



An Engineering Approach for Online Learning

Lorna Uden, Staffordshire University, Stafford, UK

ABSTRACT

The design and development of effective online courses for distance learning is a complex process involving many forms of expertise. Several disciplines such as instructional design theories, software engineering principles, human-computer interaction and multimedia are involved. It is not always feasible for a novice to be familiar with such a range of expertise. A methodology integrating all of these various disciplines is urgently needed. The Courseware Engineering Methodology (CEM) has been developed by the author to guide novices to design effective online courses, based on the integration of the various disciplines. CEM has been used successfully by over 70 students at a UK university to develop their online courses in the last few years. This paper describes the CEM development process. The CEM process consists of four models. The pedagogical model is concerned with the pedagogical aspects of the course; the conceptual model, dealing with the software engineering aspects of the design; the interface model relating to the interface of the course, and the Web modelling that deals with the Web useability and navigation issues of the course. Each of the models will be briefly reviewed. Design principles concerning both the pedagogical and interface models will be further discussed. The paper concludes by stating the benefits of using an engineering approach to online development and reuse.

Keywords: distance learning; online courses; courseware engineering methodology

INTRODUCTION

The World Wide Web (Web) has become a powerful, global, interactive, dynamic, economic and democratic medium for teaching and learning at a distance. The Web is being increasingly used by universities, corporations and governments to deliver instruction and training. Students and employees at all levels of these institutions are being encouraged to participate in online learning activities. The Web supports open learning because it is platform,

distance and time independent. It allows the creation of learning environments that are flexible for learners. There are three main characteristics that make the Web appropriate for the design and development of online learning courses. These advantages include: the delivery of courses on most operating systems and computers; instant distribution of the instructional content to an unlimited number of worldwide students with no required time or expense for duplicating, packaging, or mailing of materials; affordable technology that does not require costly new hardware or software

and there is no problem with room capacity, or the number of available tutors (Milheim & Bannan-Ritland, 2001).

Besides the above characteristics, other advantages include the following (Wulf, 1996):

- Immediate access to a wealth of information in a given content area;
- The ability to create links to extend Web resources from a given page;
- Time and place independence, allowing users to log on whenever and wherever they want;
- Savings on costs and productivity losses when employees need to travel for training;
- Opportunities for collaborative learning and instruction from around the globe;
- Utilisation of Web-based tools such as e-mail, bulletin boards, real-time conferencing;
- A high degree of learner control;

There is a tremendous increase in the on-demand, just-in-time, anytime/anywhere high-quality online delivery of instruction and training to prospective learners worldwide. Currently, according to PITAC (2001), educators are not effectively integrating information technology with education and training. Many educators are developing online courses with little training on how to do so effectively. It would appear that most educators are merely recreating a classroom-teaching model within an online learning environment in their course design. Although there are tools that minimise the computer-related knowledge required, they are merely implementation tools. Successful designers need to understand both the subject upon which lessons are based and the principles of instructional design and learning theories. On top of these are the issues of software engineering principles, human-computer interaction

and hypermedia involved. A methodology is urgently needed to enable novice designers to design and develop effective courses. The different types of expertise need to be integrated and transformed from one form to another in order to maintain a seamless transition.

The author believes that an engineering approach to online course development is desirable. The methodology should be based on sound principles from the various necessary disciplines that have implications for effective online course design. To be effective, it should contain design principles and guidelines, which can help designers, in the various phases of the courseware development process. The Courseware Engineering Methodology (CEM) has been developed specifically to help develop online courses.

In order to evaluate the methodology, CEM was used by over 70 student designers over a period of three years in the Instructional Software Design (ISD) module at a UK university to develop online course. Section two of the paper discusses several issues that have important implications for online course development. This is followed by a brief review of CEM, a Web engineering approach for online course development, with particular emphasis on design principles for pedagogical and interface design. The paper concludes with evaluation of the methodology.

DESIGN ISSUES FOR ONLINE DEVELOPMENT

In order to produce effective online courses that will facilitate learning by students, several design issues need to be considered. These include the pedagogical, Web design and interface designs. Each of these is briefly reviewed.

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