1. PROJECT TITLE

Reusable e-learning course development: Two case studies at the University of Cambridge

2. REQUIRED INFORMATION

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- Project location: Cambridge and East Anglia Zone, United Kingdom.
- Project Start date: January 2002 to July 2004

3. DESCRIPTION

- Conceptual framework of objectives:

(a) To raise the interests and levels of understanding in Physics among 11-19 year-olds students;

(b) To assist the Cavendish Laboratory in developing, expanding and improving regional educational outreach events in East England.

(c) To identify the levels of effectiveness for interactive learning and virtual learning software / website

- Project partners and stakeholders

Higher Education Funding Council for England (HEFCE) and Aspiration-Raising / Widening participation community within the University of Cambridge (about 25 departments and colleges taking part).

- Project methodology and grass roots activities carried out:

  Action research, web / software development, feedback / surveys, interviews, workshops and exhibitions.

- Tools leveraged (specify if communication and or information technologies were used and if so how.):

  Web development tools: Dreamweaver, CSE Validator, Flash, SSH Secure Shell and servers (IIS, Linux, Apache and MySQL).

  Computer languages: ASP / ASP.NET, PHP, JSP, Java and DHTML (with Javascript).

  Open-source learning website: Cambridge Physics (http://www-outreach.phy.cam.ac.uk/camphy/)

  Virtual Learning Environment: BlackBoard (available at the Institute for Manufacturing)

4. PROJECT EVALUATION AND APPLICABILITY OF BENEFITS

- Principle project results:

(a) At the Cavendish Laboratory:

100% of participants feel their knowledge in Physics has improved by up to 150%.

90% of participants acknowledge the effectiveness of interactive learning (combination of face-to-face learning and 100% online learning) for improving their IT skills and knowledge of Physics.

(b) At the Institute for Manufacturing:

90% of undergraduate students find that interactive learning with the use of virtual learning environment has stimulated their interests and improved their learning efficiency.

- Evaluation of project and realized contributions

Evaluation was proven successful: 100% of feedback from the Cavendish Laboratory and 90% of feedback from the Institute for Manufacturing have positively acknowledged the effectiveness of interactive learning. The main reasons are due to the easy ability to: (1) view the course materials and develop their thinking skills; (2) discuss various academic questions online; (3) receive new and useful ideas from peers; (4) receive answers from tutors in a shorter time and (5) develop the learner-centred model for learning.

• Assessment of how the project benefits can be extended to a larger area or community, or can be applied within a different socio-cultural context

This project is having long-term positive effects and transferable skills / developments for both Cambridge communities and participating high schools in East England regions. It involves more than 15,000 people and the next stage is divided into two categories: (a) further development of interactive learning programmes at growing number of departments in Cambridge and also enhanced delivery of interactive learning for the existing programmes and (b) development of online learning supports and tutorials for the participating high schools in East England.

Body of my paper

Introduction

Reusable e-learning development (RED) is defined as the cloning, modification and customisation of existing files or source codes for developing another website or another web-based application. Reusable e-learning development provides a practical technique for time-saving, improving efficiency and maximising utility of existing resources for creating another website or another web-based application. RED is particularly useful for large-scale web development in utilising and managing an extremely high degree of overlapping of information, resources and web designs. Therefore, RED has been widely adopted by growing number of knowledge-based organisations (KBO), including Information Technology and Higher Education. One example is the University of Cambridge, where numerous departments, including the Cavendish Laboratory, the home of the Department of Physics, have adopted RED as the web development strategy in the re-development of Cavendish website.

This paper presents two case studies at two departments of the University of Cambridge. At the Cavendish Laboratory, a Flash-based open-sourced website, Cambridge Physics, has been used for training workshops, also known as the Physics Skills Days. The website, Cambridge Physics, has been reused in each occasion and participants are able to access the learning resources online from their offices or homes. 100% of positive responses from participants are received for acknowledging their improvements in their knowledge of Physics and also 90% of feedback strongly agree for the effectiveness of interactive learning, the combination of face-to-face learning and 100% online learning. At the Institute for Manufacturing, 90% of undergraduate students find that interactive learning with the use of virtual learning environment has stimulated their interests and improved their learning efficiency.

2.1 REUSABLE E-LEARNING DEVELOPMENT FOR COURSE DEVELOPMENT AND CONTENT MANAGEMENT

In the context of education delivered by e-learning, a Virtual Learning Environment (VLE) is designed and adopted to facilitate learning processes and enhance learning efficiency. Among VLE, BlackBoard and WebCT are the most commonly used by the HE sector in the UK. There are several reasons for universities to move from class-based to web-based learning:

(1) providing flexible ways of learning for students due to the development of a student-centred learning model;

(2) increasing enrolments on and revenues from the benefit of distance learning programmes;

(3) improving the quality of education;

(4) convenience of reusing their course materials.

RED is also useful to course development and content management. In order to support this hypothesis, two case studies are presented and analysed in this section.

2.2 ANOTHER CASE STUDY FROM THE DEPARTMENT OF PHYSICS, UNIVERSITY OF CAMBRIDGE: PHYSICS SKILLS DAYS

At the Department of Physics, "Physics Skills Days" (PSD) form a series of events designed specifically for newly qualified teachers of physics, as well as those who do not have a background in physics. There have been three PSD so far since June 2003. On the second PSD last December, participants were asked to read online course materials on the existing Cambridge Physics website, where multimedia is used to explain some complicated concepts of Physics through simulations. The feedback from participants suggests that their knowledge of Physics has improved. In March 2004, the third PSD was organised and limited 20 participants. Similarly all participating high-school teachers, trainee teachers, final-year undergraduate students and postgraduate students have acknowledged that their knowledge in Physics has improved.

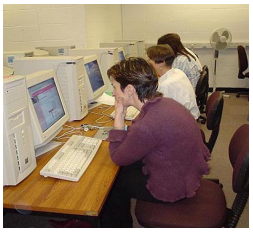

Figure 1(a) and 1(b): Participants improving their Physics skills by reading online course materials and multimedia simulations on the 2nd PSD.

Figure 2 (a) and 2 (b): Participants improving their Physics skills by reading online course materials and multimedia simulations on the 3rd PSD.

This case study also implies that course materials can be re-used repeatedly each year, so that this saves time and effort for lecturers, who can repeat their lectures to different groups of students with the same learning materials by allocating these materials in the VLE. The reused course materials on Cambridge Physics website demonstrates a good example of how web-based course materials can be reused repeatedly and effectively with the combination of face-to-face workshops, eventually creating a greater effect on teaching and learning. The integration of e-learning and face-to-face learning is known as interactive learning (IL) and IL is reported to increase learning interests, enhance learning efficiency and improve learners' performance after their workshops (HP 2001; Katzy, 2000; Sloman, 2001, Chang 2002). In our case study, 90% of the feedback from 20 participating teachers consolidates these theories: the usefulness of the reused course materials and the effectiveness of IL.

CASE STUDY TWO: THE INSTITUTE FOR MANUFACTURING, DEPARTMENT OF ENGINEERING, UNIVERSITY OF CAMBRIDGE

The Institute for Manufacturing (IFM) of the Department of Engineering has a Virtual Learning Environment (VLE) built on the BlackBoard technology that has been implemented by the Centre of Applied Research in Educational Technologies (CARET) that acts as a Cambridge software-outsourcing provider. When there are other Cambridge departments requesting CARET for developing their online curriculum in BlackBoard platform, there is a very high possibility of reusing the existing resources that are adaptable to BlackBoard, thus making reusable e-learning development (RED) likely to happen.

In the context of reusing course materials for teaching, VLE enables IFM academic staff to have the convenience of reusing their course materials. They can upload and save their course materials online safely, thus allowing them to reuse the same course materials repeatedly to different groups of undergraduate students each year. In order to validate the usefulness of this approach, interviews with 4 academic staff and 10 undergraduate students were conducted. Interviewing results suggest that 100% of academic staff enjoy the convenience of reusing course materials. This approach leads to a debate, as some researchers suggest that providing course materials online could make some students lazy, as they may not attend classes if they can easily obtain course materials. However, interviewing results also suggest that 90% of undergraduate students find that this way of learning has stimulated their interests and improved their learning efficiency. The students indicated that this is due to the easy ability to: (1) view the course materials and develop their thinking skills; (2) discuss various academic questions online; (3) receive new and useful ideas from peers; (4) receive answers from tutors in a shorter time and (5) develop the learner-centred model for learning.

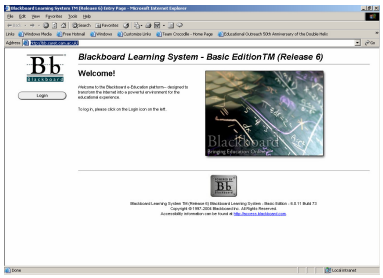

Figure 3: RED for learning and content management for the undergraduate students and academic staff of the Institute for Manufacturing, Cambridge.

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