

Overview of national and international scientific publications on mobile learning and collaborative practice

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Abstract

This study aimed to present an overview of national and international scientific publications on mobile learning in collaborative practice and the use of mobile devices with students from the 4th to the 9th grade of basic education. Its relevance comes from analyzing how these technologies can be used to assist collaborative practices in and beyond the school. In addition, concepts of appropriation and pedagogical mediation are considered in the use of mobile devices to mediate the teaching and learning process, in order to know their effects in the educational context. In this sense, a systematic review of the literature was carried out in the Brazilian Digital Library of Theses and Dissertations (BDTD, in Portuguese) and in the following databases: SciELO, ERIC, Web of Science and Science Direct, resulting in eighteen scientific publications concerning mobile learning in collaborative practice and the use of mobile devices with elementary and middle school students. There was a shortage of Brazilian research that addresses mobile learning, collaborative practice and the use of their mobile devices in elementary and middle school.

Keywords

Mobile learning. Teaching practice. Collaborative Practice. Mobile devices.

Panorama das publicações científicas nacionais e internacionais sobre a aprendizagem móvel e a prática colaborativa

Resumo

O presente estudo objetivou apresentar o panorama das publicações científicas nacionais e internacionais sobre a aprendizagem móvel na prática colaborativa e a utilização de dispositivos móveis com alunos do 4^o ao 9^o ano do ensino fundamental. Sua relevância parte da análise de como essas tecnologias podem ser utilizadas para auxiliar práticas colaborativas na e além da escola. Além disso, considera-se conceitos de apropriação e mediação pedagógica na utilização dos dispositivos móveis para mediar o processo de ensino e aprendizagem, a fim de conhecer seus efeitos no contexto educativo. Nesse sentido, realizou-se uma revisão sistemática da literatura na Biblioteca Digital Brasileira de Teses e Dissertações (BDTD) e nas seguintes bases de dados: SciELO, ERIC, Web of Science e Science Direct, resultando em dezoito publicações científicas relacionadas a aprendizagem móvel na prática colaborativa e a utilização de dispositivos móveis com alunos do ensino fundamental. Constatou-se carência de pesquisas brasileiras que abordem a aprendizagem móvel, prática colaborativa e o uso de seus dispositivos móveis no Ensino Fundamental.

Palavras-chave

Aprendizagem móvel. Prática docente. Prática Colaborativa. Dispositivos móveis.

Resumen de publicaciones científicas nacionales e internacionales sobre aprendizaje móvil y práctica colaborativa

Resumen

El presente estudio tuvo como objetivo presentar el panorama de las publicaciones científicas nacionales e internacionales sobre el aprendizaje móvil en la práctica colaborativa y el uso de dispositivos móviles con estudiantes de 4 ° a 9 ° grado de la escuela primaria. Su relevancia proviene del análisis de cómo estas tecnologías se pueden utilizar para ayudar a las prácticas de colaboración dentro y fuera de la escuela. Además, los conceptos de apropiación y mediación pedagógica se consideran en el uso de dispositivos móviles para mediar en el proceso de enseñanza y aprendizaje, a fin de conocer sus efectos en el contexto educativo. En este sentido, se realizó una revisión sistemática de la literatura en la Biblioteca Digital Brasileña de Tesis y Disertaciones (BDTD) y en las siguientes bases de datos: SciELO, ERIC, Web of Science y Science Direct, que dio como resultado dieciocho publicaciones científicas relacionadas con el aprendizaje móvil en la práctica. colaboración y uso de dispositivos móviles con estudiantes de primaria. Hubo una escasez de investigación brasileña que aborda el aprendizaje móvil, la práctica colaborativa y el uso de sus dispositivos móviles en la escuela primaria.

Palabras clave

Aprendizaje móvil. Práctica docente. Práctica colaborativa. Dispositivos móviles.

1 Introduction

We observe, in literature, relatively little understanding concerning the ways that mobile devices can be designed and used to support collaborative practices in school. Hsu and Ching (2013) recommend that these devices' mobility enables mobile learning through collaborative production between students, mediated by the teacher, in order to establish movement and interaction with others in different environments, instead of limiting the activity with one partner assigned to a desktop computer inside a laboratory. In addition, they reinforce the need for research that investigates how to promote collaboration and interaction using mobile applications available online that may be used for education.

Mobile learning in collaborative practice requires relevant abilities, such as: planning, negotiation and capability to listen to others (FERREIRA; MUNIZ; OLIVEIRA JÚNIOR, 2018; FANTIN, 2017). Accordingly, Torres and Irala (2014, p. 61, our translation) highlight that "knowledge is socially constructed, in the interaction between people". The authors illustrate that – when students are involved in problem situations in which they must make decisions, forming value judgements and evaluating social implications – learning

becomes more contextualized. This way of thinking removes the student from the axis of mere passive knowledge assimilation and places them in the perspective of active constitution of knowledge, which stimulates a greater commitment to their own learning and promotes the development of more autonomous attitudes (BERRIBILI; MILL, 2018; NASCIMENTO, 2016).

In this perspective, we question: which national and international studies on mobile learning in collaborative practice with focus on the use of mobile devices in elementary and middle school can be found through the systematization of studies carried out in databases and indexers? The objective was to present an overview of national and international scientific publications concerning mobile learning in collaborative practice and the use of mobile devices with students from the 4th to the 9th grade of basic education.

The social relevance of this study consists of analyzing how these technologies can be used to assist collaborative practices in and beyond school. In addition, we must consider how the concepts of appropriation and pedagogical mediation during the use of mobile devices can help the teaching and learning process in order to discover their effects in the educational context.

2 Methodology

In order to select studies related to the central scope of this study, we undertook a systematic review of literature, which, according to Silva, Dias and Rios (2019, p. 152, our translation), “consists of a research approach that has been explored more frequently in the past ten years, due to the need to point out what has already been produced about a determined theme”. This review used the Brazilian Digital Library of Theses and Dissertations (BDTD, in Portuguese) and the following databases: 1) Portal of Periodicals of the Coordination for the Improvement of Higher Education Personnel (CAPES, in Portuguese); 2) Scientific Electronic Library Online (SciELO); 3) Web of Science (WOS); 4) Education Resources Information Center (ERIC); and 5) Science Direct (ScD).

For search criteria, we defined descriptors to identify studies about mobile learning in collaborative practice. Thus, we searched for those two expressions in English and in Portuguese (*aprendizagem móvel; prática colaborativa*), peer reviewed, with help from

filters to follow, analyze and visualize the studies. The same procedure was followed for the terms: mobile device, mobile technology (*dispositivos móveis; tecnologias móveis*).

All search tools used have filters that delimit the theme that is being evaluated: some use “and”, “or”, others have fields for publication date, type of material, language. Therefore, we filtered, in two steps, the national and international articles, dissertations and theses from the last five years for selection aiming to collect more information.

In the first step, we carried out a pre-selection of articles relevant to the main issue, reading their titles, abstracts and descriptors. In the second step, all those pre-selected were evaluated by the researcher and, in each article, we identified how the descriptors were revealed, applied and discussed. Then, the data from the studies provided answers to the question originated from this systematic review of literature. The studies found on more than one database were removed to avoid duplicates.

In BDTD, the terms “mobile learning”, “collaborative practice” and “mobile device” were searched combined. In addition, we used the criterion of date to select studies published in the last five years. The first search found 11 dissertations and 3 theses. After reading the abstract, only 3 dissertations matched the scope of this article, since the others, even approaching the expressions searched, didn’t really discuss collaborative practice, that is, the investigations culminated in individual activities for the students.

In the Portal of Periodicals CAPES, which has only two fields to enter descriptors, the search was divided in two phases. In the first phase, we delimited the expressions “mobile technology” and “collaborative practice” with the criteria of date, type of material, in this case, articles, and any language. In this search, we obtained 32 articles. In the second phase, we delimited the keywords “mobile learning” and “mobile device”, with the same criteria, finding 19 other articles. After reading the 51 abstracts, we identified that only 7 studies were carried out with students from elementary and middle school, since the others discussed the themes in higher education or in vocational courses.

The ERIC service, sponsored by the U.S. Department of Education, disseminates publications in the Education field. Based on the date criterion and through the Boolean operator “and”, we searched the descriptors “mobile learning”, “collaborative practice” and “mobile device”, which, added to the term “elementary school/middle school”, found 8 articles. However, we only analyzed 2, because the others had been found in the search carried out in the CAPES Portal.

In the North American platform Science Direct, which offers access to the full text of articles written by authors from the scientific scenario in the main fields of knowledge, we selected a search with the same descriptors and criteria used in ERIC, obtaining 6 articles, but 5 of them were also found in the CAPES Portal. Therefore, only one article was analyzed.

In SciELO, we used three keywords: “mobile learning”, “collaborative practice” and “mobile device”, followed by the Boolean operator “and”, resulting in 12 articles, but 10 of these hadn’t been carried out in basic education, which left us only 2 articles for analysis. In WOS, the search used the same descriptors, which, added to the date criterion, found 20 articles. After reading the abstracts and removing duplicates, we obtained only 3 studies.

3 Results and Discussion

The initial search resulted in three Master’s dissertations developed in Brazil and one hundred and eleven articles published in scientific journals: twenty in Brazil and ninety-one in other countries. After adding “elementary school” and “middle school” to the search, in order to further specify the study, all four search tools also compiled other education levels and modalities. We also emphasize that the terms “elementary school” and “middle school”, in English and in Portuguese (*ensino fundamental*), were essential to the search, because they define a specific audience of students, subjects and school level to answer the main objective of this study, which is to present an overview of national and international scientific publications about mobile learning in collaborative practice and the use of mobile devices with students from the 4th to the 9th grade of basic education.

Thus, ninety-six articles were excluded, because they concerned Higher Education, Distance Education or Vocational Education, or didn’t have empirical research about the use of mobile devices in collaborative practices. Therefore, in the second triage, based on the choice criterion related to elementary and middle school, it was possible to extract and analyze only eighteen studies that concerned the target audience of students from the 4th to the 9th grade, as can be seen in the following table. Out of these eighteen studies, three are Master’s dissertations developed in Brazil and fifteen are scientific experiments that took place in the USA, England, Singapore, Finland, Taiwan and Spain.

Table 1 – Relevant aspects of the studies on mobile learning

(to be continued)

Authors / Year	Subject / Content	Mobile device and app	Territory	Database	Type of publication
Gomes (2011)	Transversal themes	Expanding the classroom: Ubiquitous technological resources in collaborative processes of teaching and learning	National	BDTD	Dissertation
Barbosa Neto (2012)	Math	A methodology to develop educational games on mobile devices for virtual learning environments	National	BDTD	Dissertation
Higuchi (2011)	History	Mobile technologies in education	National	BDTD	Dissertation
Norris e Soloway (2012)	Language	Under what conditions does computer use positively impact student achievement? Supplemental vs. essential use	International	CAPES	Article
Boticki et al. (2011)	Math	Supporting mobile collaborative activities through scaffolded flexible grouping	International	CAPES	Article
Liu, Lin, Paas (2014)	Language	Effects of prior knowledge on learning from different compositions of representations in a mobile learning environment	International	CAPES	Article
Laru, Järvelä, Clariana (2012)	Text genre	Supporting collaborative inquiry during a biology field trip with mobile peer-to-peer tools for learning: a case study with K-12 learners	International	CAPES	Article
Pérez-Sanagustín et al. (2012)	Geography	4SPPIces: A case study of factors in a scripted collaborative-learning blended course across spatial locations	International	CAPES	Article
Charitonos et al. (2012)	History	Museum learning via social and mobile technologies: (How) can online interactions enhance the visitor experience?	International	CAPES	Article
Ting (2013)	Text production	Using mobile technologies to create interwoven learning interactions: An intuitive design and its evaluation	International	CAPES	Article
Barbour, Grzebyk, Eye (2014)	History	Any time, any place, any pace? Exploring virtual	International	ERIC	Article

		students perceptions of mobile learning			
Norris e Soloway (2011)	Science	Learning and schooling in the age of mobilism	International	ERIC	Article
Roschelle et al. (2010)	Math	From handheld collaborative tool to effective classroom module: Embedding CSCL in a broader design framework	International	ScD	Article
Warshauer (2011)	Science	Tablet computers in education	International	WOS SciELO	Article
Sharples e Roschelle (2010)	Social life	Guest editorial: Special section on mobile and ubiquitous technologies for learning	International	WOS SciELO	Article
Goundar (2011)	Reading	What is the potential impact of using mobile devices in education	International	WOS SciELO	Article
Laru, Naykki e Järvelä (2015)	Projects	Four stages of research on the educational use of ubiquitous computing	International	WOS SciELO	Article
Sharples (2013)	Learning theories	Shared orchestration within and beyond the classroom	International	WOS SciELO	Article

Source: Prepared by the author (2019).

The discussion about the data collected was divided between national and international publications, presented in the following topics.

3.1 National research perspectives

In the study by Gomes (2011), mobile learning was the starting point to seek guidance to plan, execute and evaluate educational activities that use mobility through tablets. The author proposed educational activities supported by the mobile devices in order to reflect educational praxis in the perspective of complex thought in formal contexts of teaching and learning. Three types of games were described: one that facilitates gymkhanas; one that consists of a virtual visit to an art museum; and, lastly, one that handles a critical collection of sounds for music composition. The results expose the feasibility of using ubiquitous technological resources to expand the classroom, since they

tend to be potentially efficient for learning in a contextualized manner in projects with transversal themes. However, the research applied these resources only in the school space and during class hours, and didn't develop experiences with students and teachers discovering other physical and temporal environments, which would be important to visualize mechanisms to minimize school failures (PEREIRA; RIBEIRO, 2017).

Barbosa Neto (2012) presents a methodology to develop a digital educational game for mobile devices and its integration with virtual learning environments (VLE). The methodology to create the game for Math class in middle school was divided in three phases: development of the app, integration with VLE, and final assessment. The research participants who used the game after its implementation were: four students in the 8th grade at a private middle school and twelve students in the sophomore year of high school at a state public school in the city of Recife-PE. The results indicated the students' ease when using the games on a smartphone, being encouraged to advance in stages through individual problem-solving strategies at any time. Although students used the game on mobile devices, the study doesn't show collaborative learning situations between students during the use of the game or in VLE. We notice, however, that the actions were individual and provided only communication between student and machine.

Higuchi (2011) investigated how the school environment incorporates mobile technology into the educational process. The researcher explores an experience carried out at a public school with students in the 9th grade of basic education who used smartphones to help with pedagogical activities developed in History class. The study shows that, to motivate students in class, the teacher asked them to record pictures of possible points of water accumulation where dengue mosquitos could breed in the region where they live, since everyone was committed to the development of tasks of the project "Dengue Prevention" that took place in the first semester of 2010. Therefore, they shared information and organized debates about the subject. The research results show the students' ease to access online digital resources through the smartphone during classes, as well as the need to know more about the theme, using online research as a basis. Despite that, the study doesn't clarify how the teacher mediated the students' collective actions and what collaborative productions emerged from the project. It is important to shed light on studies that discuss teacher training (ARAÚJO; ESTEVES, 2017; JARDILINO;

SAMPAIO, 2019; SOUSA; MARQUES, 2019; VASCONCELLOS; BERNARDO, 2016), specifically, to work with digital technologies (FONSECA, 2019).

The analysis of these studies reveals that none of the Brazilian studies emphasizes the potential of mobile learning in collaborative practice for the development of activities that go beyond the school environment itself. In addition, the studies didn't analyze the mobile devices from a teaching point of view and their role in learning. It is even more important to acknowledge that the development and use of technology standards is changing rapidly, demanding a diagnostic of the tendencies and functionalities of different types of mobile devices in education, which also wasn't revealed in the investigations (FONSECA, 2019; FERNANDES, 2016).

Despite that, these three studies report positive results that show the students' engagement with mobile technologies. However, it is necessary to verify if what happens during the mobile learning process is also being discussed and related to the school context and what is experienced in the general community, overcoming the school walls. That is, identifying strategies of how the teacher can mediate collaborative practices with mobile devices in the context of the classroom in situations present in the students' daily life (SOUSA; MARQUES, 2019; THERRIEN; AZEVEDO; LACERDA, 2017).

We can also notice that the enterprise in developing resources for mobile devices doesn't use the potential for collaboration present in some technologies (FANTIN, 2017; TRIGUERO, 2018). These studies bring the idea of interactive interface that enables communication between user and product, i.e., each student has a mobile device that allows them to interact and carry out a task completely or in part.

3.2 International research perspectives

Norris, Hossain e Soloway (2012) admit that the students from a school located in the rural area of Ohio, in the USA, in a project carried out in 2008 and 2009, used cell phones to develop 50% of their daily activities in school and, later, used them for tasks outside the school environment. The students used a learning platform called *Studywiz* that provides some digital resources, among them a collaborative text editor. The results evidence that students in basic education showed better writing performance. They wrote

texts collectively, first divided in groups and later organized with all the students in the class.

In a Math collaborative activity, a teacher reinforced the course syllabus, adjusted the class times and sought strategies to identify peers with complementary fractions combining circular sectors in a group of students in the 4th grade of basic education at a school in Singapore, and then formed groups among themselves. For that, they used the Form-a-One (FAO) app, which treats fractions in the form of graphic representations. Boticki, Looi and Wong (2011) investigated and mapped the collaboration of each group based on three aspects: technological, social and pedagogical, in order to identify how mobile technologies support the development of the activity with fractions. According to the authors, technological and social support were reciprocal, the students communicated and negotiated verbally, as well as through smartphones.

In addition, these technologies facilitated the understanding of problems mediated by the teacher and promoted advances in problem resolution, because the students visualized each other's fractions, being able to refer to their devices and go through the corresponding lists, helping, explaining and justifying their hypotheses. The teacher was able to specify parameters in the resolution of problems that directly impacted the accomplishment and possibilities of collaboration between students, that is, on each step, the teacher questioned, guided the students along the new problems, encouraged them to move around the classroom and negotiate.

On another study, Liu, Lin and Paas (2014) investigated an initiative of mobile learning in a large school district in the USA, based on providing iPod touch devices on all days of the week in any time and space for teachers and students of English. The teachers showed texts and songs in English and the students added extra information, such as videos and images, to the task bank available in a shared virtual folder. The results revealed that the iPod touch was used to support language content learning, provide differentiated pedagogical support and expand research time with activities developed at home. However, some challenges were identified, such as: a need for professional training and technical support.

Field classes with the use of mobile devices were highlighted in three studies that we will discuss now. Laru, Järvelä and Clariana (2012) identified and compared the performance of twenty-two students in the 7th grade of basic education, divided in two

groups of two and six groups of three, during argumentative discussions with the support of cell phones, in a 1:1 proportion (one device for each student), carried out on a trip to a natural park in the north of Finland. The project consisted of solving problems proposed by the teacher through a series of sequential images (storyboard) of the Flyer app, which enables the creation of a social network, transmitting and searching information of people or groups. In the project, the students presented their own arguments to the teacher's questions in the form of messages and compared them to the other answers. According to the researchers, the use of the messaging tool fostered argumentative interactions during the students' questions, which enabled the establishment of levels of answers and of participation and, consequently, the creation of a new sequence of images to produce a video.

Pérez-Sanagustín et al. (2012) recommend that collaborative activities with support from mobile devices in field classes should consider four factors: space, pedagogical method, participants and history. These factors comprise the term 4SPPIces and establish a framework that produces a script to facilitate the development of these activities. The researchers tested 4SPPIces in a classroom with thirty-four students and two teachers (incumbent and assistant). The script aimed to resolve the limitations of an activity that happens annually, a field work within the Geography subject to promote students' familiarity with urbanism and social and geographical characteristics of different districts of the city of Duc de Montblanc de Rubí, in Spain. The authors revealed that the space factor proved a good mechanism to use available tools (webcam, GPS, map research) in mobile technologies, given the possibility to record spatial locations where the activities took place. Due to the project organization, the teachers were limited to observing and answering questions about the subject, and their communication with students happened in-person, sporadically and verbally.

Charitonos et al. (2012) investigated the use of social networks and mobile technologies in a school trip to the Museum of London with 29 (twenty-nine) students in the 9th grade and the History teacher from a school in Milton Keynes, located 72 km away from London. Pedagogical work in museums is anchored in different sociocultural learning perspectives with a focus on artifact mediation to understand what is seen, read and heard. The authors concluded that using Twitter improved the understanding, participation and enthusiasm of students during the museum visit. Online interactions helped in the

negotiation and knowledge exchange between students. In addition, the technologies didn't interrupt or disturb the authenticity of the scenario, on the contrary, they had an impact on the social and pedagogical dynamics proposed in the museum visit, as well as helped the process of constructing meanings collectively. However, the role of the teacher in the research was restricted to observing the students and helping them with issues related to local security, thus, it wasn't possible to understand teacher mediation and the connection between content studied in the classroom and on the field trip.

These last three studies point to the possibility to record information collected in environments outside the school through the use of apps and mobile devices. These facts were important to the development of activities of sharing and production, in addition to enabling the continuity of curricular subjects and fostering debates about what was analyzed and revealed.

Ting (2013) carried out a study to identify how students in the 6th grade of basic education at a school in Taiwan interacted when using mobile technologies in school activities. Fifty-seven students divided in nineteen groups participated in this experiment. Before starting the activities, they filled a questionnaire about previous knowledge in the use of mobile technologies. The results emphasized the students' point of view on the use of mobile devices in the school routine, and they were unanimous in saying that these technologies enable better interactions among them and make learning more practical and full of possibilities, because there are several apps that help in the development of the activity.

Another study analyzed the use of an app that works on mobile devices, called *Mobl21*, by eleven students between ten and twelve years of age enrolled in a supplementary course on European History, initially taking place in a virtual learning environment, offered by a school in the Midwest of the USA. According to Barbour, Grzebyk and Eye (2014), the implementation of *Mobl21* in the place of the virtual environment of the course, in the students' perspective, caused a pedagogical shift. This app assists on the learning of several educational themes through questions, video presentations and texts, and works in three operational systems: iOS, Android and Blackberry, as well as an emulated version that can be executed on any mobile device. As a result, students' perceptions on *Mobl21* were justified by its usability and mobility: 1) easy access of tools on any device; 2) regularity in studies, since technology is on hand; and 3) can be used at

any time and in any space. However, the study revealed that students had difficulty adapting to Mobl21 functionalities on their own cell phones and felt the need for teacher mediation: when they had doubts about the subject, they couldn't turn to forums, because the app didn't have that resource.

Norris and Soloway (2011), in turn, presented the results of a study with students in the 4th grade of elementary school at a school in Singapore. They implemented an app called Mobile Learning Environment (MLE) and allowed all activities to be shown on a smartphone. For example, on the activity about plants, the students were invited to create a conceptual map, an animation and an electronic spreadsheet. Student production is represented on MLE. In this project, students had full access to the device, that is, the smartphone was used during 100% of class time to develop each task, as well as outside school. However, the study shows that collaboration is an ability that Singapore teachers are trying to develop in their students due to the need to rethink the curriculum to obtain maximum advances with smartphones, implement pedagogical strategies based on questions that support curriculum goals and accompany the impact of that change in student performance. Despite that, the authors presume that the use of cell phones in schools has lower cost and predict that within five years every child in the USA will use a mobile device and mobile learning apps. The investigation observed that the 1:1 situation, if not duly planned, offers little advantage compared to the traditional uses of technology.

Roschelle et al. (2010) investigated that TechPALS offers evidence that, in order to develop efficient collaborative practices, it is necessary to expand the focus beyond the tools. The authors reinforce that activities must be contextualized to integrate the collaboration actions between students into the curriculum. However, the research shows a limited experience regarding collaboration between peers, because the student group had a series of behavioral problems and didn't have a minimum mastery of the content explored in TechPALS. The field notes evidenced more technical difficulties than pedagogical ones. This contributed to improve the functionalities of that resource.

The study by Warshauer (2011) presents the use of iPads in a Science class, in which the teacher asked the students to research about elements from the Earth and the galaxy. Through online collaborative apps, they accessed the school's own environment, recorded and produced reports. For the students, the iPad enabled better data collection and general notes in movement.

The studies by Sharples e Roschelle (2010) show that connected mobile devices overlay the physical space in social life, teaching and learning in three different types of participation: at the same time and in the same space, social participation in the classroom and virtual participation between connected devices. In addition, it creates learning situations that encourage collaborative practices assisted by mobile technologies, causing a positive interdependence, because the activities must be planned so that individual contributions are necessary for the success of the group, as well as taking on individual responsibility, since each student recognizes themselves as an important participant in the process.

Goundar (2011) analyzed the use of smartphones in education for 30 months. In the results, it was noticed that learning is interwoven with other activities as part of everyday life, thus it cannot be separated from a conversation in the park, reading a magazine, watching TV; these activities can be incorporated into different resources and contexts of learning. In this context, smartphones integrate activities considered “not learning”, such as shopping, sales or entertainment, organized in projects that are interspersed with daily activities and that reveal learning needs, which appear when a person strives to overcome a problem. However, they emphasize the teacher’s mediating role that can also be attributed to the more experienced students and to other teachers.

Laru, Naykki and Järvelä (2015) developed an analysis of the use of ubiquitous technologies in different educational contexts and concluded that it is necessary to create pedagogical projects more grounded on the promotion of competencies to use mobile devices in collaborative learning, in order to qualify people for the 21st century with abilities to learn how to control their feelings, to deal with success and disappointment related to collective goals. Pedagogical work fills the gaps that exist between individual and collaborative activities, as well as activities in mobile and in-person social networks. The authors reinforce the need to promote autonomous activities, facilitating the interaction and sharing of knowledge.

Sharples (2013) carried out a research in England based on mobile learning and learning theories. The study revealed that, for a certain type of learning, the mobile devices must involve procedural rules in the development of activities and well-structured technological abilities. This makes people learn in order to achieve a specific task with the

help of others at any time and anywhere. The mobile devices used to support mobile learning must be integrated to everyday life, since they are small in size and easy to use.

We notice, in these studies, that mobile technologies, due to their low cost and easy access, seem to be able to suppress the digital inequalities of the general population, the companies that want to invest in commercial mobility and, especially, education institutions without funding to implement computer laboratories. In addition, it changes the forms of learning from static to dynamic, fixed to any time and place, according to Traxler (2009, p. 14, emphasis by the author), “[...] this means that **mobile** is not merely a new adjective qualifying the timeless concept of **learning** – **mobile learning** is emerging as an entirely new and distinct concept alongside the **mobile workforce** and the **connected society**”.

In spite of that, it isn't enough just to have mobility and connectivity, it is necessary that these technologies benefit the development of collaborative practices, bringing students from different realities closer.

We also envisage that national studies are concerned with presenting the use of mobile devices in school, but don't discuss the potential for collaboration present in these resources outside from there. Likewise, these studies don't clarify which teacher mediation strategies were used in collective actions with the students. These aspects differ from the international studies, which discussed the application of those devices outside of school: parks, museums etc. Perhaps this happens due to the fact that they have more access to the technologies. Another element is communication with the entire school community, projects in international research integrated other resources (smartphones, tablets, social networks), discovering other physical and temporal environments.

Therefore, *m-learning* can potentialize the students' collaborative learning process facilitating the access to information and promoting mechanisms that encourage collective production between peers. This happens because the individual who learns and attributes meaning to their activities in diverse contexts through mobility also seeks to intervene in the world surrounding them (BERRIBILI; MILL, 2018).

Analyzing the results of these studies, we noticed that: different fields of knowledge were investigated; many focus on the students and their performance when using mobile devices individually; pedagogical practice was little explored and was limited to the organization of activities by the researchers.

Based on the reading, we understand that the results from mobile learning in school collaborative practices arise from a more experienced adult, promoting activities in which groups of students really engage with productive interactions. Thus, it was possible to notice that the studies reported some attempts to develop collaboration with the use of mobile devices, however, it was evident that these practices in school need to be learned through a plan that guides the steps to be accomplished, otherwise both student and teacher can feel lost.

5 Final considerations

The objective of this study was to present an overview of national and international scientific publications about mobile learning in collaborative practice and the use of mobile devices with students from the 4th to the 9th grade of basic education. To complement that scope, we carried out a systematized review based on the descriptors: mobile learning, collaborative practice, mobile devices, mobile technologies, elementary school and middle school, in Portuguese and English, peer-reviewed, with the help of filters to accompany, analyze and visualize the studies.

In the face of a scenario of significant experiences to advance the study of m-learning in education, it is timely to emphasize that mobile devices won't be responsible for high performance levels from students in the classroom nor will they solve the problems found in education and in the curriculum. Despite that, it is necessary to have a pedagogical proposal to use these devices in which the teacher feels confident to interpret, reflect and master critically their tools in favor of their pedagogical practice and encouragement of their students' learning, based on the digital culture so quickly disseminated in current society.

We notice a scarcity of Brazilian research that present the characteristics of mobile technologies mediated by the school teachers in a well-defined manner, in the same way that they expose clearly how the use of these devices took place in different times and spaces. There is also the need to find methodologies and resources to execute these teaching experiences produced daily in the school, integrating pedagogical contents and the real contexts lived by the students and the community.

Nevertheless, the international studies report positive responses from teachers and students involved in mobile learning and collaborative practice based on the use of mobile

devices. However, it is necessary to identify if the teacher mediation that takes place in these situations can be transferred to other learning contexts and understand how the mobile devices and apps can support it.

For a determined type of learning, mobile devices must involve procedural rules in the development of activities and well-structured technological abilities. This makes people learn in order to accomplish a specific task with the help of others anytime and anywhere. The devices are used to support mobile learning must be integrated to everyday life, since they are small in size and easy to use.

In a broader view, we observed, in the beginning of this research, a discrepancy between the number of articles published in the context of Higher Education, Distance Education and Vocational Education and those that didn't have empirical studies about the use of mobile devices in collaborative practice in basic education. In this sense, this survey clearly revealed the dearth of Brazilian studies that approach mobile learning, collaborative practice and the use of mobile devices in elementary and middle school.

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