95 - PROPOSAL OF AN ELECTRONIC ANSWERING SYSTEM FOR PROBLEM SOLVING CLASSES

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ABSTRACT

This paper presents a proposal to develop an application program for smartphones to be used as an electronic voting system in problem solving activities in various curricular subjects. This theoretical research aimed on both electronic and low-cost voting systems and their respective contributions to improvements in the teaching and learning processes. It approaches the insertion of mobile phones and smartphones in classes, as well as the relation of response systems with interactive teaching methodologies, in order to inform the reader about the importance of voting systems and their potentialities for the educational process.

Keywords: Application program; Teaching; Technologies in Education

INTRODUCTION

This work was based on the observation that there are few voting systems to assist the teacher in problem solving activities in class. From this we can note that strategies such as the creation of a quiz with rapid tests, or with problems that require a greater degree of reasoning, can be powerful tools for students' learning in various curricular subjects. Allied to this, if the sending of the answers to the teacher happens quickly and practically, it favors the dynamization of the activities and the motivation of the students.

Some ways of sending the answers to the teacher have already been experimented, such as flashcards (MÜLLER, 2013), handwriting, internet forms, clickers (radio frequency devices), via laptops (MÜLLER, 2013), etc. Experience indicates that the electronic systems favor the dynamization of activities, as well as the archiving of the information for later query and individual student assessment. However, the acquisition of electronic voting systems may require some financial investment from schools, making it difficult or even impossible to implement.

In this sense, we understand that there is a field of possibilities for the development of electronic systems for problem solving in the classroom, mainly with the use of devices that students already have, such as smartphones. Thus, the general objective of this work is to discuss how the absence of low-cost electronic resources to vote during problem solving makes it difficult to carry out collaborative activities in the classroom. And as specific objectives, to reflect on the importance of voting systems and the use of smartphones in class and to propose the development of a free voting system, that can operate on students' smartphones, to be used in schools.

LITERATURE REVIEW

Answering voting systems

In problem solving activities, sending the answers to the teacher can occur in many ways, either manually or electronically. The simplest form would be a simple raise of hands, when the teacher cites each alternative of answer. However, there may be the influence of colleagues' votes and the teacher's difficulty in recording the number of votes.

Another option is the use of colored cards, or flashcards, that can be made of paper, so that each card represents a letter, corresponding to the alternative, and a color, to help the visualization by the teacher. Thus, each student chooses an answer to the question and raises the corresponding card, as in Figure 1, below.



Figure 1: Voting in a Conceptual Test using flashcards in a classroom
Source: Araújo and Mazur, 2013, p. 378.

One of the advantages of flashcards is the low cost and ease of making of the cards. As disadvantages, it is possible for a student to be influenced by the colleague's choice and the counting and storage of the voting is more time-consuming for the teacher. One solution would be to photograph each vote for further analysis.

With the intention of solving these problems, electronic systems of answers have arisen in the attempt to provide greater agility and reliability in the voting process. According to Araújo and Mazur (2013, p.367), "answering systems involving any internet-enabled device such as notebooks, smartphones and tablets are proving to be a promising alternative", especially when using devices that students already have (ARAÚJO and MAZUR, 2013).

One of the most cited electronic systems in the literature (MAZUR, 1997; ARAÚJO and MAZUR, 2013; LASRY, 2008) are the clickers: devices similar to remote controls that communicate by radio frequency with the teacher's computer. Electronic commerce websites have its price listed up to USD 70 for each device, plus up to USD 170 for the receiver that must be attached to the teacher's notebook. We believe that these values are high for most schools, and large classes will require dozens of equipment, requiring a considerable financial investment. In figure 2, it is presented an example of a flashcard and a clicker.



(a) (b)

Figure 2: (a) Example of a flashcard with the letter "A" representing the chosen alternative. (b) USB radio receiver and remote answer system (clicker).

Source: Araújo and Mazur, 2013, p.368.

Manual systems have a low operating costs that facilitates their insertion. However, they lose out to electronic systems when it comes to agility in enabling the processing and archiving of these data, and real-time monitoring of answers that allow the teacher to make decisions immediately (Miller et al, 2014).

Muller (2013) describes classes that occurred with interactive teaching methodologies, such as Peer Instruction (MAZUR, 1997), in which problem solving activities were fundamental to have a system of sending the answers to the teacher. In this research flashcards and voting through students' laptops were used. According to the author, in both processes it was possible to achieve the same learning objectives,

... however, in terms of teaching, clickers have shown themselves to be better at facilitating the counting of votes, by not allowing a student to see what the other is checking at the time of voting, and also by keeping a record of the options individually, which can be used to monitor students' progress towards the learning objectives. (p.14).

However, financial spending for the acquisition of electronic answering systems may be a hindrance to the introduction of interactive activities in classrooms (Muller, 2013). That is why we believe in the potential of an electronic voting system, distributed free of charge, that can be operated by equipment that students already have, such as smartphones.

Lasry (2008) describes a research comparing two classes taught through Peer Instruction during a semester, in which problem resolution answers were reported by flashcards and in another class by clickers. The author concluded that both systems make it possible to achieve the learning objectives, however, the electronic system motivates students more and allows better archiving of individual answers. The answers can be archived during the lesson and reviewed later.

By archiving the answers to the questions, the teacher will be able to analyze the data and monitor the performance of each student, seeking the understanding of facts or improvements for the next classes, as in researches conducted by: Crouch and Mazur (2001), Lasry 2008), Miller el at (2014), among others.

USE OF MOBILE PHONES AND SMARTPHONES IN TEACHING

The use of mobile phones and smartphones in education can bring new possibilities, as Ribas (2012) emphasizes, in which he presents a work where high school students used their cell phones / smartphones in school activities. The author defends the use of technology in teaching, stating that the school cannot distance itself from the reality of students regarding technologies. The fact that cell phone use is banned in many school settings but, as it is part of life outside school, it is already a factor of demotivation for students and "continuing to use decontextualized teaching practices of adolescent culture will only alienate subjects/students from the process of knowledge production "(p.24).

Ribas (2012) demonstrated that the pedagogical use of the cell phone can enhance students' involvement, strengthen the motivation to learn and, because of their mobility, it is possible to use the cell phone "to facilitate mobile access and reach the goal of mobile learning anytime and anywhere." (p.50). It is noticed that students use the cell phone for various activities of their life, such as communication, entertainment, leisure, social networks, shopping, sales, etc., which indicates that there is a strong relation of coexistence/dependence on the equipment. According to the author, this also suggests that the students have acquired certain skills in the handling of the equipment, its applications and functions which could make its didactic use more spontaneous. "It would be natural for these young people to use the same resources to collect data outside the classroom, interview people, shoot and/or record situations related to a topic under study, record an audio of an explanation of their teacher ..." (p. 112)

For Gonzalez et al (2015), smartphones have the potential for mediation in teaching, since

"... students' interest in mobile technologies, as well as their knowledge using these devices can be used as a powerful tool to enhance their interest in learning and to facilitate their access to learning resources." (Page 2).

Gonzalez et al. (2015) cite that the didactic use of smartphones can take place in two lines: one in which the devices are used for communication, research and studies of didactic material and a second, where the functionalities of the device can be used as measuring instruments in experimental physics activities (stopwatch, sensors and other functions through installed applications) at virtually no cost. Yet, mobile learning power can also be used to help users convert their downtime into some productive activity. (idem)

THE PROPOSAL: AN ELECTRONIC SYSTEM OF ANSWERS

Our proposal focuses on the possibility of developing an application for use in teaching practices as an electronic system of answers in various curricular subjects, that operates on students' smartphones and communicate with the teacher's personal computer. In a schematic way, as shown in Figure 3, the app can be installed on smartphones and communicate via Wi-Fi network with the teacher's notebook. The notebook will hold the database, storing the questions and receiving the answers sent by the students. In Figure 3, it is shown a router-smartphone-notebook connection scheme.

So that smartphones can communicate with the notebook, it is necessary to establish a Wi-Fi network through a router. This must be configured so that the server machine is visible to all smartphones that have the application installed and have the static DHCP functionality, used to "register" the server machine to a fixed IP address used in the application. The router may or may not have access to the internet, which will depend on the conditions of each situation.

For the development of the application and the connections, according to Figure 3, tools and/or software such as the

following can be used: Android Studio IDE, MySQL or PostgreSQL, NetBeans IDE, WAMP Server, Apache Tomcat, among others. We stress that all these tools are free and available on the internet.

We seek that students have an app installed on their smartphones which will communicate with the notebook, so that the questions are sent by the computer to the app and the answers return through the same connection. That is, the app that receives the problems, in which students can solve directly on their smartphones and send the answer to the teacher. This, in turn, will file the answers to keep track of individual student performance.



Figure 3: scheme of the notebook-router-smartphone connection for app operation.

RESULTS

With the developed app installed on students' smartphones, the problem-solving activity can be leveraged in classrooms. When students read the questions on their devices, peer influence during resolution is minimized. It also favors concentration on reading and interpretation. And the sending of answers is individualized, that is, each student knows only about their performance in the activities, benefiting the work of the teacher.

The fact that students are allowed to use their smartphones during school activities can increase their responsibility, since they will have to organize the time available in the classroom only for didactic activities, because in the network there will be no connection to the internet. And it may also bring some motivation to the students, since in most school activities the use is prohibited, and they present skills to manipulate the technologies, being the education professionals responsible for directing this kinship for the purpose of improvements in the school teaching and learning.

FINAL CONSIDERATIONS

We believe that it is possible to develop tools to assist in the development of effective educational practices using resources that students already have, such as their smartphones. The incorporation of these devices can provide a stimulus to the students, arousing more interest in the school activities, as well as making the classes more dynamic and productive.

A smartphone application goes beyond the current devices having, more than the answer sent, also reading and solving the problem on the smartphone, favoring the introduction of other teaching strategy, such as mobile learning (m-learning).

The elaboration of this work provided a bibliographical review and reflection on the use of electronic resources in problem solving activities. It was also possible to verify that several researchers in the area of education defend innovative educational practices, with tools that can bring some benefit to learning.

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Keywords: Application program; Teaching; Technologies in Education

LA PROPOSITION D'UN SYSTÈME DES RÉPONSES DANS LES CLASSES DE RÉSOLUTION DE PROBLÈMES.

RÉSUMÉ

Ce travail présente une proposition de développement d'une application pour smartphones. Il s'agit d'un système électronique fournissant des réponses aux problèmes formulés dans différentes matières du programme d'études. Il est cherché une réfléxion théorique soit sur les systèmes de vote électronique soit les de bas prix pour améliorer les processus d'enseignement et d'apprentissage. Il est discuté sur l'entrrée des téléphones portables et smartphones dans les classes est en discussion tou comme la rélation des systèmes des réponses avec les méthodologies interactives d'enseignement, dans le but de montrer au lecteur l'importance des systèmes de vote et leur potenciel dans le processus éducatif.

Mots-clefs: L'application; L'éducation; Les technologies dans le éducation

PROPUESTA DE UN SISTEMA ELECTRÓNICO DE RESPUESTAS PARA CLASSES DE RESOLUCIÓN DE PROBLEMAS.

RESUMEN

Este trabajo presenta una propuesta de desarrollo de un aplicativo para smartphones para ser utilizado como sistema electrónico de respuestas en actividades de resolución de problemas en varias asignaturas curriculares. Se ha buscado una reflexión teórica tanto sobre sistemas de votación electrónicos cuanto los de bajo coste con sus respectivas contribuciones para la mejoría en el proceso de enseñanza y en el aprendizaje. Se discute sobre la inserción de móviles y smartphones en clases, bien como se indica la relación de sistemas de respuestas con metodologías interactivas de enseñanza, de forma a situar el lector sobre la importancia de los sistemas de votación y sus potencialidades para el proceso educativo.

Palabras-clave: Aplicativo; Enseñanza; Tecnologías en la Educación

PROPOSTA DE UM SISTEMA ELETRÔNICO DE RESPOSTAS PARA AULAS DE RESOLUÇÃO DE PROBLEMAS.

RESUMO

Este trabalho apresenta uma proposta de desenvolvimento de um aplicativo para smartphones para ser utilizado como sistema eletrônico de respostas em atividades de resolução de problemas em várias disciplinas curriculares. Buscou-se uma reflexão teórica tanto sobre sistemas de votação eletrônicos quanto os de baixo custo com suas respectivas contribuições para a melhoria no processo de ensino e na aprendizagem. Discute-se sobre a inserção de aparelhos celulares e smartphones em aulas, bem como indica-se a relação de sistemas de respostas com metodologias interativas de ensino, de forma a situar o leitor sobre a importância dos sistemas de votação e suas potencialidades para o processo educativo.

Palavras-chave: Aplicativo; Ensino; Tecnologias na Educação