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Hybrid Learning Environment in Teaching Chemistry: a Perspective of Pedagogical Innovation in the Era of Mobile Learning

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Abstract

It is common to find students in classrooms using mobile devices. This implies in the pedagogical adequacy to the present moment, evaluating the potentialities of Mobile Digital Technologies (TDM) in the teaching and learning process. In opposition to the advance of technological innovations, there is a persistent lack of education in Brazil to which technological equipment generally does not meet the number of students and is generally outdated. In addition, other problems hinder the educational process: the cost and maintenance of copiers for xerocopy activities, limiting the use of complementary materials. In this context, the research: How to constitute a hybrid learning environment using smartphones in the process of teaching and learning chemistry in a public school system. The aim of this study was to evaluate if the use of TDM modifies the type of relationship that is established inside and outside the classroom, between teachers, students and the process of teaching learning, as well as support, so that the students become protagonists acting with more autonomy in their learning path. Participants of the survey were 240 high school students from public schools. Questionnaire, elaborated activities and interview were instruments of data production, analyzed qualitatively. The authors acknowledge FAPEMIG by financial support.

Keywords: *Hybrid Learning Environment, Mobile Devices, Chemistry Teaching*

1. Introduction

With the increased access of the population to digital technologies (DT), the interactions between subjects, have intensified through the digital environment, as well as broke with the “local and temporal barier” of a conventional classroom, since through these DT people can interact from anywhere at any time.

On this context, the use can’t be limited and interrupted by the walls of schools. It is necessary to enter the classrooms, in order to extend learning and teaching practices. Mobile technology represents an innovation in pedagogical practices, expanding the learning space-times, contributing to the modification of teaching paradigms, which increasingly tend to include on-line, hybrid and collaborative learning models.

As for teaching chemistry, through the use of mobile technologies, simulations of phenomena through student interaction with digital educational objects allow dialogue, as well as the acquisition of skills in the interpretation of chemical symbols, equations, structural diagrams and animations of nanoscale, may be appropriate both for the solution of problems and tasks in research as well as for understanding phenomena and chemical concepts [1].

It must be admitted that digital media differently constitute the intellect of the new generations compared to previous generations, this is part of the evolutionary process. Therefore, interaction and exchange of experiences are conducive to the search for new teaching strategies in the school environment. In addition, the use of smartphones can be a strong motivational effect, encouraging group work among students, being a resource to facilitate the process of expanding knowledge.

In this context, the objective of this article is to present how a hybrid learning environment was built using smartphones in the process of teaching and learning Chemistry, at a public school in Uberlândia - Brazil. The intention was to identify the potential of using an online environment organized for a hybrid learning, available for any technological devices, especially smartphones, favoring activities inside and outside the classroom, as well as serve as a motivation for development practices in the context of Bring Your Own Device (BYOD).

2. Methodological Approach

Considering the hypothesis that today's high school students are part of the Homo zappiens generation [2], in addition to autonomous, leaders of movements that claim to improve the educational system, was adopted the option for the research of nature Participant [3], considering that the

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participating students were able to identify problems by performing a critical analysis and to seek the appropriate solutions to any problems.
According to the Participatory Research process model [3], it was divided into four stages, however, in relation to the activities developed to favor the teaching / learning process of Chemistry, were applied with greater emphasis in the third moment of the third phase, having in order to familiarize the participants with the learning environment.

2.1 Description of each phase of the research

- **First Phase - Research Plan**
  - The research came about through the dissemination of the MD in classrooms, the inefficiency of physical laboratories and the advancement of the virtual ones, the limitation of the time and the unavailability of printed material.
  - Through a search and tests the virtual environment, Google Classroom (GC) was defined. The choice of GC was due to its simplified configuration, as well as to integrate other Google applications that facilitate interaction between the participants and the researcher. This environment facilitates the autonomy and communication, allowing the participant to ask questions of the matter at any time and place, beyond accessibility in any device and enable offline mode.
- **Second phase - Preliminary and Provisional Diagnosis.**
  - In this phase, through structured questionnaires and closed forms, the social and economic structure beyond the Digital Culture of the participants were analyzed.
- **Third phase - Critical analysis and resolution of the problems found in the preliminary diagnosis.**
  - In this phase, the functionalities of GC were presented. However, some of the participants did not welcome the idea of using the "space" of their smartphone for educational purposes, as well as the MD of some of the participants did not have "space" enough for this. Therefore, a new discussion arose, regarding the accomplishment of the activities and in consensus, the participants suggested forming groups to develop the activities in the classroom, and, the activities outside the school, carried out individually. What is more interesting is that there was no option at all for the delivery of the printed material.
  - Still in this phase, new questionnaires were applied aiming to know the difficulties of using the application and the development of activities.
  - As Chemistry is a Science that seeks to explain the phenomena that occur in daily life [4], the insertion of several tools developed by the technological advance, and available in the GC such as: simulators, virtual laboratories, videos, conceptual maps, games were used in the activities to help approximate the three dimensions of chemical knowledge - macroscopic, submicroscopic and representational.
- **Fourth phase - Finalization and validation of the Plan of Action.**
  - During the eighteen months, we sought to analyze and reflect on the actions, with the objective of identify what was needed to be improved in the use of GC, to increase knowledge. It is emphasized that the goal was not only to insert a virtual environment as a repository of activities, but to bring it as a fundamental part in the development of students' skills. To this end, the environment and the activities developed were adapted according to the specificities of each class. Regular evaluations were carried out through semi-structured questionnaires and discussions with participants as a qualitative research tool.
  - This research does not end in the fourth phase, at the beginning of the school year; it is up to the teacher, who wants to use this technological tool to adapt all the phases presented. Only then, this technological integration will be far from representing a more "fad" to embellish and animate the classes, but to influence the development of the multiple competences necessary for contemporary society.

3. Results and analysis

The practice of mobile learning, especially in the context of BYOD and hybrid education, implies the need for a high percentage of students to use mobile devices. In Brazil, according to the National Household Sample Survey, 93% of the students in the southeastern region of Brazil, with 15 years of age or more had a smartphone. Considering the analysis of the questionnaire on the possession of the smartphone for use in the classroom 100% of the participants answered that they had this device.
During the use of educational objects, it was necessary to know the operating system of the participants' smartphones, since it manages and controls the functions of the device by organizing the

execution of applications. It was noted that the majority of the participants have device with Android operating system.

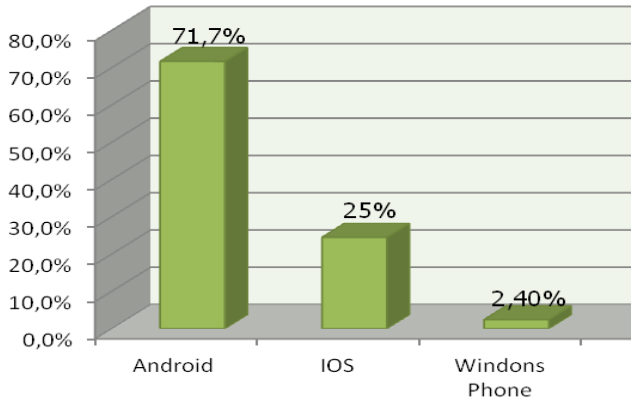

Fig.1 - Operating system of the participating devices.

Another important survey was the number of MDs with connection to internet, since public schools in Brazil lack an internet connection network for students and even for teachers, so it was necessary that at least some of the participants had mobile internet.

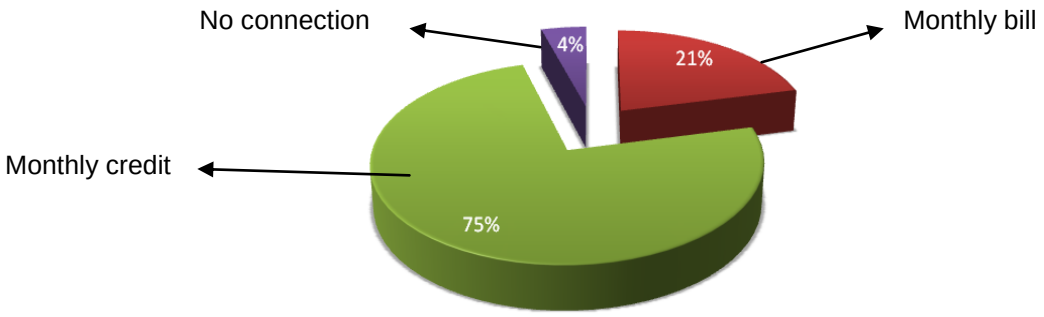

Fig.2 Type of internet connection

Through lack of connectivity the researcher sought to rely on Vygotsky's theories [5] of learning to which the student's cognitive development occurs through interaction with others and that at least two people should be actively involved. In this way we chose to work with groups, using techniques to motivate and facilitate learning. Thus, connectivity for all students would be optional. On the other hand, it was necessary to be attentive so that the student could construct his knowledge in group with active participation and the cooperation of all the involved ones [6].

Looking to know the specifics of the participants, they were asked which applications were most used in their smartphones. Of the 28 applications cited by 212 participants, 99.5% use WhatsApp. This data points out that participants use their devices in search for a direct connection between their personal and social lives, without a practical relationship with the school context. Schools still survive because they are places for certification, where most students attend classes because they are obliged, not by real choice, by interest or motivated by knowledge [7].

Regarding the virtual environment, Google Classroom, the participants did not present platform domain skills, so a presentation was necessary for adaptation. Gradually the participants were improving their skills and interacting more favoring their learning process.

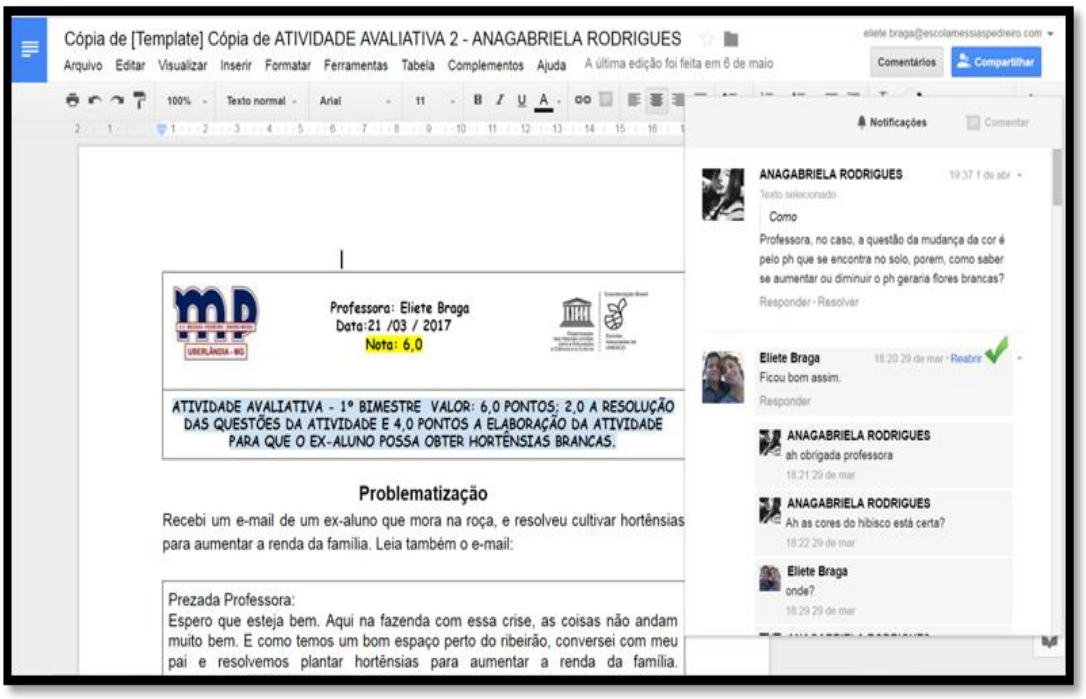

Fig. 3 Mediation in the performance of an activity applied in the CG

It can be seen from Fig. 3 that the virtual environment expands and opens new communication possibilities. The teacher stands as a collaborator and a motivator of learning, who is willing to be a bridge between the learner and his learning - not a static bridge, but a "rolling" bridge, which actively the learner reaches his goals and finally builds his knowledge. In addition, education becomes more and more blended, because it occurs not only in the physical space of the classroom, but in the multiple spaces of daily life, which include digital. This mix between classroom and virtual environments is key to opening the school to the world and bringing the world into the school [6].

4. Conclusions

In conclusion, the change goes far beyond breaking with the traditional classroom model. We live immersed in cyberculture, and require the integration of mobile digital technologies in hybrid educational spaces.

When using some activities programmed in the GC, such as a discussion forum of a certain theme, the student goes through all the stages of knowledge consolidation.

In short, it is the responsibility of the teacher to promote study activities that instigate the student's involvement in dialogic-problematizing and in collaborative learning. These activities enable the co-authoring and the articulation between information, in order to acquire new knowledge and providing the application of the same in different situations.

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