DESIGN OF A LEARNING FRAMEWORK FOR OPEN MOBILE APPLICATIONS

DESIGN DE UMA ESTRUTURA DE APRENDIZAGEM PARA APLICATIVOS MÓVEIS ABERTOS

DISEŃO DE UN MARCO DE APRENDIZAJE PARA APLICACIONES MÓVILES ABIERTAS

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Abstract

Thru Design Based Research methodology it's being conducted an investigation regarding the design of a learning framework about the utilization and development of open educational resources, with focus on open applications for Smartphone devices. As a result of the investigation is expected to be designed and deployed an open course, available for any person who wants to learn about open technology integration in education, on how to use and build, in each person's particular educational context, applications for Smartphone. The contents of this course are themselves Open Educational Resources as well as the programing language selected to promote application development is also an open programming language. The steps taken from the beginning of the investigation until the third course design interation are described in this article, along with some reasoning about the data collected.

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Key words: Design of Learning Framework. Open Educational Resources. Mobile Applications.

Resumo

Através da metodologia de pesquisa baseada em design, está sendo conduzida uma investigação sobre o desenho de uma estrutura de aprendizado sobre a utilização e desenvolvimento de recursos educacionais abertos, com foco em aplicativos abertos para dispositivos Smartphone. Como resultado da investigação, espera-se que seja projetado e implantado um curso aberto, disponível para qualquer pessoa que queira aprender sobre integração de tecnologia aberta na educação, sobre como usar e construir, no contexto educacional específico de cada pessoa, aplicativos para Smartphone. Os conteúdos deste curso são eles próprios Recursos Educacionais Abertos, assim como a linguagem de programação selecionada para promover o desenvolvimento de aplicativos é também uma linguagem de programação aberta. As etapas tomadas desde o início da investigação até a interação do terceiro design de curso são descritas neste artigo, juntamente com alguns raciocínios sobre os dados coletados.

Palavras-chaves: Design de Estrutura de Aprendizagem. Recursos Educacionais Abertos. Aplicativos Móveis.

Resumen

A través de la metodología de investigación basada en diseño, se está llevando a cabo una investigación sobre el diseño de un marco de aprendizaje sobre la utilización y el desarrollo de recursos educativos abiertos, con enfoque en aplicaciones abiertas para dispositivos de teléfonos inteligentes. Como resultado de la investigación, se espera que se diseñe e implemente un curso abierto, disponible para cualquier persona que quiera aprender sobre integración de tecnología abierta en educación, sobre cómo usar y construir, en el contexto educativo particular de cada persona, las aplicaciones para Smartphone. Los contenidos de este curso son recursos educativos abiertos, así como el lenguaje de programación seleccionado para promover el desarrollo de aplicaciones, también es un lenguaje de programación abierto. Los pasos tomados desde el inicio de

*la investigación hasta la tercera interacción de diseño del curso
se describen en este artículo, junto con algunos razonamientos
sobre los datos recopilados.*

Palabras claves: *Diseño de Estructura de Aprendizaje.
Recursos Educativos Abiertos. Aplicaciones móviles.*

INTRODUCTION

For the purpose of a doctoral thesis on Education
Programme it's being conducted a research study about the
design of an open course, that may guide teachers to learn
about Open Educational Resources (OER), with a special
focus on Educational Smartphone Apps. For this it's being
used the Design Based Research (DBR) methodology. The
study is being oriented by the general research question:
"Does teacher training on the design of open applications for
smartphone devices contributes to change traditional teaching
practices into open teaching practices?"

It's undeniable the growing importance of the use of
technology in education, in a time of constant appearance
of new technologies and technological artifacts (HEROLD,
2016). The new generations are born today in a globalized
world enabled by bigger network connectivity, devices with
bigger computing capabilities, and by the emergence of several
online social networks. The Z generation is identified by the
constant use of online technology for social interactions and
communication (TUNER, 2015). Research as proved several
times that an effective use of technology can enhance learning
in several ways (UNESCO, 2011), but research as also revealed
that the use of technology in education isn't yet being made
effectively (ERTMER; OTTENBREIT-LEFTWICH, 2010).

An aspect that is referred as being of most importance
about the use of technology in the teaching-learning process
is that it facilitates student-centered instruction, which has
been identified as the most powerful facilitating student
learning method (CUBAN; KIRKPATRICK; PECK; 2001;

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INTERNATIONAL SOCIETY FOR TECHNOLOGY IN EDUCATION, 2008; PARTNERSHIP FOR 21ST CENTURY LEARNING, 2007, APUD ERTMER; OTTEN-LEFTWICH, 2010). Along this, Open Education, which has his focus on practices that contribute to eliminate barriers to education, also promotes a shift from traditional lecturing mode to a more learner-centered learning (SPYROPOULOU et al, 2015).

Recently Open Innovation have been associated with Open Education (CIEB, 2017). Open Innovation is a paradigm that have been traditionally addressed at corporate level as a set of practices that promote the innovation needed in creative process for new products and services (DABIC; BASIC; VLAJCIC, 2017). Open Innovation is now being addressed with a new meaning, identified as Open Innovation 2.0. In this new version, innovation is understood as the way new inventions are adopted by the society, that should result from the cooperation between several society stakeholders like governments, corporations, academics and individuals (CURLEY; SALMELIN, 2013). Education has an important role in innovation, since it teaches citizens that can be involved at creative innovation process, as individuals themselves or as members of organizations and corporations. Additionally, Universities are recognized by promoting research and innovation, but not every time open innovation is being addressed at course curriculums. There still is a need to promote open innovation among academic and business partners (LACHE; TEODORA, 2017).

Another important aspect of Open Education are the OER (Open Educational Resources). OER are learning materials that can be shared, reused and modified freely. (OpenSource.com, 2017). Because of its philosophy, REA are considered as catalyst of creativity: The relationship between creativity and open educational resources is outlined to demonstrate that there is a positive feedback loop between the two processes (WELLER, 2012).

A particular set of OER are educational applications developed to execute on mobile devices, which, due to their reduced dimensions, associated to internet connectivity, allow learning to occur anytime and anywhere. This kind of learning is identified as mobile learning (or m-learning). McGreal (2012) states that OER have potential to facilitate the expansion of mobile learning worldwide. Smartphones are a kind of mobile devices that can be used for m-learning. This devices are already part of student academic lives and are very frequently taken into classrooms (MARSTON, BLANKENSHIP, ATKINSON, 2014).

The smartphone mobile applications (known by apps) market is in expansion, a proof of that is the constant growth of the number of applications in the online stores (PANDEY, 2016). However, not every time the most relevant apps are available, or if they are, they aren't always free for testing in some particular teaching settings. A possible solution for this is teacher training on app development (HSU; CHING, 2013). Teacher training on app development allows the growth of the number of educational apps available (hopefully as OER) and its utilization in education. However not every teacher has programming knowledge to build applications. Visual programming languages are considered to be learn more easily by people without programming skills (HSU; CHING, 2013). Another aspect to consider is that having knowledge on how to develop apps isn't enough to use them in education. Teachers must understand what uses are more effective in their teaching settings. With this in mind, it's being designed a learning framework, to teach how to use and produce OER, with Design based Research methodology.

METHODOLOGICAL APPROACH

The methodology adopted for this study was the Design Based Research (DBR), because of its applicability to the investigation of new technological learning artifacts

or learning innovations as is the subject that is currently in investigation.

Kop (2010) stated that

> At the heart of Design Based Research is a methodological approach that examines and analyses in a systematic way every aspect of a new learning design innovation.From the moment the initial idea for the development is born, through an iterative process of development and testing, to the dissemination, diffusion and adoption-stage of the tested prototype of the designed environment, research takes place. (KOP, 2010, p. 105)

This methodology is known by its characteristics such as being iterative (the investigation occurs by cycles of design, analysis and redesign), process based, interventionist, collaborative, multi level, utility guided and based on learning theory (SHAVELSON; PHILLIPS; TOWNE; FEUER, 2003).

The investigation begun with a study regarding the use of open technology in teaching practices and by observation of the TPACK framework. TPACK framework proposes that each teacher must build its own reasoning about the experiences regarding the use of technology in their teaching practices. Starting by the investigator's past experiences on teaching adults relatively to the use of digital tools in education, it was built a primary design of an online course, which started the first investigation phase, corresponding to DBR first iteration.

I. FIRST ITERATION

As previously stated, the first phase begun with the design of a teacher training course about the use and development of OER. As the course at design was intended to be offered to people that have few available time to learn, it was conceived in a project based logic, where, along with the study's resources, was proposed the execution of simple

tasks that would allow the participants to explore the course contents in an experimental way.

So, it was necessary to delineate a course program, select existent resources and produce new resources. The course's program was structured to allow the exploration of several aspects of OER such as localization, production and sharing. The structure was organized in four main themes from the exploration and reasoning about what are OER to the development of a learning App. As it was a course on OER, it was desired that its contents could also been OER. Because of that, it was utilized existing resources and produced new ones. Besides that, was necessary to select a development tool that could be easily learned by the participants, which don't have necessarily programing knowledge, that was free of charges and that allowed them to produce educational applications for smartphone devices (apps). With that um mind and considering that visual programming languages are referred to be simpler to learn by people that don't have programming skills (HSU; CHING, 2013), the MIT App Inventor (http://appinventor. mit.edu) programming tool was selected to be the one used in the course. It is a visual programming tool that allows to build apps for Android mobile systems, by a mechanism of drag and drop of puzzle pieces, which encapsulates all the programming details from the user. Also, it is an open source web based tool, that works with a graphical user interface. The reasons why this tool was chosen are related by that it has fulfilled the established requirements and also, that it has been used in educational environments, has support from a large online community and is curated by well known entities (Massachusetts Institute of Technology and Google, for instance). Additionally, it provides documentation in several formats, such as pdfs, web page, blog and video and this is available in several languages, including Portuguese (the base language of the course at design). Another aspect that was valuated was that the apps developed by this tool can be used without adds, as it occurs with other free visual programming tools. This along with the possibility of utilization without

time restrictions, such as trials, and the complete access to all of its components made strong favour points for this tool to be choosed. But, even being compliant with all the requirements identified, this tool has one aspect that is a little restrictive and is that, until the present, is only possible to develop apps for Android devices. There are reports that in the near future, App Inventor will enable the development for iOS devices, but until that, it provides some work around to overcome this restriction, and that is that, it provides an Android emulator, that can be installed and used in other systems like Windows PCs, Mac OS and Linux, enabling users to use it even if they don't have any Android devices.

Since it was intended to offer this course online, and a MOODLE Content Management System (CMS) was available, this CMS it was chosen to structure and deliver the first edition of the course in design. This CMS is a well known platform in Portuguese Schools, and it allows to access course contents as well as the use of other communication and sharing tools, among course participants, such as discussion forums, simple messaging sharing and real time chat, allowing participants not only to consult the course documentation but also online interaction and collaboration.

TESTING PHASE

The first course was delivered to a first group of 10 volunteer teachers, that accessed the course contents actively for the period of four weeks. The volunteers were invited from the investigator and PhD Coordinator's personal contacts. The intention was that this first participants group could be free of any inhibitions about their evaluation of the course. During this trial phase the investigator acted as a tutor, encouraging interactions among participants, clarificating doubts and helping to troubleshoot, particularly when the participants where learning the programming language and developing their own apps.

Data Collected and Analysis

For evaluation of this phase of the course design, along with the educational course contents and activities proposed, it was asked the participants to respond to two questionnaires. The first one at the beginning of the course and the second after the course ending. This, along the course participation data recorded by Moodle, was the data analysed and used as input for the second DBR posterior phase.

The first questionnaire was used to characterize the course participants about their REA knowledge and utilization of mobile devices in teaching activities. The second questionnaire was used to gather the participants evaluation about their course experiences.

The data collected at this phase revealed that all individuals of this group stated that considered having technological knowledge, ranging from medium level knowledge to high level knowledge. Half of the participants said that already had programming knowledge, with 40% stating that had a high level of programming knowledge and 60% medium level. The individuals that had programming knowledge stated that already had used visual programming languages, but not App Inventor. Every individuals had a smartphone, although not everyone had used this device for educational purposes. The ones that already had used it in education, three stated that they used it very frequently. The ones that had never used smartphone in education activities, said that the reasons was that there were no suitable applications to use in their particular teaching contexts (50%), the intended applications weren't free (25%) and because the use of smartphone devices weren't allowed by their teaching institutions policies' (25%).

The final questionnaire revealed that the participants had been very favorable to the course content, having rated globally the course as good and very good.

The participants that finished the course (7 of the initial 10) were able to develop by themselves one simple

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app for smartphone, as a testing experience. Although this was considered positive, we must reinforce that everyone had stated that had previous programming knowledge.

They also indicated that the training obtained with the course had contributed positively to the participant's professional activities and, most of them, stated that they would use the App Inventor tool after the course ending.

The evaluation about OER course component, was, in the multiple inquiry questions very positive. The participants that ended the training course were able to successfully carry out the activities about identification, search and sharing of OER, with focus on apps for smartphone as being OER.

A final remark about the apps developed by this course group is that they were so basic level that hardly can be used in educational contexts, but it showed that everyone was able to learn the basics of the App Inventor language.

The data gathered in this phase revealed that the course design tested has contributed for teachers learning about the use of educational apps for smartphone, lead the participants to reflect about the value of OER and rethinking about their educational practices, where OER can have a more expressive role, and the learning about how to become a contributor to OER production and sharing.

II. Second Iteration

For the second course iteration it was made some changes, resulting from the feedback received from the first phase, and from the fact that this course was offered as a module in a master degree course regarding Materials and Contents for e-learning.

The first significant change was at the documentation level. For the first phase it was produced specific content using the journal module of the Moodle platform. This format don't allow the direct use of the documentation in other platforms or copy for another courses, even between similar platforms.

Because of that, all the documentation was revised, updated and converted to PDF format. Is this revision, there was a specific care about the use of terms regarding technology and added adicional explanations for the ones that suscited doubts at the first course. For example, it was explained in a very simple way what is an operating system, before referring to Android and iOS Systems.

Another change made was that the proposed developing App was a more complex one. In this course the participants were invited to plan and implement a "Trivia" App, regarding some educational problem that they recognized to happen frequently in their teaching practices.

The course program was also adjusted and clarified the expected completion time for each activity proposed, since scheduling was an issue revealed in the first course. In this course it was reduced the OER component exploration, since the course participants were students having already explored OER theme, and enlarged the time to explore App Inventor language, as suggested by the first course participantes. As in the first course, this one was also organized in four weeks of activity.

The second course had 13 student participants of the Master Pedagogia do e-Learning from Universidade Aberta, enrolled at the course Conteúdos e Materiais para e-Learning, that agreed to participate in the investigation. The course was offered as a module of the master's course, as indicated. The investigator was a course teacher that leaded the participants thru the exploration of the course materials and clarified doubts, similarly, as happened in the first course.

DATA COLLECTED AND ANALYSIS

The data gathered for the analysis came, as in the first course, from the response of the two questionnaires and from the records course participation of Moodle platform. 38,5% of the participants stated that had basic level technological knowledge, 53,5% had medium level and only 7,7% considered

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to have advanced level. The majority (84,6%) indicated not having programming knowledge. This group was different of the the one participating in the first course having significant lower levels of technical and programming knowledge. The ones that indicated having programming knowledge, 50% indicated having a basic level and 50% indicated having an intermediate level. Half of these participants also indicated that had visual programming language knowledge. Only one course participant indicated that don't had a Smartphone. 61,5% indicated that already had use Smartphone in their teaching activities. The majority of participants that indicated never had used a smartphone in teaching activities justified that because they didn't know how to use it that way. Note that this group was composed by teachers living in different countries, with distinct technology settings at their schools (Portugal, Brazil, Mozambique and Malawi).

As in the first course, the evaluation was made by the response of a final anonymous questionnaire. Also, it was provided a discussion forum, that allowed the participants voluntarily express their feelings about course experiences. These two instruments revealed that the participants were globally very satisfied with the learning developed in the course. Additionally, the evaluation questionnaire revealed that the learning provided by the course has contributed positively for the teaching activities of the participants, contributed for a greater understanding about OER and the use of educational apps. The App Inventor language was considered easy to learn (good and very good) despite of one single negative evaluation regarding esayness of learning. In the evaluation the participants indicated that, regarding App Inventor, the best aspects were the online documentation and support. 75% of the participants stated that intend to use this language in the future. The participants also indicated that the developing an app was a challenging task, despite that, they were very satisfied for each individual accomplishments. One of the participants indicated that had shared his work at

the App Inventor site repository, with a Creative Commons licence, and so, he made his first active contribution to OER.

III. THIRD ITERATION

The third course was, in its contents, very similar to the second one, because the data previously collected indicated that the participants were able to reach the learning objectives proposed thru them. At this third course the contents and activities regarding OER were included again, because the participants hadn't explored them previously. This group of participants were also students of a Master (Gestão da Informação e Bibliotecas Escolares) enrolled at the course Desenvolvimento e Gestão de Coleções, and was composed by teachers and school librarians, which was a shift from the two inicial scenários.

The data from this course iteration is still being analysed, but as happened in the second iteration, the students were able to learn about Open Education, OER, Open Mobile Apps and developed successfully their own apps. Several of them shared their apps on App Inventor Repository with some Creative Commons licencing. Two of the participants decided not to share their work and stated that with an appropriate licensing information.

IV. FINAL COURSE - NEXT STEPS

After three course iterations we are confident to have reached a stability point for the course framework in investigation. The data collected shows that the course objectives were achieved by the course participants, more specifically, teachers who want to learn about Open Education, OER and OER for mobile devices, such as smartphones, can do that with the content provided by the course, as it was presented in the third iteration. The biggest issue that all the three courses didn't resolved was the creation of a learning community to support teachers in locating, using and develop apps for education. The courses dynamics and

timings were imposed primarily by the presence of a tutor. Along this and because one of the investigation's objectives was to develop an open framework for mobile learning, and the course contents gathered so far have been successfully tested, the course materials are being deployed online, thru a free Moodle platform, available in Moodle Cloud. This platform will provide users the ability to communicate using Moodle communication tools along with course materials' exploration. All the contents are being made available with a Creative Commons licensing. The course platform is being divulgated in OER repositories so it can be located and used.

Off course, all the three courses where accompanied by a tutor, and the resulting course will not have one, although the investigator will be present and will contribute to the community, but with a different level of participation. Because of that, the course contents' is being reviewed and reorganized so it can be used without an active tutor user and leave room to the creation of a online community, that can learn collaboratively and support individuals in the subject of the use of open applications for mobile devices, in their own educational settings.

CONCLUSIONS

Although the data collection and analysis is not finished, there is possible to do some reasoning about of what has been achieved so far. Teacher training about the use of technology has been made with the focus on the technology itself and not on how it can be used in education and this has revealed to be insufficient to solve the problem about technology integration in education (MISHRA; KOEHLER, 2006). This study has the pretension to contribute (in a very small scale) to the solution of this problem thru the design of a training course about open educational practices, with focus on OER for Smartphone, using teacher contributes in its conception, and that, along with technological knowledge, wants to lead the trainees to reflect on how the technology

can be incorporated in teaching practices effectively. As its intended to be offered openly, this course can also be useful for several people involved in some kind of teaching and contribute to the widespread of open educational practices in several distinct teaching contexts.

Has for the data analyzed, it was clear that there are still some barriers and mistrusting about the use of particular technologies in teaching and learning practices, not only at individuals' level, but also at institutions level, by the imposition of prohibitive rules on use of technologies, such as the prohibition of utilization of smartphones in classes.

Globally, almost all course participants knew about OER (not very accurately), but never had any concerns about its utilization or had contributed as OER producers, although they had some sharing practices among well known peers only. The participants didn't know how to state an open licencing and misunderstood the difference between open and free content.

The majority of the participants of each phases were lacking knowledge about how to use smartphone devices in their teaching practices, with some exceptions, that stated already used apps in classes. The participants feedbacks also revealed that the course has contributed to their knowledge about open licencing and the use of OER. Several participants stated that have considered the course has had a positive impact in their professional activities, and that they would like to develop more knowledge about the course's themes, at a deeper level.

Regarding the investigation question "Does teacher training on the design of open applications for smartphone devices contributes to change traditional teaching practices into open teaching practices?", the data has shown that it can contribute to some changing, more specifically, because the course allowed teachers to develop apps with a specific teaching problem in mind, and as testing them, it allowed to

make some reasoning about how mobile technologies can be used to solve real problems.

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