INTEGRATED AUTHORING TOOL FOR MOBILE AUGMENTED REALITY-BASED E-LEARNING APPLICATIONS

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ABSTRACT

Learning management systems are increasingly being used to complement classroom teaching and learning and in some instances even replace traditional classroom settings with online educational tools. Mobile augmented reality is an innovative trend in e-learning that is creating new opportunities for teaching and learning. This article proposes a research approach to integrate an augmented reality authoring tool, which enables teachers to design and deliver augmented reality learning activities on mobile devices, into current learning management systems. In this research, we aim at complementing current e-learning systems, providing a wider and richer range of learning activities for teachers and students.

KEYWORDS

Learning Management System, Augmented Reality in education, e-Learning, ubiquitous learning, Mobile Learning (m-Learning), contextual learning.

1. INTRODUCTION

Due to rapid technological advancements over the past half century, technology has become an integral part of learning environments. This has greatly changed the practice of learning (Paramythis, A., 2003). Learning management systems (LMSs) have evolved in an attempt to keep pace with the World Wide Web (WWW), incorporating new technologies as well as adding pedagogical principles to a wide variety of software tools (Álvarez García, V.M., 2011). At present, LMSs such as Moodle and Blackboard, are very successful in e-education (Farman Ali, K., 2010).

Traditional e-learning platforms, or LMSs, provide holistic environments for delivering and managing educational experiences (Dagger et. al., 2007). They present suites of tools that support online management courses and student enrollment and management, education administration, and student performance reporting. Furthermore, increasingly, these Internet-based learning systems are being used to host new tools, such as Wikis and forums (among others), which support and extend the collaborative aspects of the teaching-learning process.

Virtual environments (VEs) such as LMSs can be seen as “empty” settings which are developed for teachers to create and manage their courses and fill them with digital content (Graf, S., 2007). Augmented Reality (AR) is a variation of VEs (Azuma, R.T., 1997) that integrates virtual information with the user’s physical environment. The combination of AR technology with educational contents creates a new type of automated applications and acts to enhance the effectiveness and attractiveness of teaching and learning for students in real life scenarios (Kesim, M. et al., 2012).

VE technologies completely immerse a user inside a synthetic environment. While immersed, the user cannot see the real world around him. In contrast, AR allows the user to see the real world, with virtual objects superimposed upon or composited with the real world. Therefore, AR supplements reality, rather than completely replacing it (Azuma, R.T., 1997). Augmented Reality has application in the field of learning (Di Serio, Á. et al., 2012). New possibilities for teaching and learning provided by AR have been increasingly

recognised by educational researchers (Wu, H.-K. et al., 2013). At the same time, research has indicated that AR systems and environments can help learners develop skills and knowledge that can be learned in other technology-enhanced learning environments, but in a more effective way (El Sayed, N.A.M. et al., 2011).

Adding augmented reality activities into e-learning require authoring tools that enable teachers to design the AR tasks and deliver them to the students. In previous studies, our research team has developed a stand-alone authoring tool that allows teachers to create and deliver AR activities (Hernández García, A.M., 2011). However, the proliferation in the use of LMSs at Spanish universities (Álvarez García, V.M. et al., 2012) suggests that teachers would greatly benefit from the integration of the authoring tool into the LMSs, thus complementing current e-learning systems, and contributing to the improvement of teaching methodologies and learning by providing a wider and richer range of learning activities for teachers and students.

2. RESEARCH PROPOSAL

Augmented reality authoring tools existing today (Jee, H.-K., 2011; Klopfer, E., 2002) are more related to digital content creation (Ha, T., 2010; Shin, M., 2005) than to the design of learning activities. These authoring tools are usually characterised by including the necessary functionality to design the interface to be visualised. The proliferation of these tools is limited and their use is not widespread.

Our research group has developed an augmented reality authoring tool named Ariane (http://www.pulso.uniovi.es/mobilelearning/ariane/), which allows teachers to design and deliver augmented reality activities, and students to download and interact with the activities from their mobile devices.

The aim of this research is to explore and address the use of authoring tools to support the design and delivery of AR educational activities, and the integration of the authoring tool into existing LMSs, such as Moodle, in such a way that the use of a different learning platform than the one currently used in the institution is not longer required. This research will be conducted on the most used LMSs at Spanish public universities (Álvarez García, V.M. et al., 2010), such as Moodle, Blackboard and Sakai.

The research methodology follows primarily a constructive research approach. Research activities related with this methodology include build, evaluate, theorise and justify. Nonetheless, some stages of this research have a more exploratory focus and hence they require a thoughtful review of the scientific literature on AR tools, AR activities, authoring tools, and their implications for the teaching-learning process. This study is aimed at providing us a global overview of the educational settings which are the most appropriate to implement AR activities, as well as a discussion on the proposed theories and models, both from an instructional design and technical perspectives, which are required to validate or refute our proposal.

Another outcome of the exploratory phase of this research consists in determining which activities must be managed by augmented reality authoring tools, and consequently, deciding the activities that will be integrated into the LMSs. In order to perform this study, we propose to search for indexed journal papers and relevant conference papers on augmented reality in education, as well as gathering information from teachers and students by means of surveys and questionnaires. One of the goals of the questionnaires is to detect lacks in the current teaching-learning process, and help to find solutions by means of using augmented reality technologies. Furthermore, surveys are also designed to facilitate teachers and students to detect and contribute in the selection of activities that are the most useful for their final implementation using educational augmented reality. Finally, the participants will be asked to try the Ariane's authoring tool, and determine its current possibilities in the educational realm as well as its expected value to different subjects.

Once the activities and their value are determined, we will explore the different modules and services currently provided by LMSs, and the best approach for allowing the integration of the augmented reality authoring tool into the LMSs. The development of prototypes is also covered in the constructive phase of the research methodology, which includes also the evaluation and collection of results to validate or refute our proposal. We will develop prototypes for all selected activities in the previous phase, and different approaches for allowing the integration into the e-learning platform will be tested, as an important factor for the selection of the best technical solution. The knowledge acquired during this research phase must enable us for determining the architecture of the solution and allowing us for the integration of new educational augmented reality features as needed. Latterly, the evaluation of the results obtained with teachers and the subjects of the study will enable us to determine the success of the approach proposed in this article.

Augmented reality activities will be added to the subjects conducted by teachers who decide to participate and collaborate on this research. Teachers and their students will be asked to rate the benefits of integrating augmented reality activities into LMSs. Two approaches will be used in order to rate the integration. On the one hand, surveys and interviews with teachers and students will allow us to provide a measure of the satisfaction as well as identify the strengths and weaknesses of the proposals. On the other hand, students's marks will be used as an indicator that allows us to rate the extent to which the proposed solution contributes to bring didactic effectiveness and improve learning.

3. CONCLUSIONS AND FUTURE WORK

Educational Augmented reality environments and systems can help learners to develop skills and knowledge that can also be learned in other technology-enhanced learning environments, but in a more effective and attractive way, enabling the exploration of the physical space. Adding augmented reality activities into e-learning require authoring tools that enable teachers to design the AR tasks and deliver them to the students. However, the proliferation of authoring tools is limited, and they are more focused on creating digital content rather than the design of learning activities.

In this paper, we propose a research aimed at exploring and addressing the use of authoring tools to support the design and delivery of AR educational activities, and the integration of the authoring tool into existing LMSs. In this way, the teacher does not need to use a different learning platform from the one currently used in the institution. From the student perspective, learners are encouraged to discover new learning activities they can perform as well as new ways of learning by means of interacting with the real environment.

We propose to conduct a prospective study on this subject in order to determine which augmented reality activities must be added to the teaching-learning process, the best manner to integrate them into existing LMSs, and evaluate the results obtained from testing educational augmented reality activities with teachers and students in experimental subjects. While AR offers new and exciting opportunities, it also creates new technological and pedagogical challenges that require researchers from different backgrounds and disciplines to collaborate interactively. A thorough evaluation of educational AR systems must consider, besides technical, pedagogical aspects, in order to determine the degree of completeness of the objectives and allow researchers to rate the extent to which the proposed solution contributes to bring didactic effectiveness and improve the teaching-learning process.

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