Technologies for Interactive Learning and Assessment Content Development

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ABSTRACT

Recent technology trends evolved the student assessment from traditional ones (“pen-and-paper” and “face-to-face”) to modern e-Assessment system. These modern approaches allow the teachers to conduct and evaluate an exam with huge number of students in a short period of time. Even more important, both the teacher and the students achieve the evaluation results immediately after the assessment has finished. Although the e-Assessment system speeds up the evaluation, teachers face a huge challenge to prepare, organize and generate a huge set of questions. The questions must cover all learning objectives and their number should be as large as possible to prevent cheating by guessing or memorization of correct answers from previous exams. This paper presents several technologies that can efficiently realize strategies to develop a huge question database with minimal teacher efforts. It also describes the methodologies and strategies based on a specific technology. The technologies are categorized in two classes of e-Assessment systems that are used at the authors’ faculty: the traditional e-Assessment system with usual multiple-choice answers and the newest e-Assessment system with interactive images. The question generation is based on defining the questions and answers as XML files (for more advanced users) and MS Word-based files (for users with basic IT background). The question database can be used both for efficient and effective e-Assessment and e-Learning.

KEYWORDS
Click Test, E-Assessment, E-Learning, E-Testing, Interactive Images

1. INTRODUCTION

ICT supported learning is practiced in last 30 years (Hennessy et al., 2005). There are a lot of studies that show various applications and the benefit of their use (Bandung et al., 2011). Here, we refer to the use of e-Assessment and e-Testing as a support to the overall learning (Al-Hamad & Mohieldin, 2013). Ristov et al. (2014) have reported that interactive e-Testing is preferred as a learning tool than simulators and other visual tools. Therefore in this paper we address the technologies to realize visual interactive e-Assessment as a learning tool.
The idea of using the e-Assessment tools and engines for e-Learning is not new. It is based on establishing a highly interactive environment that helps the discovery based constructive type of learning, where the student is encouraged to activities to find clues and solutions to problems, instead of a classical way of having an instructor presenting the lectures. So the target is to help the students to construct appropriate knowledge understanding the basic principles of the study area (Gusev & Armenski, 2014).

The technology to establish the highly interactive environment is based on realization of an e-Testing system as a part of a more complex e-Assessment (Lazarinis et al., 2010). The motivation is not towards the assessment and grading the overall student knowledge and obtained skills, but to support him/her in the process of learning. In this case the role of the instructor is replaced by ICT tools interactively asking the student relevant questions. Further on, corrective measures are taken to enable a positive feedback to the student, enabling learning by doing and experimenting (Leyer et al., 2014).

Technology is not the only burden that system enablers are facing. The content might become a higher problem, since in case of a small number of questions, the students will learn by heart the corresponding answers, and the complete concept will become a miss-use. One should aim at learning the concepts and methods, instead of just memorizing several facts. Therefore, a huge challenge is to focus on construction of the questions and building the knowledge database. The conventional approach assumes that the instructor (including teaching assistants and even the students) will prepare the questions and then all mistakes will be corrected in the approval process. However, this might be a long process and requesting a huge amount of resources (Pain & Le Heron, 2003). For example, creation of a minimal set of questions might require at least 10 hours per week (Powers, 2007).

In this paper we aim at presenting technologies and strategies for development of a large set of questions for two types of e-Testing: the conventional use of multiple choice questions (Gusev & Armenski, 2014) and e-Testing with interactive images, instead of textual questions and possible answers (Gusev et al., 2014 a). The proposals of new technology solutions specify the file format the questions should be defined, while the strategies for question development define how the teacher will use his/her intellectual capability to develop questions. Both the technologies and strategies result with specification of a document that can be used for bulk upload into the e-Testing system, using a rather straight-forward interface instead of a mixture of mouse-related moves and keyboard strokes in a classical user interface. In our earlier paper (Gusev et al., 2015) we introduce strategies to generate question with multiple-choice questions or with interactive images. Here we reflect the technology background to use the strategies in defined architectural scenario, such as definition of the structure of used XML or word document files. We also present an illustration of the evolution path how to solve the challenges to create a huge number of questions.

The structure of the paper uses the following organization. Section 2 gives the background definitions. Section 3 discusses research and evaluation done on how e-Testing can be used as a learning tool. This is followed by Section 4, which describes e-Testing technologies that support the learning process, instead of being just a part of the overall assessment. After analyzing the existing technologies, Section 5 discusses the question development technologies for a large set of questions. Section 6 describes a new method based on a proposal of using standardized XML files to allow bulk upload and question development, and describes a new proposal of strategies as a methodology for creation of a large set of questions. Section 7 shares our experiences and gives a detailed discussion about the new proposal and existing technologies that support learning. Finally Section 8 provides conclusions and recommendations for further work and improvements.
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