

Work in Progress: Learner-Centered Online Learning Facility

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Abstract - This paper describes a novel, learner-centered technology for authoring web lectures. Besides seamless integration of video and audio feeds, Microsoft PowerPoint slides, and web-pages, the proposed Online Learning Facility (OLF) also facilitates online interactive testing and review of covered materials, online provision of feedback, real-time navigable lesson structure, e-mail, threaded discussion and a chat room. To assess the effectiveness of interactive learning in OLF environment, we conducted a small research study using OLF-based web lectures in the context of a tutorial on Multi Agent Systems (MAS).

Index Terms – web lecture authoring tool, active learning.

INTRODUCTION

With the rapid advancement and the ever-increasing diffusion of computer and Internet technologies in society, effective and efficient training methods are crucial to companies to ensure that employees are equipped with the latest information and most advanced skills. On the other hand, this advancement and diffusion offer diverse means to support learning in a flexible, on-demand and personalized manner. These radical changes in learning needs and technology are the mainspring of the fundamental shift in delivering education, commonly referred to as e-learning.

E-learning can be defined as learning that is accomplished via a computer network. It is characterized by on-demand content delivery and cost effectiveness. Education can be distributed to geographically-dispersed learners who can learn at their own pace at their workplace or at home, that is, wherever and whenever they chose. Since it eliminates travel costs and classroom upkeep, maintenance or rental costs, e-learning results in major cost savings. Although there are numerous times when learners benefit from observing and being observed by a real instructor, there are also numerous times when learner-centered, self-paced, constructive (hands-on) learning is desirable and when the cost/benefit favors an e-learning training program.

However, inadequately designed e-learning environments can result in frustration, confusion and reduced motivation of learners. For instance, using only text-based learning materials may lead to boredom and disengagement in learners. Although more and more multimedia-based e-learning systems are becoming available, most of these suffer from insufficient learner-content interactivity and flexibility due to their passive and usually unstructured way of presenting teaching materials. It is very usual in current e-learning environments (such as MS

Producer and E-teach) to be unable to skip a portion of an hour-long instructional video or to ask questions about the instructed topic and get answers immediately instead of sequentially going through the instructional video to find an answer. Interactive problem solving (hands-on experience), online testing, immediate feedback provision, and online forums and discussions are still considered challenges facing the researchers in the field.

ONLINE LEARNING FACILITY

In order to address some of the existing challenges in e-learning and facilitate development of interactive, flexible, learner-centered e-learning environments, we propose a novel web-lectures authoring tool called Online Learning Facility (OLF) that enables well-structured, synchronized, and fully interactive (student-content, student-student, and student-instructor interactive) multimedia instructions.

OLF facilitates the following (Figure 1):

- seamless integration/synchronization of two video and two audio feeds, MS PowerPoint slides, and web-pages,
- subtitles, which may alleviate the learning process by foreign and hearing impaired learners,
- synchronization of instructional materials (video, slides, etc.) and the lecture overview, which facilitate fast and easy locating of particular segments of the lecture that will be played (or skipped) by clicking the appropriate line of the overview,
- interactive testing and review of covered material by means of a question system that embeds questions within a lecture (Figure 2) and can be used to define the context of learners' interest in the lecture, to assess learners' level of (prior) knowledge and understanding, to enable them to choose parts of the lecture that should be reviewed and those that can be skipped, to verify progress, or to ask them for their opinion and start a discussion (to prevent that the same questions are posed each time when verifying progress, a pool of questions should be related to each thematic part of the lecture from which questions can be randomly chosen),
- immediate feedback provision, which allows the learner to see whether his or her answer to the posed question was correct, what his or her overall progress in the lecture/course is, and what the instructor's suggestions given the current progress are,
- taking notes, which are automatically organized according to the lectured topics and which, similar to traditional

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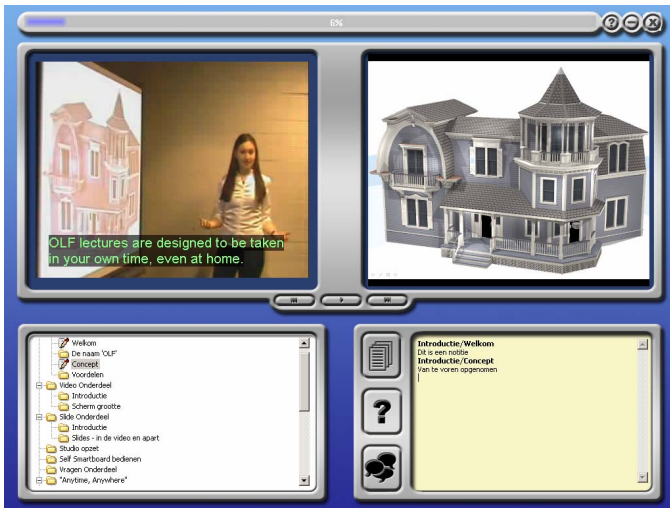


FIGURE 1

SCREENSHOT OF THE GUI OF OLF: THE PROGRESS BAR IS LOCATED ABOVE THE VIDEO AND SLIDES PANELS. THE CONTROL PANEL IS LOCATED UNDER THESE PANELS. THE INTERACTIVE LECTURE OVERVIEW IS LOCATED UNDER THE VIDEO PANEL. THE NOTES PANEL IS LOCATED UNDER THE SLIDES PANEL. THE TOPMOST BUTTON OF THE NOTES PANEL ACTIVATES ‘NOTES TAKING’ OPERATING MODE, THE BUTTON IMMEDIATELY UNDER IS USED TO SEND E-MAILS TO THE INSTRUCTOR, AND THE LOWERMOST BUTTON OPENS A BROWSER DISPLAYING THE CONTENTS OF THE FORUM RELATED TO THIS E-LECTURE.

notes, enhance remembering and provide an overview of the material but, in contrast to traditional notes, can be easily saved, shared, and printed,

- feedback requests, which will be sent to the instructor by e-mail,
- an asynchronous chat forum, which can be used to pose questions and initiate discussions with instructor and other participants in the e-lecture/course, effectively reducing the feeling of isolation (to enable fast and easy access, discussions are grouped according to the lectured topics),
- a simple Graphical User Interface (GUI), which allows the learner to see the progress of the lecture by means of the progress bar, to access help files, and to pause, stop, and review (parts of) the lecture by means of a control panel situated under the video and slides panels (Figure 1).

OLF-BASED WEB LECTURES ON MAS

To assess the effectiveness of interactive learning in the OLF environment, we conducted a small research study in the context of a tutorial on Multi Agent Systems (MAS). The tutorial on MAS is a short series of classes instructing undergraduate Computer Science students on basic concepts like agents’ communication, coordination, planning, and epistemic logic. It represents a synthesis of the objectivist and the constructivist approach to teaching – except learning by listening, class time is used for learning by solving real-world problems. We made a separate web lecture for each class, a separate simulation of each real-world problem, and we integrated those into a complete OLF-based tutorial on MAS.

Since each lecture handles several subtopics, each instructional video has been recorded as a series of short video clips such that each video clip focuses on a specific subtopic.

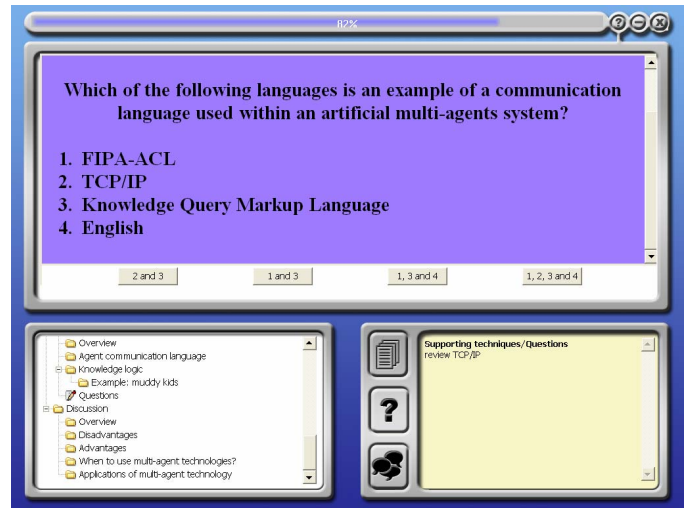


FIGURE 2

SCREENSHOT OF THE QUESTION SYSTEM OF OLF, ITS PANEL SUPERIMPOSED OVER THE VIDEO AND SLIDES PANELS (FIGURE 1). THE LEARNER CAN CHOOSE TO ANSWER THE QUESTION BY CLICKING ONE OF THE BUTTONS LOCATED UNDER THE QUESTION OR TO RETURN TO THE STANDARD LECTURE MODE BY CLICKING THE APPROPRIATE LINE OF THE LECTURE OVERVIEW. COMPELLING THE LEARNER TO ANSWER THE QUESTION PRIOR RETURNING TO THE STANDARD LECTURE MODE CAN BE FACILITATED BY DISABLING THE LECTURE OVERVIEW PANEL UNTIL THE QUESTION IS ANSWERED.

The learner is presented with a number of questions and/or simulated real-world problems each time before and after a specific subtopic is handled. Based on the provided answers, the learner’s level of (prior) knowledge and understanding is assessed and he or she is advised to either (re-) review or to skip the instructional video on the subtopic in question.

An experiment was conducted in Autumn 2005 with two sections of students attending the MAS tutorial: one using web lectures and one using traditional lectures. To ensure the lecture content was consistent across the experimental groups, the same instructor who taught the classroom group also prepared online course material and every group went through the same experimental procedure. The learning effectiveness was assessed by objective measures (test grades) and subjective measures (perceived satisfaction). Each student was given a closed-book test before and after attending the MAS tutorial. The difference between the two scores has been used as the individual learning performance. Learner satisfaction was evaluated via a standard questionnaire that employs a 5-point Likert scale ranging from extremely dissatisfied (1) to extremely satisfied (5). The web lecture section’s grades were in average 10% higher than the grades of the lecture section and web lecture students reported on increasingly strong positive experiences with learning in OLF environment, in particular as means to prepare for final exam, gain practical (hands-on) experience, and obtain novel knowledge by engaging in discussions with peers.

Motivated by these positive results, we intend to conduct a large study on the effectiveness of interactive learning in OLF environment in the context of the introductory course on Artificial Intelligence, which the tutorial on MAS belongs to.