it serves.

The educational activity during the second phase was divided into two parts. In the first months of the second phase (October 2021-January 2022), several sample lessons were carried out by the researcher-educator in all the classes that participated in the research (4th,5th,6th), which were mainly attended by the directly involved teachers, without this meaning that another teacher of the school could not attend them if he/she wished. The sample lessons were designed in a different lesson each time in order to highlight to a greater extent the use and usefulness of mobile devices in all subjects of the Primary school. During the following months, however, in order to highlight the initiative of the teachers involved and to enable them to become capable of implementing and effectively implementing pedagogical activities using the portable devices, they organized the lessons themselves (each at a different frequency) using the mobile devices in their lesson without the presence of the researcher-educator. At the end of these lessons there were informal conversations of a feedback nature with the researcher-educator but also between the teachers themselves regarding the conduct of the teaching, their own views on the teaching practice they followed and its effectiveness, the pedagogical benefits they identified, positive or negative that they found regarding the way students learn through the use of mobile devices as well as their reactions as well as problems or difficulties that arose.

Phase 3: The third phase of the integration of mobile devices was carried out at the end of the first academic year, i.e. in the month of June, and concerned the *general evaluation of the program as well as the educational activity*. The multiple sources of data collected in Phases 1 and 2 were analyzed in detail to assess the effectiveness of the program and identify potential improvements.

Data Collection and Analysis Methods

During the project, various sources of data were collected to explore the attitudes and practices of the involved members towards the use of mobile devices in teaching as revealed in each phase of the implementation of the project. At the beginning all the teachers of the school, including the principal, who were twenty-three (n=23) in total were given to complete anonymously three vignettes (hypothetical scenarios). Although the directly involved teachers who participated in the research and used mobile devices pedagogically throughout the school year were 6, we nevertheless wanted to investigate the previous attitudes and perceptions of all teachers towards the inclusion of this particular innovation/change. The students of only the three largest classes (4th,5th,6th), who were about one hundred (n=96), filled out an online questionnaire created through Google forms while a group semi-structured interview was conducted with each department separately. Finally, an online questionnaire created via Google forms was also completed by the parents of the specific students in order to investigate and understand some additional aspects of the research compared to those of the children, such as for example the students' previous contact and use with mobile devices in their daily life (home) or if parents are informed about the educational possibilities that mobile devices can offer.

Throughout the second phase, observation and field notes and a reflective diary were kept regarding the daily interactions/actions of the teachers and the principal, their teaching practices and the training program that ran alongside the effort to integrate mobile devices into teaching. Finally, in the third phase, wanting to investigate and capture any changes or shifts from the initial attitude of the involved members towards the usefulness and utilization of mobile devices in teaching, a more complete picture of the teaching practices and interactions of the teachers as well as the effect of the training provided throughout the year, semi-structured group interviews were carried out with the students of the departments of the three largest classes, individual interviews with the directly participating teachers and an individual interview with the principal of the school, as well as the school counselor.

At this point, it needs to be clarified that the data of the individual interviews of the teachers who participated directly in the research, as there were 6 people, were combined and strengthened with data from individual research tools (observation, field notes, diary) that were utilized and related to the final beliefs and attitudes of the rest teachers of the school unit regarding the integration of mobile devices in teaching. In addition, without focusing to a large extent, some data was also collected regarding the final opinions of the parents regarding the specific innovation/change as a result of this effort. This combination of data helped significantly on the one hand in sketching and capturing the overall picture of the school at the end of the program of integrating mobile devices in teaching and on the other hand it was a measure of comparison with the initial situation that prevailed before the adoption of the innovation of mobile learning. The quantitative data obtained from the questions of the hypothetical scenarios and the questionnaires were analyzed through descriptive and inductive statistics with the help of the SPSS statistical package. The analysis of the qualitative data on the other hand was done with the method of thematic analysis.

In-School Teacher Training

The training, which was designed and organized by the researcher, had a flexible format and functioned throughout the program as a professional learning community. Like the mobile device integration program, the educational activity was also divided into phases. All phases are detailed in the diagram below (see Diagram 2).

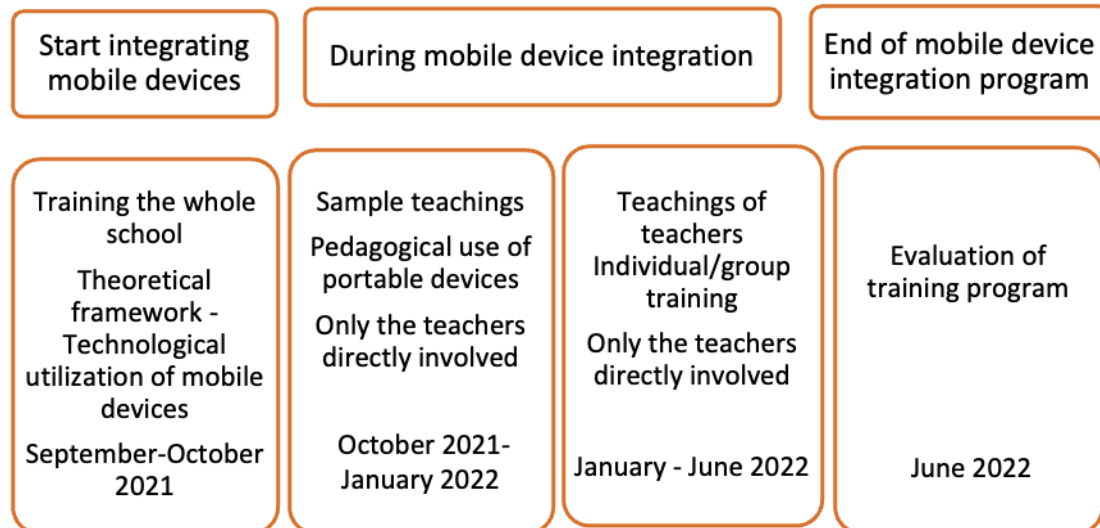


Diagram 2: Phases of in-school training program

Before the start of the training program, the principal of the school was informed about the context, objectives and organization process of the in-school training, while there was continuous and close cooperation with the teachers' association in order to meet the training needs and priorities of the teachers. The topics of the training were related to technological as well as pedagogical issues of the use of mobile devices and were mainly based on the theoretical framework of the SAMR model but also on some learning theory approaches (eg constructivism, constructionism). More specifically, the technological part concerned:

- getting to know the basic technical characteristics of a mobile device and their importance.
- exploring and changing basic settings of a mobile device.
- internet connectivity.
- searching, installing applications/software.

On the other hand, the training issues related to the pedagogical part were connected to:

- *content consumption*. Mobile devices as multimedia devices for content consumption enable students to access documents, books and presentations, photos, audiobooks, radio broadcasts, podcasts, videos, educational TV, 360 videos, explore interactive objects, 3D models, augmented reality models, virtual worlds (virtual tours) and even experimenting in virtual laboratories.
- *content creation*. Of course, the training did not focus only on the consumption of content, but had as the main and ultimate goal the motivation of the students to create with the mobile device and to become knowledge builders themselves. With the right apps, students can create documents, presentations, interactive books, photo collages, posters, comics, videos, concept maps, and more. In the same way, teachers can also create educational content and interactive objects.

- *classroom and learning management.* Learning management systems (LMS) such as Google Classroom, Class Dojo, Moodle can be integrated into teaching in order to implement the "flipped classroom" method and/or to support teaching and asynchronous learning. Such applications, such as the ones mentioned for example, also help in the organization of the course. Through them, material can be collected, tasks can be assigned and/or students' progress can be monitored.
- *the creation of formative assessment tests* with simple questions or enriched with multimedia by incorporating game techniques (gamification) to attract the students' interest.
- *the introduction and exploration of a number of educational applications (apps) suitable for mobile devices and their essential inclusion in teaching* (e.g. in which phase of the lesson to be included and in what way, their duration, the pedagogical benefits, etc.) The choice of application was made based on specific criteria, such as being relevant to one of the basic teaching subjects of the Primary school (language, mathematics, geography, environmental study, history, physics, etc.) or the age group to which it is addressed. Educators at this point could suggest educational applications that they may know about or have used so far.
- *the creation of educational scenarios* that utilize mobile devices.

Results

Although the data collected also related to other aspects of the wider research carried out in this work, we focused our interest on the attitudes and perceptions of teachers (and students by extension) but also on their teaching practices towards the adoption of this specific innovation as a case of educational change. Through the analysis of the vignettes and focusing on the investigation of teachers' beliefs towards the specific technological, educational tool, useful information emerged. Initially, most teachers of the school unit (86%) expressed positive opinions regarding various aspects of the inclusion of mobile devices in teaching. These attitudes were expressed because they considered the existing situation unsuitable for the modern era, the goals of innovation/change met the needs of society, or because they considered the differentiation of teaching methods as a modernization of education. Of course, there were also some (14%) who, although they were not negative about the use of mobile devices, expressed caution and hesitation regarding its application. More specifically, regarding the opinion that mobile devices have the ability to modify the learning process, the majority of teachers interviewed (68%) share this belief, while regarding the perception that mobile devices can contribute to a better understanding of the lesson, comparatively in the traditional way and to be useful teaching tools almost all teachers (92%) agreed. Consequently, the same number of teachers (92%) considered the use and exploitation of modern mobile devices in teaching and learning to be particularly effective, while most (86%) believed that their use increases the involvement of students in the learning process and can to improve learning outcomes. Regarding the primary school subjects where mobile devices can be used better, most teachers (68%) mentioned the secondary subjects (History, Geography/Environmental Studies and Physics) while all the teachers who answered (100%) agreed that they find it more difficult to include them in Language and Mathematics. Also, most teachers (92%), although they showed that they are aware of the new educational data and the modern pedagogical requirements imposed by the 21st century, admit that they are not ready to respond to their new role as needed. In relation to this, a large number of the interviewed teachers (86%) answered that they want to be trained often mainly in techniques related to the integration of modern ICT in teaching and

their pedagogical use as they recognize that it is the only way to be trained in this regard and to empower themselves professionally.

At the end of this effort, through the individual semi-structured interviews, it was briefly shown that those teachers who were particularly positive about the change strengthened their belief in the value of mobile learning even more as they realized practically the educational possibilities of mobile devices. On the other hand, the more hesitant teachers (who were fewer) showed that they modified and shifted their initial opinion by adopting a more positive attitude towards the inclusion and integration of mobile devices in teaching. Regarding the usefulness of mobile devices in primary school lessons, all 6 directly involved teachers who used mobile devices in their classroom throughout the school year through their interviews underlined the great and extensive educational usefulness of mobile devices, demonstrating positive perceptions but in a different way, degree and intensity. Particularly important factors that negatively affected teachers' attitudes towards the inclusion and utilization of mobile devices were seen from their statements to be technological issues such as unsatisfactory internet connection and the existence of insufficient and adequate equipment. The training program that was implemented at the same time as the effort to integrate and implement this particular innovation seems to have had a significant positive effect on the change of teachers' attitudes towards the use of mobile devices. As mentioned by all the teachers who systematically attended it, the continuous support that existed at a technological but mainly at a pedagogical level contributed to a large extent to the greater acceptance of the specific technological medium.

From the answers to the questionnaires filled in by the students (n=57) in the 2021-2022 school year and also by their parents (n=54), it appeared that mobile devices are used daily on a personal level. All students have access to a mobile device at home, while more than half of children (59%) have their own device. Impressive are the results regarding the use of mobile devices as 96% of students know how to use them at a very good or excellent level. The main reason they used mobile devices was to play digital games (90%) of a recreational nature (e.g. Minecraft, Roblox) while the next choice was to listen to music (77%) or communicate with friends (67%). For engaging in educational games, 56% of students stated that they use them, but even this portion of students who used mobile devices for educational purposes, the examples they mentioned were limited to practical and practice-type applications and mainly concerned exercises that related to the Maths course (e.g. multiplication, division, tangram, etc.) or general knowledge exercises (e.g. quizzes, knowledge tests). Few students (24%) played educational games related to a school subject. But even at school, although about half of the children (40%) stated that they used educational games or other applications almost every day in the classroom, they were games of the practice and practice type. Important at this point was the statement of several students (31%) that the technology was used by the teacher in the classroom and not by the children themselves. When asked if they wanted to make more use of mobile devices at school, 71% of students said they would very much like to use apps related to all subjects, while half of students (49%) said they wanted receive assignments through a platform or do assignments at home through a mobile device.

Like teachers and students, parents also showed a positive attitude towards the pedagogical use of mobile devices. The majority of parents (90%) stated that it is useful for the children to know the teaching part of the specific technological media as it is now part of their daily life. Most (84%) agree that the use of mobile devices in teaching significantly contributes to an easier and better understanding of the lessons by the students. Finally, an equally large

percentage of parents (82%) agreed that they would like to be informed about the educational use of mobile devices at home through a seminar.

Conclusions

In conclusion, the implementation of the specific M-Learning program developed within a defined pedagogical framework led for the first time a Greek public school to the pedagogical use of mobile devices on a daily basis for an entire teaching year in all the basic subjects of the Primary School. Undoubtedly, the adopted SAMR model can be a valuable guide for teachers in their efforts to effectively incorporate modern technological media such as mobile devices and effectively utilize digital technologies. Based on the results, as presented, we conclude that M-Learning can significantly contribute to the cultivation and acquisition of learning knowledge, be connected to the syllabus of the Primary School courses and transform the educational process by connecting the educational work with the social reality of 21st century.

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