

Using Mobile Learning in Formal and Non-formal Educational Settings

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Abstract. This paper presents experiences on mobile devices in formal and non-formal educational settings based on the relation among different ongoing research projects involving the use of mobile devices, such as tablets in educational processes. The experiences addressed in this work are interconnected through a common objective: to use of mobile devices as tablets in education to enhance teaching and learning processes. Therefore, this paper presents our experiences in two educational settings, regarding the challenges and issues we face when including the use of mobile devices in educational processes. The study uses a qualitative approach with results indicating three relevant aspects, apart from the educational setting. Therefore, we concluded that the use of mobile technologies in educational processes involve: the training of teachers or educators; the selection, organization and planning of digital resources; and, the profile of the students implicated in the educational process.

Keywords: Mobile learning · Formal education · Non-formal education

1 Introduction

The rapid technological and social changes, which are characteristic of our society, bring technological advances that provide support for new social norms [1]. Education is one of the areas impacted by this technological society [2]. In this way, the proliferation of mobile computing devices and social networks are impacting on social and educational habits [1–3]. Mobile technologies allow the user to take with him/her the object of study or to access it from anywhere, intensifying the use of mobile devices in education – it is called Mobile Learning [4–7]. The use of mobile technologies in education facilitates the development of personalized educational processes, focused on the needs and learning profile of the subject [8–10].

To keep up with technological and social changes, formal and non-formal education spaces need to constantly reinvent themselves [11–16]. Formal education corresponds to a systematic, organized educational model, structured and administered

according to a given set of laws and norms, a curriculum with objectives, content, and methodology, which necessarily involves the teacher, the students, and formal institutions, such as schools or universities [11, 14]. According to Eaton [8], Non-formal Education is an educational process that involves flexible curriculum and methodology, capability of adapting to the needs and interests of students, for whom time is not a pre-established factor but is contingent upon the student's work pace. Generally, this educational process takes place in non-formal educational institutions and a qualified teacher or a leader with more experience may conduct the learning process.

This paper presents experiences on mobile devices in formal and non-formal educational settings based on the relation among different ongoing research projects involving the use of mobile devices such as tablets in educational processes. We understand that there is an interconnection between these types of educational processes, which can improve the learning processes in both cases and increase the use of mobile technologies in educational settings. In Brazil, previous work has reported on the benefits of the use of mobile devices in formal education [9, 12, 13, 17–19] and also for students undergoing oncological treatment (non-formal education) [20]. The interconnect way in the process education in both cases can increase the use of mobile technologies in educational processes.

The researches are developed in the region of Vale do Sinos, in the state of Rio Grande do Sul, Brazil. With a focus on formal education, the research aims to investigate different opportunities of using tablets in the classroom in order to encourage innovative educational practices. The study is conducted in two different elementary schools involving teachers and students. With a focus on non-formal education, the research aims to identify how mobile devices, as tablets, can be used to assist in tutoring children and adolescents receiving treatment for cancer. The study is conducted in partnership with the Support Association in Oncopediatrics (AMO), which assists children and teenagers with cancer and a vulnerable social situation.

Therefore, this paper presents our experiences in two educational settings, regarding the challenges and issues we face when including the use of mobile devices in educational processes. The study uses a qualitative approach with results indicating three relevant aspects, apart from the educational setting. The methodology research is classified as applied, involving case studies and informal interviews and observation methods. Therefore, we concluded that the use of mobile technologies in educational processes involve: the training of teachers or educators; the selection, organization and planning of digital resources; and, the profile of the students implicated in the educational process.

This paper is organized as follows. In Sect. 2, we present the research context, the methodology proposal for applying mobile devices and the proposal for the selection and organization of mobile technologies for tablets. In Sect. 3 we present our experiences with the use of mobile devices in formal and non-formal context educational and a reflection about the results. Finally, in Sect. 4, we present the research conclusions and future works.

2 Research's Organization

2.1 Understanding Research's Context

Considering the formal educational setting this study presents experiences in using tablets in the classroom based on three different projects¹. The *Educanet project* happens in a private school and aims to enhance educational practices with the use of ICT. The project *Teaching and learning on the web: the architecture of participation of web 2.0 in the context of face-to-face education*, already finished, happened articulated along with *Educanet*, and was focused on the investigation of the use of social software in the final years of elementary school. Finally, the ongoing project *Pedagogical practices in cyberspace* is involving students and teachers from the first years of an elementary public school.

Considering the non-formal educational setting, this study presents experiences in using tablets based on *Mobile Learning project*, conducted in partnership with the Support Association in Oncopediatrics (AMO). AMO assists children and teenagers with cancer besides having a vulnerable social situation and it offers a range of activities involving cancer patients and their families, including a computer workshop and tutoring. In order to accomplish this, AMO relies on social educators and a pedagogical educator. One of the main difficulties faced by those receiving assistance from AMO is that of keeping up with the school curriculum during and after periods of hospitalization or low immunity. So, the study seeks to identify how mobile devices can be used to assist in tutoring for children and adolescents receiving treatment for cancer and their families. The study involves subjects from the fourth and ninth of elementary school.

2.2 Applying Mobile Technologies

The proposal for applying mobile technologies in formal and non-formal education follows the Information and Communication Technology (ICT) Competency Framework for Teachers, developed by Unesco [21]. The Framework is arranged in three different approaches to teaching (three successive stages of a teacher's development): Technology Literacy, Knowledge Deepening, and Knowledge Creation.

It is also important that students develop competencies for the use of technology in learning. In this paper, the proposal for applying mobile devices follows Unesco's framework including the student perspective (Fig. 1). Figure 1 shows how Technology Literacy, Knowledge Deepening and Knowledge Creation are articulated for the mobile learning perspective in Formal and Non-formal Education.

The first approach involves **Technology Literacy**. During this stage, the discovery and free exploration of technologies is developed. For the teacher, this step is necessary

¹ The educational system in Brazil is organized into basic education and higher education. Basic education involves the elementary school (9 years – children from 6 to 14 years old) and the high school (3 years – from 15 to 17). The beginning years of elementary school involve 5 grades (children from 6 to 10 years old) and the final years of elementary school involve 4 grades (children 11 to 14).

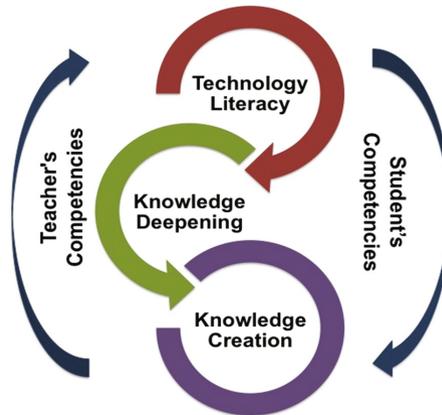


Fig. 1. Framework for applying mobile technologies

in order to appropriate the technology and consider and plan methods to integrate the use of ICT in the standard school curriculum, pedagogy and classroom structures. From the students' perspective, this involves the acquisition and recognition of devices and applications, the usability and development of the various necessary elements, such as registration, profile, navigability, etc.

The second approach involves **Knowledge Deepening**. At this stage, from the teacher's perspective, the changes should be broad and have more impact on learning, creating opportunities to develop skills in order to use more sophisticated methodologies and technologies, driving change into the curriculum. From the students' perspective, this step enables students to acquire in-depth knowledge of their school subjects and apply it to complex, real-world problems.

The third approach involves **Knowledge Creation**, which includes the 21st century skills that are needed to create new knowledge and engage in lifelong learning – i.e. the ability to collaborate, communicate, create, innovate and think critically [21]. From the teacher's perspective, the use of technology must be understood in terms of cultural artefacts, surrounding both the subject student and the subject teacher. From the students' perspective is necessary to be prepared for the development of pedagogical activities that will require the effective use of virtual communities, collaborative applications, teamwork, tools for communication and creation and problem solving.

2.3 Selecting and Organizing Mobile Digital Resources

One of the fundamental issues for the use of mobile devices in education is the selection and organization of applications. In this sense, frameworks or methodologies can be sought in the literature for the selection of applications for mobile devices in education. Most studies, in addition to addressing the pedagogical issue, analyze the function of applications and their potential use [5, 18, 22]. In the other hand, the online

stores (Google Play and iTunes - Apple Store), considering Android and iOS/Apple platforms, use categories to allow specific applications to be found easily, according to the needs of users. Considering these studies, we tried to select applications that were focused on assisting teaching and learning processes in formal education, as well as in tutoring in a non-formal setting. Firstly, applications were organized according to their organization in the online store. However, during development of the experiments, we identified the need for a categorization that supported the selection and organization of applications on the devices, assisting in the planning of pedagogical activities. Considering this, the following categories were proposed for classification of the applications in our researches:

- **Support:** The *Native* applications already available on the devices and applications used to assist and support pedagogical activities. These applications are, in general, not the focus of the process, but rather support the use of other applications or activity. The applications in this category are widely used in the Technology Literacy phase, in which subjects adapt to using the devices. This category includes many different applications. So, it is possible to create a subcategory in order to group the applications according to their features. For Example, it can be **subcategorized** into *Media Option* group application voice recognition, audio files, video, etc.;
- **Education:** Applications specifically focused on the themes to be developed within the pedagogical proposal being applied. These are **subcategorized** according to the themes to be worked on, such as *Literacy, Portuguese, Mathematics, Spanish, English, Music, Arts, etc.* The applications in this category can be widely used in the Knowledge Deepening phase;
- **Entertainment:** These may also include an interdisciplinary approach with respect to other categories and involve applications used in a less restrictive approach to take advantage of the devices. At the same time, they are fundamental to the process of technology literacy the subjects undergo in order to use the devices. These can be **subcategorized** into *Action and Adventure; Sports; Casual, etc.*
- **Collaborative:** Applications that make use of mobility, encouraging exchange of knowledge and teamwork among subjects, involving activities focused on their social interaction. This category can be **subcategorized** into applications for *Social Networking, Virtual Learning Community and Environment, Collective Writing, Blogs, Creativity/Multimedia, etc.* The applications in this category can be widely used in the Knowledge Deepening and in the Knowledge Creation phase;

In our classification we do not explicitly use a *Games category*. In this paper, a game, when applied with an educational goal, is considered to have the aim of involving the player-student in a playful and entertaining, although formal, universe, with an educational objective to be achieved. In this way, we conclude that the game concept is incorporated across categories. For example, a game can be classified as a *Collaborative* as well as an *Entertainment* or *Education* resource.

3 Using Mobile Learning in Education

3.1 Experiences in Formal Education

The use of tablets in education, in the context of the *Educanet* project, began in 2012, when the school purchased 20 iPads. These are currently used in early childhood education and in the initial years of elementary education, totaling 177 students and 9 teachers (in the third stage of the second cycle/fifth year of the double teaching system). The teachers involved in the project were accompanied on a subject basis and/or in small groups for studies on the use of tablets in the classroom. In the first phase of using the iPads, focusing on technology literacy (2012/1st semester), student activities involved entertainment and the use of several applications for tutoring. Entertainment activities were performed for the first few occasions in order to assess students' knowledge of the devices and to enable teachers to become familiar with the dynamics of using iPads in the classroom. In this stage were used mainly applications from the categories **Education** and **Entertainment**. In the second phase, focusing on knowledge deepening (2012/2nd semester and 2013), the teachers began to use the tablets in the classroom without any monitoring by the training staff. The activities proposed for students involved the use of applications in order to reinforce the school curriculum in development. The activities in this stage sought coordination between the applications and the proposed lesson, but activities were still very much focused on the applications. In this stage were used mainly applications from the category **Support**, especially photography, video and text editing. The third stage, involving knowledge creation, in development this year, seeks to explore pedagogical practices through the use of tablets from the perspective of the digital cultural artefact. In this perspective, we seek to overcome the emphasis on applications and create opportunities for activities effectively integrated into content and the daily lives of students. Therefore, in this stage, applications from **Support** and **Collaborative** categories were the most used.

The research called *Teaching and learning on the web: the architecture of participation of web 2.0 in the context of face-to-face education* has begun in 2013 with the acquisition of 17 tablets with Android. This research was developed during two years (2013–2014) using the action-research methodology involving teachers and students in the final years of elementary school. We understand that changes in the pedagogical practices can't be mandatory. This way, involving the teacher in the research process and turning him the actor of his educational process could provide significant changes through new teaching practices. The approach used in the teacher educational process was based in according to the three phases of framework for applying mobile technology (Fig. 1). The first phase involved the **Technology Literacy** of the teacher. This phase, which occurred in the first semester of 2013, involved experiences with the use of tablets and with mobile applications with the purpose of allowing the teachers to know the potential of mobile devices and the possibilities of the use of social software in the classroom. The **Knowledge Deepening** phase was developed in the second semester of 2013. During this phase we worked with the teachers in order to develop class planning and to help them in the activities with the tablets and with the use of social software in the classrooms. The third and more complex phase is the knowledge creation. This phase occurred during 2014, when the teachers were challenged to use

the tablets and the social software without the overseeing of the research team. This proposal involved mainly applications categorized as collaborative like Evernote and Pinterest. However, applications from the **Support** category also were necessary, especially video, photography, and audio applications.

The research called *Pedagogical practices on cyberspace* has begun in 2014 with the acquisition of 15 tablets with Android. The research is happening in a public school involving students and teachers of the first years of elementary school. This school is part of the One Laptop per Child program. In this program each student has his own laptop to study. The school also has a laboratory with 15 computers, and wifi internet access in the whole school. During the first semester of 2014, the activities involved the organization of tablets, installation of applications, and teachers' education in the technological literacy perspective. In the second semester of 2014 the activities with students began. The activities were conducted in partnership with the teachers. The students' first experience with tablets aimed to observe their previous knowledge in the use of mobile devices. The students could freely explore the different applications installed. We perceived that they chose applications from entertainment and collaborative categories such as Facebook and Youtube. We understand that this free activity can also be understood as a time when teachers could explore, along with the students, the different possibilities of the tablets, and to learn more about the applications. From the second semester of 2014 until the present many activities were conducted with students. The most used applications were those, which allow the production of students, such as text applications (Bamboo Paper), photography (camera, Paper Artist), video (VideoShow), and others. Therefore, in this stage, applications from **Support** category were the most used.

It is important to highlight that in all the three-presented cases the proposal of the activities and the selection of applications were guided by the learning goals.

3.2 Experiences in Non-formal Education

The research called *Mobile Learning Project* has begun in the first semester of 2013 with the acquisition of 7 tablets with Android. In the case of this research the tablet devices are shared.

During 2013 year, twelve subjects in the age range of eight to sixteen participated in this research, which also involved the AMO. Of these, seven subjects are undergoing cancer treatment and the others are family members. Seven of them were patients, while the others were family members. The patients were undergoing medical treatment for cancer problems such as leukemia, lymphoma and bone cancer. The work has been developed through weekly classroom-based workshops in according to the three phases of framework for applying mobile technology (Fig. 1) and was integrated with the basic computer course offered to patients and families. The educator responsible for the course was involved in the process and assists researchers in the proposed activities.

In the **Technology Literacy** phase, free entertainment and appropriation workshops were held for use of the mobile devices. During this phase, the subjects were observed to have no great difficulty using the devices. In this stage, applications from **Support** category were the most used. The **Knowledge Deepening** phase took place

from April to October 2013. Planning is conducted for each workshop, in which subjects are asked to develop the proposed activities, according to the themes to be addressed. The workshops to use the applications related to the teaching Mathematics, Portuguese, Entertainment, as well as basic computer and office tools. For example, we used an educational application called “Jogo da Forca” (hangman game) that improves Portuguese skills. As a result of using the applications in this phase, we realized the need to develop mobile educational games that addressed more specific content focused on the needs of the subjects – in Portuguese and Mathematics. Accordingly, the project team developed two games, called “Corrida Gramatical” (Grammar Race) and “Navegática” [10]. These applications are also used in the workshops and are continually updated. Therefore, in this stage, applications from **Education** and **Entertainment** category were the most used. The **Knowledge Creation** phase began in the second semester of 2013 and made use of collective and collaborative writing with Evernote. During this phase, each subject created a note in the Evernote. In this note, they wrote about things that they liked, as music, sports, friends, etc. So, in this stage, **Collaborative** category was the most used.

During the second semester of 2014, five subjects in the age range of six to fourteen participated in this research. The subjects were students from the fourth to ninth year of elementary school. The subjects used tablets containing applications for entertainment and for stimulating skills of the reading, the writing and the logical reasoning. During this year the workshops were developed only by the researcher’s team. Sometimes AMO’s educator (a pedagogue) used to observe the work being developed. The educator did use tablets or participated in the activities.

The activity that all of them developed was a Fanzine. The objective of this activity was to stimulate skills of reading, writing and text structure. This activity also was chosen because it provided the authors expressing their interests on various subjects such as music, toys, drawings and hobbies. Each workshop had a plan, which was required to subject them to develop the proposed activities, as the project developed. First the subjects passed the **Technology Literacy** phase where the tablet and its resources were used freely. During this phase the subjects were motivated to use the applications that involve Mathematics and Portuguese, as well as explore device capabilities, surf the Internet and access to Google Play to suggest new applications. Therefore, in this stage, applications from **Support, Education** and **Entertainment** category were the most used. In the **Knowledge Deepening** phase, the Fanzine project was development. For this, we used the Supernote application, which allowed the inclusion of images, audio and drawings, as well as written with keyboard and hand.

The subjects also used the device features such as the camera, to photograph objects and put in the magazine. The teachers pointed out areas for improvement and the correction during the writing, so that participants were able to learn rules and apply them appropriately in their texts. They also play during this phase the games that the project team developed (“Corrida Gramatical” (Grammar Race) and “Navegática”). We evaluated these games during workshops and we used the information for update them. As the first phase, applications from **Support, Education** and **Entertainment** category were the most used. The Knowledge Creation phase was development interchanging with the **Knowledge Deeping**, because during the workshops, the participants also used the browser to process the information on the Internet and capture images,

manipulated through the photo application. They used e-mail to share their fanzines with each other, using for this applications classified in **Collaborative** category. So, it was observed that the fanzines' productions reflected the personality of each author.

3.3 Analysis

The autonomy becomes an important element in the meaning of learning for the subject. The subject, responsible for their own education, develop and redevelop the elements of the learning, making choices and interacting and selecting meaningful elements to assist in their learning. This process of meaningful learning and the subject's engagement with teaching and learning are present in both formal and nonformal education settings. In the formal setting, we realize that the more the teacher coordinates the technology with the curriculum and pedagogical practices, the more students engage and perceive meaning in pedagogical activities, including relating with other areas of knowledge. In the non-formal setting, we see that coordinating technology with the pedagogical objective to be achieved, together with the social context and health of the subject (in the case of this study, considering the stage of cancer treatment of the subject) is fundamental to the proposed objectives. In addition, regardless of the context, we observe students exploring the potential of tablets, making choices and using resources and applications beyond those proposed for the pedagogical activity, collaborating to achieve the proposed objectives. In many cases, teachers or educators find themselves learning new tools that had not been considered in the context of the proposed activity. It can therefore be seen that the effective use of technology in an educational context involves the training of teachers or educators and the appropriation of technologies by students, with the involvement of both subjects as active players in the educational process.

Pedagogical actions that involve meaningful learning and student autonomy have specific characteristics in formal and non-formal education settings. In formal education, the fact activities are aimed at organized groups, with similar ages, interests and knowledge, which is a facilitating factor. For example, the activities generally involve classes of students who are in the same school year and have been together for a longer period of time – usually one year. In addition, teachers often have a “history” of the student or class since they have attended the school for a long time. Accordingly, this scenario is seen to facilitate the planning of pedagogical activities involving technologies and the evaluation of results, impacting new activities to be proposed. In a nonformal educational setting, planning, observing and evaluating educational activities with the aid of technologies involves a broad diversity of subjects and interests. Generally, groups are heterogeneous both in terms of interests and knowledge. For example, in the same group we have subjects from the fourth, fifth and ninth years of elementary education. Consequently, the same activity needs to involve different subjects, content and objectives.

Whether in a formal or non-formal context, we observed that the student subject truly perceives and uses technology, to a greater or lesser degree, as a part of their culture. So, the subjects in school or in social projects today were born and live in a digital culture in which digital technological artefacts, according to Bassani [9], are

natural elements, embedded in the lives of these subjects, to a greater or lesser degree. From the perspective of the subject teacher or educator, technology is an element to be understood, explored and reworked, given that it is not a “natural” part of the culture. According to Prensky [16], these subjects, who are generally teachers or educators, tend to speak a digital language with an “accent” and may demonstrate difficulty in understanding and expressing themselves digitally, need to adapt to this new digital culture and appropriate digital technological artefacts. In both research settings, we clearly see the differences related to digital culture among teachers or educators and students. For the teacher or educator, considering the use of technology in the educational process always involves knowledge of this technology and a level of comfort with the resources to be used. This aspect limits use of the available resources, even if a team of experienced researchers supports the teacher. This occurs more clearly in a formal setting since the teacher has responsibilities with regard to the formal school process and needs to reinvent and rework the educational process. The teacher therefore needs to deal with the new and the unknown. In the context of non-formal education, although researchers also support educators, they feel less restricted to experiment with technological resources, learning along with the student and changing the pedagogical activity during the process. In addition, since this occurs in a more informal setting with more varied subjects, it naturally creates an environment in which living with diversity is natural. The autonomy of the student in this case is fundamental since the educator needs to take account of the different objectives and needs present in the same class, within the context of a single activity. The same activity can therefore achieve the objectives of one group, but needs to be adjusted for another. Accordingly, both the student subject and the educator subject are more comfortable in exploring the proposed digital resources.

4 Conclusions and Future Works

This article presented the relation between the formal and non-formal educational settings regarding the challenges and issues we face when including the use of mobile devices as tablets in both educational processes. The experiences were interconnected through a common objective: to use mobile devices, as tablets, in education to enhance teaching and learning processes. According to our studies, we identified that the main issues regarding the use of mobile technologies in educational processes are related to three aspects: (1) *The training of teachers or educators*. The use of technology in the educational process always involves knowledge of this technology and a level of comfort with the resources to be used. It is important that teachers or educators make use of mobile technology and identify how this technology can support learning process. For this, the training for the use of technology in teaching is necessary; (2) *The selection, organization and planning of digital resources*. It is important to identify and organize the mobile application considering the learning objective. So, teachers and educators need to be updated about applications and its possibilities; (3) *The profile of the students involved in the educational process*. Pedagogical actions that involve meaningful learning and student autonomy have specific characteristics in formal and

non-formal education settings. Therefore, it is necessary that teaching and learning process take this into consideration.

The research has not been concluded yet. We are analyzing the data collected considering the learning process. Regarding formal education, it is necessary to identify how the tablets have improved the pedagogical practices of teachers and how students were involved in the proposed activities. On the other hand, considering the non-formal education, it is necessary to analyze how the activities with the use of tablets have assisted tutoring and how the reading and logical reasoning skills have been developed.

Moreover, it is important to review the proposal for the selection and organization of applications in mobile devices. During the research we concluded that there are different needs in formal and non-formal educational settings. In addition, we must evaluate effectively if this proposal helps teachers and educators in the applications' selection.

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