THE NEW METHOD OF PROBLEM SOLVING IN PHYSICS EDUCATION BY USING SCORM-COMPLIANT CONTENT PACKAGE

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ABSTRACT

In this article, two basic purposes are presented. First, taking effective feedbacks in the electronic learning environment about the learning level of students at the problem solving which are told in physics lessons and laboratories. Second, providing a possibility for students to repeat the subjects and solved problems by watching and listening, which are told in lessons and laboratories, whenever or wherever they want. For this purpose, in the first step, the problems solved in classroom and laboratories about physics and subject expressions are transferred to digital environment and e-learning materials are developed. In the second step, these materials are converted to standard SCORM (Sharable Content Object Reference Model) package and integrated to Course Management System (CMS).

Keywords: Physics education, SCORM, Moodle, distance education.

INTRODUCTION

Distance learning has been widely used in recent years because of the internet popularity and fast development of computer systems. These rapid advancements require integration of technology into the learning processes. A growing body of research on adult learners further suggests that increased learning gains can be achieved when instruction is designed with students' learning styles in mind (Dunn, Bruno, Sklar, & Beaudry, 1990; Gordon, 1993; Larkin-Hein & Budny, 2001; Lenehan, Dunn, Ingham, Murray, & Signer, 1994; Nelson, Dunn, Griggs, Primavera, Fitzpatrick, Bacilious, & Miller, 1993; Ranne, 1996; Williams, 1994). An increasing number of technology-based educational methods currently exist within the domains of science, technology, engineering, mathematics, and physics education. Physics is a difficult lesson for students from secondary school to university   to understand and to solve problem and also for adults in graduate education. For the former, it is claimed that without constant individual intervention and feedback, the student cannot learn problem-solving alone, and for the later.

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There are examples of instructors integrating computer technology into their teaching as early as the mid-1980s (Taylor&Edwin, 1987), although what was then available differs substantially from the tools to which instructors now have access. Problem solving with technology, which seems to be so strong a deterrent to physicists, does not seem to have heretofore been addressed in any comprehensive way. But today we know that science needs new technology in physics education in order to increase education level. The new and various internet-based distant educationsshould be put into action and it should be wide spread. We observe in our lessons the impossibility of physics education and problem-solving and the necessity to do laboratory exercises. When we see this is a major and difficult part of the physics education, we began to search on the web for "problem solving". We found many literatures about distance physics education based on texts, textbooks, chats, homework, CDs and java applets. But a few articles were exciting for problem solving. Tim Fahlberg's study about whiteboard math movie in 1997 draws our attention in e-learning. A whiteboard math (WBM) movie is a screen recording of writing plus voice and/or text explaining a mathematical concept, or solving a problem that has been produce to Flash movie and distributed via CD or Internet (Fahlberg, Fahlberg-Stojanovska & MacNeil, 2006). WBM can be suggestible for students from elementary to high school as a standard teaching tool. We converted WMB technique to a standard SCORM package and integrated to CMS (Moodle). This method is considered as a new, more cheap, effective and funny for physics students. In this study, our expectation is increasing the understanding and learning of students in physics education and trying the different teaching methods in physic fields.

WHY WHITEBOARD MOVIES?

There is a strong prejudice among physicists, and specialists in other mathematically intensive disciplines, that effective distance education is not feasible in their subject because of the impossibility of teaching "problem-solving" without strong one-on-one interaction and because of the necessity to conduct meaningful laboratories which require expensive apparatus. Our basic reason for choosing WBM when we started working is that WBM is still very good and new instructional method. Students can access these instructional WBMs via Moodle by using their username and password whenever they want. They can run again the videos as many times as they need. WBM have great value for educators, they can cooperate with each other asynchronously since it's very difficult for educators to meet other educators somewhere else. The list of the instructional benefits of WBMs:

Educators and WBM
1. It is incredible different method from traditional education methods.
2. WBM is a way for educators to make themselves much better.
3. They also can collaborate with other educators about different methods of solving problems.
4. WBM allow educators to see a really new method to use and show a different way to explain a concept.
5. Educators can be aware of the problems of students in different lessons by feedback evaluation.
6. There are many educators who have a poor education in certain disciplines. These educators can follow other educators actually teaching many problems, to see various explanations and teaching methods.

Students and WBM

1. WBM is a new, funny and a different problem solving method for students.
2. In recent years, internet has been widely used. As a result, the technology based on techniques in education as WBM becomes more preferable for student.
3. The students can complete their deficiency about problem solving out of classroom and laboratories.
4. The students can form a valuable development at problem solving in physics.
5. WBM empowers to an extent repeatedly problem solving and explanation by listening and watching but the traditional problem solving methods does not allow.
6. Students can be very critical of their work when they view the problem solving step by step. This increases their natural desire to improve.
7. Students can be more interested in problem solving and strictly more concentrated about physics.
8. WBM can be set up when a student can not able to get to university for any reason and it can be very helpful.
9. WBM allow students to learn problem solving not only by using watching but also by listening.

APPLICATIONS OF WHITEBOARD MOVIES

- Watching and listening the problem solving.
- Listening whenever you want and repeating how often you want.
- You can see educator if he or she allows from webcam.
- You can see and hear each step.
- You can stop wherever you want so that you can make critic of your work.
- If you don't want to see the result, you can hide the result.

Figure: 1 shows how WBM fit wholly into the educational process.
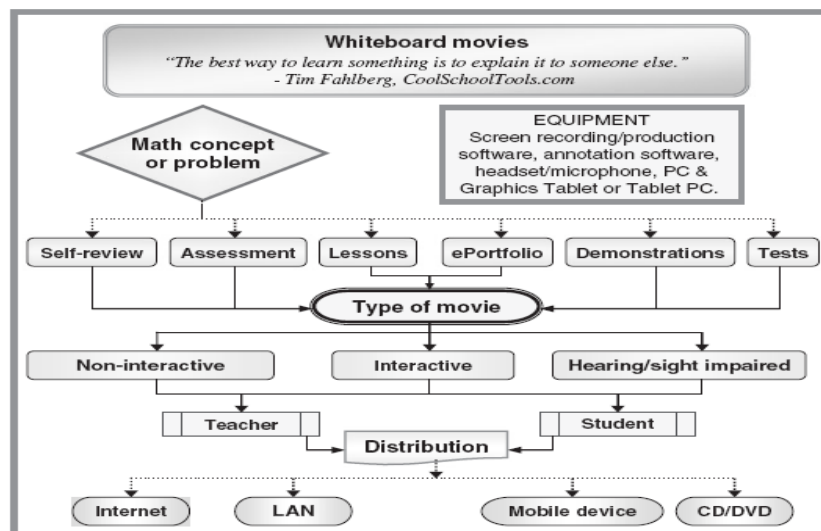

Figure: 1
Whiteboard movie in education (MacNeil, 2005)

Basic Equipment for WBM

We need a PC, a headset with microphone, a graphics tablet with pen, recording and production software and annotation software for WBM.

- ➢ **Graphics tablet with pen: You can choose the smaller 6x4 in. in tablets, or the bigger 8x6 in. in tablets. But we use 6x4 in. in tablets in our study.**
- ➢ **Recording and production software (R&P): R&P allow you to record a window or a region since recording the screen. Additionally, the R&P software should allow to combine several recordings and to produce to a number of formats including avi, swf (Flash movies), flv and SCORM package. There are many R&P software program for example TeachSmith's Camtasia Studio (CS) (Camtasia Studio, 2006) or Adobe's Captivate (Adobe Captivate, 2007). We prefer CS. Because it seems much cheaper and very effective. We convert the movies to SCORM package by using CS.**
- ➢ **Annotation software is the interface between your writing on your graphics tablet and the computer. Annotation software has a variety of pens, lines, geometric shapes, cleaners, etc. and we use these features to add visually and interest to our application. There are many annotation software programs as NotateIt (NotateIt, 2006), Smart software (Smart Software, 2006), Interwrite etc. We prefer the Interwrite annotation software. It comes with the GTCO SchoolPads (Interwrite, 2007).**

The process-making the movies

The basic steps are as follows (Fahlberg-Stojanovska, 2005):

- ➢ **We opened our annotation software.**
- ➢ **We woke up our tablet by tapping on it with our pen.**
- ➢ **We wrote our problem by using our tablet or capture our problem from electronic materials (scanned texts, pdf files, and typed materials) by using the capture feature of our annotation software or a program like SnagIt. Long problems can be solved by using multiple pages in our annotation software or by scrolling down while recording.**
- ➢ **We turned on recording software in pause mode and make sure the recording window was easily visible, in order not to write accidentally outside of the window.**
- ➢ **We checked the microphone and that the recording software set to record audio.**
- ➢ **We started the recording software.**
- ➢ **We solved our problem. When we made a mistake while talking, we stopped talking and we restarted our sentence after a few minute. When a mistake occurred while writing, we backed up our annotation software and than started writing and talking again. We didn't stop our recording software. The "bad part" in production can be cut out. When it was done, we stopped recording.**

We also integrated as following two steps.

- ➢ **We converted the movie to SCORM packages by using recording software.**
- ➢ **We transferred SCORM packages to Moodle.**

Who can use WBM?

➢ **WBMs support the students outside of the classroom and laboratories because students can listen and watch our movies over the Internet.**

➢ **Educators can help each other about the teaching techniques by using WBM.**

MATERIAL AND METHODS

A learning object in the educational field is considered as any kind of material that can be reused in teaching, such as a lesson plan, video, or section of a program code (Spalter & Dam, 2003), or it can be any digital or non-digital object and used or reused for the technical support of learning (Friesen, 2001).

Learning objects have some common characteristics (Paulsson & Naeve, 2003): they are described according to learning technology standards of an organization such as Institute of Electrical and Electronics Engineers, Inc. (IEEE)/Learning Technology Standards Committee (LTSC), Instructional Management Systems (IMS), and SCORM; and the content is modularized, which can make each learning object independent and thus increase the opportunities to reuse them.

According to Advanced Distributed Learning (2006), a learning object should have the following advantage:

➢ **Accessibility: the ability to locate and access instructional components from one remote location and deliver them to other locations.**

➢ **Interoperability: the ability to take instructional components developed in one location with one set of tools or platform and to use them in other locations with a different set of tools or platform.**

➢ **Durability: the ability to withstand technology changes without redesign, reconfiguration or recoding.**

➢ **Reusability: the flexibility to incorporate instructional components in multiple applications and contexts. If the development of learning objects followed these four characteristics, e-learning would evolve steadily.**

➢ **Manageability: The observation of information by learning management system which belongs to user or content.**

➢ **Scalability: the technology's capability must be enough for the increasing number of user, lessons and content. Moodle (Moodle, 2006)**

Moodle is a course management system (CMS). This free software package which has been designed using sound pedagogical principles helps educators to create effective online learning communities, to participate actively in the learning process and to collaborate in groups. The collaborative activities often promote meta-cognitive processes such as reflection, self-explanation and self-regulation.

This platform allows the management of contents, students and teachers and offers a large variety of resources and activities, such as quizzes, consults, diaries, workshops, SCORM objects, among others. Because of the advantages of SCORM that explained above and the conformant of SCORM with the MOODLE, we convert WBM to SCORM package.

Applications of whiteboard movies

Telling and presentation of this whiteboard movie is very difficult in an article but we will try to do by giving examples.

Figure: 2

Figure: 3

In Figure: 2 we tried to show a sample screenshot of a WBM as a SCORM package in a Moodle. And, In Figure: 3 The sample of problem solving associated with the webcam screenshot of educator.

DISCUSSION AND CONCLUSION

Distance education is a trend in education. E-Learning enables e-learners to learn without the restrictions of both time and space. Furthermore, building an e-learning environment means not only building a new system but also developing high-quality new teaching techniques.

In this study a different problem solving strategy is applied on physics education. WBM provides alternative way of problem solving. SCORM is aiming at the standardization of computer-based teaching components.

Using of a common standard, in this case CMS and SCORM, enables the sharing of content, monitoring the student activity and evaluation of students problem solving performance. The advantages of this technique are not only cost-efficient and effective but also more practical. WBM aided learning is also seen as a more 'fun' way of practicing otherwise the subjects can be boring subjects. Ideally less experienced educator would be supported by experience educator and experiences are shared. Students can practice physics in anytime and anywhere. The amount of watching and listening exercises become infinitely large. Student's activities can be stored and monitored, so that the educators can be aware of the subjects in whom the students are more compelled.

Tim Failberg improves statically the uses and benefits of WBMs in mathematic education. In our opinion, WBM technique will be more effective than the traditional methods including blackboard lessons or making assignments from a book in physics education for students.

Our purpose in further study is sharing our experience statically on the university student in physics department about problem solving performance by using WBM technique.

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