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Science teaching and the mobile collaborative learning approach: different educational contexts

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ABSTRACT. The study described in the article aims to understand how mobile devices can help teaching practices in the pedagogical project in the classroom and beyond. We opted for a qualitative approach with the use of research-action, involving the collaborative work of a teacher interested in contributing to the resolution of concerns related to the use of these technologies in the school context. Interviews, field diaries, and class observations were analyzed and coded. The results indicate that the elements that supporThe research deals with how mobile technologies helped Science classes, articulating curriculum content and real situations experienced in the community. t Mobile Collaborative Learning, based on teaching practice supported by mobile devices, recognize the importance of teaching as a mediator, involving students in discussions about the themes studied in different learning contexts. One way, via, or possible path that the study brought out is that for these technologies to be integrated into school activities it is necessary to make the curriculum more flexible, both in planning and execution, thus rethinking public policies that encourage the use of these devices at school, especially those of students' own use.

Keywords: mobile collaborative learning; teaching practice; mobile devices; teacher training.

O ensino de ciências e a abordagem da mobile collaborative learning: diferentes contextos educacionais

RESUMO. O estudo descrito no artigo tem como objetivo compreender como os dispositivos móveis podem auxiliar a prática docente, durante a realização de um projeto pedagógico na e além da sala de aula. A pesquisa tratou de como as tecnologias móveis auxiliam as aulas de Ciências, articulando conteúdo curricular e situações reais vividas na comunidade. Optou-se por uma abordagem qualitativa com o emprego da pesquisa-ação, envolvendo o trabalho colaborativo de uma professora interessada em contribuir com a resolução de preocupações relacionadas ao uso dessas tecnologias no contexto escolar. As entrevistas, o diário de campo e as observações das aulas foram analisadas e codificadas. Os resultados indicam que os elementos que subsidiam a *Mobile Collaborative Learning*, a partir da prática docente apoiada por dispositivos móveis, reconhecem a importância docente como mediador, envolvendo os alunos nas discussões sobre os temas estudados em diferentes contextos de aprendizagem. Uma maneira, via, ou possível caminho que o estudo fez emergir é que para que essas tecnologias se integrem às atividades escolares é preciso tornar o currículo mais flexível, tanto ao planejamento quanto à execução, assim repensar políticas públicas que incentivem o uso desses dispositivos na escola, especialmente aqueles de uso próprio dos estudantes.

Palavras-chave: mobile collaborative learning; prática docente; dispositivos móveis; formação docente.

La enseñanza de las ciencias y el enfoque del aprendizaje colaborativo móvil: diferentes contextos educativos

RESUMEN. El estudio descrito en el artículo pretende comprender cómo los dispositivos móviles pueden ayudar a la práctica docente, durante la realización de un proyecto pedagógico dentro y fuera del aula. La investigación trata de cómo las tecnologías móviles ayudaron a las clases de Ciencias, articulando contenidos curriculares y situaciones reales vividas en la comunidad. Se optó por un enfoque cualitativo con el uso de la investigación-acción, que implica el trabajo colaborativo de un profesor interesado en contribuir a la resolución de las preocupaciones relacionadas con el uso de estas tecnologías en el contexto escolar. Se analizaron y codificaron las entrevistas, los diarios de campo y las observaciones de clase. Los resultados indican que los elementos que sustentan el Aprendizaje Colaborativo Móvil, basados en la

práctica docente apoyada en dispositivos móviles, reconocen la importancia de la enseñanza como mediadora, involucrando a los estudiantes en las discusiones sobre los temas estudiados en diferentes contextos de aprendizaje. Una vía, ruta o camino posible que el estudio hizo emerger es que para que estas tecnologías se integren a las actividades escolares es necesario flexibilizar el currículo, tanto en la planificación como en la ejecución, replanteando así las políticas públicas que incentivan el uso de estos dispositivos en la escuela, especialmente las de uso propio de los alumnos.

Palabras clave: Aprendizaje colaborativo móvil; práctica docente; dispositivos móviles; formación del profesorado.

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Introduction

Mobile devices (notebook, netbook, tablet, and smartphone) have web-based interactive systems and mobile communication networks (3G/4G), enabling mechanisms for communication and information exchange.

The potential for the integration of these technologies with other activities, medium, and environments, whose knowledge production can collaboratively take place, allows for multiple authorship and sharing the resources outside the limits of any educational institution (Fantin, 2017; Ferreira, Muniz, & Oliveira Júnior, 2018). In this context, how can these mobile technologies support teachers and students in the collaborative production of knowledge? This recurring problem is a challenge that all educational institutions are facing since the arrival of these resources in a mobile collaborative learning approach or mc-learning.

The Mobile Collaborative Learning (mc-learning) takes advantage of the potential that mobile devices provide and opportunities for teaching and learning through different contexts, spaces, and times. Its definition and characteristics are analyzed by studies focused on student mobility, others on learning in different contexts (Hsu & Ching, 2013; Almeida & Valente, 2011; Wu et al., 2012; Sharples, Taylor, & Vavoula, 2010) and others in the development of mobile learning applications supported by different learning theories (Mehdipour & Zerehkafi, 2013; Laru, Näykki, & Järvelä, 2015).

Based on that, this study aimed to understand how mobile devices could help teaching practices, during the implementation of a pedagogical project in and beyond the classroom. This article is relevant because it addresses MC-Learning concerning the use of mobile devices in collaborative pedagogical experiences that go beyond the classroom, for the purposes of formal education. In addition, it's in line with United Nations Educational, Scientific and Cultural Organization (Organização das Nações Unidas para a Educação [UNESCO], 2014) which also recommends its use at school.

Methods

This study was carried out in a municipal public school in Ceará countryside (Brazil), here called 'Escola Verde', located in a coastal region. The preference for this institution came from the following elements: availability of mobile devices to benefit the teaching and learning process of teachers and students; Internet access; the researcher was a trainer of the course contemplated in these two projects; and, school agreement.

Thus, the teaching practice of a Science teacher was observed, due to her interest in developing a project with her students during Science classes, using mobile devices: tablet and netbook, from the question: How can mobile technologies support teachers and students in collaborative knowledge production? The interpretive paradigm with a qualitative approach is specified, as it clarifies the phenomena from their context.

Regarding the method, the research-action was selected, which is a collective action by people interested in contributing to an immediate resolution of a practical issue, in which they are concerned, acting according to a negotiated structure (Barbier, 2007).

Therefore, the teacher and researcher deliberated on strategies to carry out an educational project with collaborative practices at the school to be developed with a group of students. Accordingly, they planned activities that allowed the exchange and the collective production of information between students using mobile devices and applications that supported the sharing of information, as well as synchronous and asynchronous communication beyond the school.

Data collection was a dynamic process carried out by the researcher, having as instruments: interviews with the teacher; notes; field journal; photographs, and audios. These include information necessary for research to understand the teaching practice when using mobile devices in everyday school life.

Phases of the research development

From the research-action cycles, all stages were discussed with the teacher, who was directly involved in carrying out the project with her 7th-grade students (Elliot, 1993).

Thus, based on the research-action model, it was possible to observe all three research cycles, especially the execution of activities carried out with the support of mobile devices, whether in the Science classes, field classes, after-school hours, and in the Educational Informatics Laboratory (LIE) (Elliot, 1993).

In the first cycle, the teacher declared that she wasn't very familiar and thought that analog writing was the only way to learn, because, for her, technology was something difficult to deal with, as she says in the interview: "I thought: I don't know, I won't even try, so I'll let it go. I didn't even know how to open an email! I missed a lot of courses because of that" (verbal information).

However, that changed when she got a smartphone and realized she needed to learn how to use it as a resource, as both the school board and the students had created a WhatsApp group (instant messaging app). She understood that technologies could improve her relationship with students, she was very concerned about school dropout, which was growing considerably.

In the second cycle, the preparation and constant reflection on the project's action plan with the teacher took place on the days when she was planning, trying to distribute the time between study, reflection, planning, and monitoring sessions of the actions to be carried out.

Even though the teacher knew what she wanted to achieve with this work, she didn't want to determine all the phases of the project with the researcher at once. As a result, whenever possible, she tried to invite some students to participate in planning meetings. Thus, it was determined that the action plans would be gradually planned since the intention was to bring the students together, making them feel like they belonged and were partners in all stages of the process.

At one of these meetings, the problem-question of the project on sustainability arose: how can mobile technologies help us improve the woods in our city? From these discussions, the project was born and was called 'Reforestation and Mobile Technology: taking care of woods'.

From the group's negotiated ideas, during their Science classes, the teacher identified the skills of each team and wrote them down in her notebook. In the following meetings, she showed it to the researcher and together they planned activities, selected and studied online and offline applications that could promote collaborative productions to be carried out in a certain time.

In the third cycle, the teacher continued to monitor and reflect on the actions with the researcher weekly. The activities were developed and evaluated to integrate mobile technologies into the curriculum and carry out new actions.

This process benefited the course correction since the sequence of activities was reflected, discussed, evaluated, and advanced, as is to be expected in every pedagogical action. Thus, the curriculum becomes alive, reconstructs and gives new meaning, and isn't restricted to the transfer and application of particular content, but it's developed in two moments, according to the authors: reconstruction, in which the teacher prepares the planning of her classes according to the characteristics of the context and way of carrying out the pedagogical work; resignification, when the teacher transforms the planning of pedagogical practice, based on the needs of their students, their actions and their reflection on the action (Jardilino & Sampaio, 2019).

Thus, 20 meetings were held with the teacher to carry out the project with the group of students (40 hours), distributed as follows: 10 Science classes (20 hours), 4 in the classroom, and 3 in LIE (14 hours) for the creation of the collaborative map, a lecture given by a guest, internet research, photographic records, collaborative creation of an electronic spreadsheet, analysis of the data collected and elaboration of a graph; 3 field lessons (6 hours) to explain and compare theoretical and practical contents; 10 non-shift meetings (20 hours) for recording activities, an interview with a person who has lived for a longer time in the community, close to the school, generation of data from the online monitoring of blueprints, creation of the logo of the project and drawing of the woods.

Other apps were also used: WhatsApp for synchronous communication and information sharing; Youtube to store videos produced by students; Facebook to publicize the project. Movie Maker software was also used for editing videos. All these resources made the students' production viable and facilitated communication between the teacher, students, and the community.

Eventually, students carried out activities at home that were logged in the online applications used, such as Google Drive and WhatsApp spreadsheet and forms. On other occasions, the logs of the project's actions

were done by the teacher with the operational help of the researcher on the blog and/or on the school's fan page by the principals.

This distribution worked well throughout the project planning and execution period, other times were used for informal conversations between the teacher and the researcher, especially in the last month of the project to better organize and prepare the climax.

Results and discussion

Teaching goes far beyond explaining the content. Teaching isn't restricted to the transfer of knowledge, since mental processes, whether on the part of the teacher or the student, are central to the configuration of teaching (Veiga, 2005). This reveals that this is a teaching action from which the student's learning derives, seeking a collective construction of knowledge.

Thus, in the very first class, the teacher presented the topic of sustainability to the class with a video that explores the importance of sustainable development, preservation of the environment and examined the pressure of consumption by human populations puts on natural resources. Meanwhile, the students were answering and giving examples of pollution in the neighborhood where they live, in the city square, in the streets, including in the woods next to the school, pointing out several problems: a lot of garbage, the vegetation was growing, the stream was polluted. Thus, Prof. Júlia asked the class to organize themselves into teams to think of strategies for how to preserve the woods based on the actions planned in the project.

Therefore, in the planning meetings, the professor and researcher began to study the applications that would be used. According to the teacher, "without planning, the technology can't be used in class, but the planning needs to be flexible" (verbal information).

One of the first applications selected was Google Maps, as the activities required the mapping of plants in the region surrounding the school. From the need to share information and produce collaboratively, they chose some Google Docs applications that links to Drive from the same company: spreadsheets for data collection, comparing and creating a chart on the types of forest plants, and forms for online monitoring.

All of these features are free, but they required an email account, so the teacher created a Gmail account and shared the app's links with students on her blog. However, in the planning meetings, it was noticed that the teacher was concerned with teaching the application features to students. Despite her efforts to learn, she couldn't assimilate all the steps to produce a map, spreadsheet, graph, and form, and this was causing her stress and anxiety. However, she recognized that such resources have rich pedagogical value, but concluded that she couldn't teach the class all the functions on her own. So she asked the researcher and the students to help her.

The teacher knew of her limitations with technology, so she decided that in each activity there was at least one responsible group and that this one should be led by a student. The strategy used by the teacher was to delegate different actions to the groups so they could help her both explaining the applications and monitoring, as she explains: "Each group had a leader who helped me to check if the other students in that group were doing the activities, if they were involved, if they weren't, I would call them to talk, I would take notes of everything because then I would see who was involved" (verbal information).

At times, there were disagreements, misunderstandings between the students, but the teacher was always willing to talk and show that everyone's participation was important.

On several occasions, the teacher reinforced that everyone was on the project together, everyone had the same goal and at the same level, each learning from the other what they didn't know. The work teams were organized according to the development of each activity that was observed by the students themselves and mediated by the teacher (Field diary).

In this sense, according to Nascimento and Castro Filho (2016), teaching and learning, supported by mobile technologies, pose challenges for researchers, education professionals and software technicians in creating educational tools for clearly defined didactic purposes that respond to the real needs of teachers and students. Thus, learning experiences that cross spatial, temporal boundaries and involve interactions with fixed and mobile technologies have led teachers and researchers to reflect on pedagogical strategies in the use of these devices to promote teaching and learning, in turn portrayed in the literature.

Curriculum contents

The initial idea of the project was in line with the themes covered in the 7th grade Science course plan. The project started in the second semester and the teacher explored the plant and animal kingdoms.

Therefore, the characteristics and classifications of the plant and animal kingdoms were related and compared to the species they knew or saw in the woods, also it was the subject of 3 field classes.

In a field class in the woods, for example, the teacher went over the content about the organs of plants, asking the following questions: "Which organs did we study? Do all plants have all these organs? For example this palm tree here, does it have all the organs? What organs does it have? What organs does this cashew tree have?" (Field journal).

Then, she moved on to the bryophytes and pteridophytes and asked the students to identify them in the woods. Only 10 tablets were available, as netbooks were being used by another group. So, some students were annoyed and asked the teacher if they could use their cell phones. The teacher agreed but asked them to share the photos with the class. At various times, students preferred to use their own devices, rather than the ones provided by the school.

There was a natural attachment to the cell phone, which the students are familiar with. This leads to believe that social and personal preferences seem to affect the use of mobile devices anywhere, also at school. A part of the students who had a cell phone/smartphone also had a data plan, which made it easier to send messages, share photos, and perform other tasks online. Although Ceará prohibits the use of cell phones in schools, the teacher recognized the need to establish a very clear pedagogical objective for their use, as this instrument was used by students, she said: "I want students to understand that we can use cell phones in school, as long as it has an educational meaning behind it" (verbal information).

Thus, the use of cell phones in the classroom was prohibited at Escola Verde, but the direction authorized its use after the teacher's request, as she presented pedagogical strategies for its inclusion in her teaching practices.

Even with different types of devices, the teacher focused on the teaching process and left the technological challenges to the students. A student informed that his cell phone had a good resolution, and after this, the teacher asked the student to photograph situations that needed a greater reach, for example, the fruits that remain in the treetops (Field diary).

At all times, the students were encouraged by the teacher to ask questions, they were pointing out the plants and classifying them orally, then, through photos and texts, they recorded the types of vegetation in the woods to later enter them on the collaborative map. The teacher initially explained to the students that the class would continue with an explanation about the plants, identifying and classifying the existing species in the woods. She also asked students to form groups and photograph the species, then she reinforced the need to take notes of the plants, classifying them into angiosperms and gymnosperms (Field diary).

Theory and practice have an inseparable relationship that, when coated with reflection – action – transformation, constitutes the praxis. From this point of view, the teacher organizes and thinks about the educational process (Zabala, 1998). The pedagogical action leads the educator to constant questions about what and how to teach, how to think and act, for whom and for what to teach the contents.

Everyone participated, but one group was responsible for gathering their colleagues' records into a shared Google Drive spreadsheet. Thus, the students photographed, classified, and placed the amount of each species existing in the woods.

The second field class was atypical, it took place at a time i which normally the teacher doesn't have class, so she used another class time, making up an entire morning for the field class. On this day, the students planted 9 trees. The Arts and Math teachers from Escola Verde were also present, as well as students from the other 7th grade classes.

At the time, the teacher presented the initial version of the collaborative map to the other participants. She explained that the activities weren't finished yet, but that the students would present the results at the end of the project. In this presentation, she had the help of a student on the netbook to access the map and project it on the screen.

According to the authors, learning from web-based activities enables different real scenarios and digital resources that can complement, integrate and organize the data generated by the students' own research (Liu, Lin, & Paas, 2014; Boa Sorte, 2019). Mobile devices aren't restricted to internal school environments, virtual information can be integrated into the real environment. The authors also emphasize that students have more opportunities to get involved in school activities when they are outdoors, comparing what is seen in the classroom with real everyday situations.

Like the first field class, the second was held with the use of tablets and smartphones. The students searched and photographed animal species and classified them into vertebrates and invertebrates. They found caterpillars, tadpoles, several species of ants, butterflies, spiders, hornets, and a frightened 'soinho'

(marmoset monkey) at the top of one of the mango trees. The teacher asked about the species found: “Guys, which of these animals is from the amphibian family? How many are invertebrates? How are vertebrates classified?” The students responded as they photographed (Field Diary). Then, she made it clear that in addition to the classes, the themes should be studied and better deepened in the readings. So she took the students to LIE and started an internet search about the animals, as well as continuing the collaborative map.

According to the teacher, mobile devices helped to work the content in several different ways, she said: “We created a collaborative map, did research on the Internet, took pictures with the tablet and cell phone, created tables, and graphs on the netbook, drew, created videos, all to learn the contents”. The teacher also emphasized that the students didn't believe that they could learn the subjects of the book differently, and continued: “The ones who took this technology to the students were us, you and me [researcher]! Many of them already knew how to use it, but they never thought they could learn the contents that we see in the classroom that way. I'm not making this up! It's all there on the blog” (verbal information).

According to authors (Sharples et al., 2010), mobile technology, in different learning contexts, can allow students to learn and explore the world in continuous communication with and through technology. They also emphasize that education in the mobile age doesn't replace formal education, nor does the internet replace the textbook; rather, it offers a way to extend learning support outside the classroom into everyday life conversations and interactions.

Mobile devices and connectivity

The advantage of being anytime and anywhere using a mobile device favored the performance of activities. While the teacher explained the need to register the wood plants through photos, classify and research their scientific names, the students shared photographs and information via Bluetooth or sent them to the WhatsApp group.

This sharing of information was so naturally internalized by the teacher that she didn't even realize she was using it differently from what she was doing before this experience, for example, printing or scanning the images, photocopying them, and handing them out to the students (Field diary).

In the field classes, the teacher asked the class to photograph the species of plants and animals, as at another time they would use such records to make the collaborative map. In the following classes, students presented their photos accompanied by the information they had researched on the Internet. This also happened when comparing the types and quantity of plants existing in the woods. Most of the time, data was stored on tablets and/or netbooks and then shared with others. On other occasions, the records were on the students' smartphones and also on the WhatsApp group.

The teacher noticed that some students had data plans on their smartphones and chose to answer to the online monitoring of the woods on their own devices instead of using the tablet. Some routed/shared their Internet with colleagues, providing access and participation in online activities.

This convenience made the students exchange learning experiences in an unprecedented way (Santaella, 2013). The author reveals that “wireless and, consequently, mobile networks are the technological tonic of the moment. This makes available a type of communication that is ubiquitous, pervasive and, at the same time, embodied and multiply situated [...] in space and time displacements of individuals”. This was also noticed during the survey of the types of plants, animals, in the creation of videos and online monitoring (Santaella, 2013).

Given this discussion, it's understood that mobility can happen without Internet access and information exchange. Ubiquity, on the other hand, is linked to mobile computing in which the connection is supported by a device, regardless of the individual's movement, for example, smartphones used by some students to monitor forest plants, using an electronic form or spreadsheet, whose link was available on the teacher's blog, which could be accessed at any time and space, as well as the possibility of deepening research on plants, storing and sharing information.

For the teacher, this technology facilitated the organization, the sharing of information and brought the curricular contents closer to the students' reality, whether in the classroom, in the field, at home, or elsewhere.

The teacher made students feel free to photograph, upload videos, music, or answer the Google Drive form. Since the shared apps could be accessed anytime, anywhere, students also used the after-school hours to participate by answering or recording something. She also realized that the fact that students took their smartphones to record their observations was a motivating factor and that they made their own criteria concerning the final product.

For example, the online monitoring activity was well assimilated by the students, especially when they came across city workers and excavators handled by other employees of the city's Infrastructure Department that were cleaning the wood.

After four weeks of following the activities carried out in the woods, the teacher showed in the classroom, with the researcher's help, the answers to the Google Drive form on online monitoring. After all, they needed to analyze the data generated to identify problems related to healthy plant growth and devise strategies to solve them. Students were impressed with the number of items answered.

It was observed that all records were made on different days and times, especially in times when the students didn't have classes. The preparation of the form wasn't limited to a survey of the situation of plants in the woods, but also provided an opportunity for debates and solutions to the environment's natural and social problems. These debates were encouraged by the teacher who asked questions about the data generated and presented in the spreadsheet.

This activity made it possible to share and discuss the data found in the field in classes, as well as in non-formal educational contexts in which students weren't at school and not in the usual class hours. Non-formal spaces offer learning outside a classical environment and the formal curriculum, it can happen at any time and is influenced by the environment and by the particular situations experienced by the individual (Vieira, Bianconi, & Dias, 2005).

According to authors, using mobile devices to explore the field of investigation, receiving and sharing information with colleagues, and then returning to school to discuss and develop their interpretations with the class makes more pedagogical sense because these technologies allow the relationship between world experiences with the subjects studied in a dynamic way (Sharples et al., 2010). At the same time, the authors turn to Paulo Freire, who relates contextualization with the problematization of the lived reality, when referring to the ability to extract, evaluate, to discuss the context of reality.

Collaborative production

In the collaborative map, the teacher made clear that they needed to identify the species of plants and animals in the woods and asked the students to organize information, creating a cycle of dynamic actions (share; create marker; insert photography; research; read; reflect; make decisions; type). The topics learned in class were submitted to this treatment, that is, dealing with the curricular contents inside the school or exploring them through mobile devices outside it: in public spaces or interviewing people from the community.

The records were carefully marked on the collaborative map, in which the students inserted photos and text describing each plant, edited the footage, and posted it on the map, marking the areas with lines and geometric shapes (Figure 1).

The latest version of the collaborative map was displayed by the students themselves in the classroom to recognize the role of each one in the process. On the occasion, the teacher congratulated the class and reinforced that everyone's collaboration was important in the process.

Using Google Maps in school practice needs to be mediated by the teacher to promote moments of reflection during the collaborative action since in its platform is possible to work collectively. When a student created a bookmark and inserted a text using a certain netbook, another student, on another machine, helped them to add other elements, so the students reflected, discussed the best way to add the information, and made decisions together (Field diary).

It was found that this application is also a learning space that uses online tools as knowledge reflection instruments. However, the authors consider that teacher planning, with the support of mobile devices, are conditioning elements for learning to take place (Laru et al., 2015; Nascimento, 2021). Thus, the teacher incorporated activities that encouraged moments of sharing and discussion among students.

The different activities produced by the groups were praised, because the teacher left them free to create, as long as they kept to the themes studied and respected the deadlines. The students contributed with what they knew how to do, meaning that the final product had many personal characteristics of the students, this was seen mainly in the videos and drawings.

The achievements, challenges, and difficulties of combining various mobile devices (pedagogical, technical, and functional) with the activities that went beyond the classroom, adding different media, allowed students to produce collaboratively with high potential to compare, experience, and transform the contents studied in the classroom into real situations, closer to everyday life.

Figure 1. Latest version of the map made by the students.
Source: Elaborated by the author (2021).

Although part of the activities with tablets and netbooks necessarily came from the teacher's intentions and guidelines, for the students it was as if all the tasks had been discovered by them. This feeling was perhaps born and expressed by the teacher because at all times she made it clear that the students knew how to use technologies better than she did.

The actions mediated by mobile technologies also had the potential to transform the teacher's classes making them closer to the reality experienced in the community. When identifying the positive points of this experience, the teacher pointed out four situations that attest, according to the literature, some characteristics of collaborative mobile learning in this study, those are: the ability to do the activities together, as the students helped each other to develop a certain action. For example, the collaborative map where information (images, texts, links, and videos) was added from the markers created by the students. Everything was negotiated, they didn't erase what the other was doing, because they knew the map belonged to everyone; virtual communication was frequent, whether inside or outside the school; the recognition of the abilities of each one was pointed out by the students themselves, who organized themselves into groups, not only by affinity but also by aptitude: those who liked to draw, those who liked to write, those who liked to make slides, those who liked to photograph, those who liked to film and edit videos; the ability to use multiple media: images, videos, texts and music in one application; the integration of mobile apps and devices.

The focus of MC-Learning isn't the teacher, the student, or their technology, but the communicative interaction between these three elements. At the first level of analysis, MC-Learning tries to understand people and mobile devices in a continuous flow through dynamic environments that can be local or virtual. In the background, it assesses teaching and learning as a conversational process within different contexts that allow sharing, negotiation of ideas, and collaborative production (Triguero, 2018; Abreu, Sabóia & Nobrega-Therrien, 2019; Soares & Colares, 2020).

Conclusion

Associating mobile technologies in collaborative practices in the educational context implies thinking about the benefits and difficulties that come from a variety of resources available and the possibility of supporting new pedagogical strategies.

This integration was well represented in the project, as the teacher attributed greater responsibility to students in learning: investing in youth protagonism; teaching them to deal with the changes in the environment, with the frustrations, with the criticality of the facts. It was observed in the study that the most important thing wasn't the netbook, tablet, or smartphone, but the way the teacher conducted mediated the entire process of using these devices with her students. If students have a technology available that allows

them to record video, photograph different situations, locate, map, record, and access the Internet, it doesn't make much sense to ask them to just use a notebook and pencil.

The limitations of this research are due to the fact that it investigated the practice of a science teacher and her students. Nevertheless, it is understood that this study can be incorporated into other areas of knowledge, at other school levels with or without the presence of a researcher. For this, the municipal, state, and federal education systems need to invest in teacher training, as well as in the replacement of the person responsible for the computer lab by a specialist in technology in education, who could support teachers in this incorporation of technology into the school's daily routine.

There is certainly a lot to be done in this area. Therefore, this study makes way for future proposals that may constitute this kind of work, representing a natural continuity of the results obtained. Thus, it seems to make sense to modify the bill that prohibits the use of cell phones in schools. With the school's permission, another solution that could be implemented quickly is encouraging students to bring their own mobile devices to be used within educational spaces, especially in activities mediated by teachers. This would lead to lower maintenance costs. However, it is important to think about planning the pedagogical goals of its use and the investment in good wireless connection.

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Nota:
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