

PROTOTYPING A WEB-BASED LEARNING AID

Edward T. Chen, University of Massachusetts Lowell, edward_chen@uml.edu
James H. Hu, Southeastern Louisiana University, jhu@selu.edu
Grace M. Hu, Southeastern Louisiana University, ghu@selu.edu

ABSTRACT

We have developed a user-oriented learning aid that incorporates Web technologies in delivering instructional materials. A prototype of this learning aid is explained in this paper. It can be used as a learner-centered learning tool for students to enhance their learning experience. This learning aid is very easy for a teacher to create and it is also very easy for students to use. This prototype can be applied to courses in various disciplines. In this paper, we describe how to create this learning aid and demonstrate its applications using a specific course, Web Programming with JavaScript and Perl, as an example. Some issues are discussed to assist instructors to better develop their pedagogical strategies related to this learning aid.

Keywords: Web-based instruction, prototyping, instructor-centered aid, learner-centered aid.

INTRODUCTION

Good education depends on good pedagogical practice. The information technologies available for today's learning provide the instructors with the opportunities to adopt new approaches to teaching and learning. About 70% of four-year colleges and universities in the United States offer Web courses using WebCT, Blackboard, and related software (12). There are at least 74% of companies with 100 or more employees have used the Internet in training (6). Researchers have investigated the computer-based training methods with other instructional methods. Most of them have studied the usefulness of one or two computer-based methods in accomplishing some teaching objectives such as learning effectiveness. Most of the studies indicate that computer-based methods used appropriately can augment student learning (4), (10), (11).

The World Wide Web and multimedia technologies offer instructors the opportunity to reconsider and rewrite instructional content. Information technology allows them to think of ways to reach students and deliver curriculum as they never have before. Media as teaching tools have altered the conceptions of learning and instructing (1), (2), (13). Though information technology increases the efficiency of information dissemination, instructors should consider pedagogical strategies, learning styles, instructing modes, creativity, intellectual domains, and media characteristics when developing computer-based learning tools. Since most instructors are not technology savvy, we present a simple web-based learning aid in this paper. The purpose is to help instructors develop a learner-based environment to improve learning effectiveness.

WWW AND LEARNING MODELS

Technological advancement has driven universities and corporations to a great reliance on computers and emergent information technologies. The introduction of the World Wide Web into classroom instruction has been a recent and exciting trend in instructional paradigms. The

World Wide Web has provided many advantages as an instructional tool. In addition to its advantages of efficiency, flexibility and multimedia capability, the Web contains a vast collection of information and resources. Web-based classroom instruction can incorporate lecture notes with materials from the Web and greatly extend the limit of the instructor (3). This is an exciting trend in higher education. Using the Web as an instructional tool has infused the ordinary classroom experience with extraordinary benefits, both for the teacher and for the student. More and more teachers are placing their own instructional materials on the Web.

Leidner and Jarvenpaa identified two major models of learning: the objectivist model and the constructivist model (9). The objectivist model promotes instructor-centered instruction. It assumes that learning is the uncritical absorption of objective knowledge and the goal of teaching is to efficiently transfer knowledge and skills from the instructor to the learner. The lecture method of teaching embeds the pedagogical assumptions of the objectivist model and it is the most frequently used instructional method in higher education (12). In contrast, the constructivist model calls for a learner-centered instruction, allowing the learner to play a more active role in the learning process. The basic premise of the constructivist model is that learning is a process of constructing knowledge by the learner. An emerging trend in higher education is a shift of emphasis from teaching to learning (10).

DESIGN METHODOLOGY

Taking into account both of the emerging trends, we have designed and used a simple learning aid that incorporates Web technologies in pedagogical strategies. In a Web-based class, learning material appears on a browser window and is displayed onto a large projection screen. Normally, instructional material occupies the entire browser window. In contrast, our learning aid divides the single browser window into four sections: two large frames and two small ones as shown in Figure 1. One large frame displays the main lesson material, while the other large frame presents supplemental material or performs online demonstrations. The lesson frame has a small companion menu frame containing links to various lessons and topics; the demonstration frame also has a similar menu frame providing links to various examples and demonstrations. These four frames all remain on the screen concurrently during the entire learning period.

Figure 1. Layout of the Web-based Learning Aid

Lesson Menu	Demonstration Menu
Lesson Frame For main lesson material	Demonstration Frame For supplemental material and online demonstrations

This four-cell grid provides a learning-by-example environment. It can be used for courses in many disciplines and in numerous settings. In an application lesson, topics are covered in the lesson menu; supporting materials are listed in the demonstration menu. Detail concepts and contents are introduced in lesson frame while structured procedures are presented in the

demonstration frame. In this paper, we use a specific Web Publishing Programming course as an example. The curriculum design is based on IS 2002.5 in IS 2002 Guidelines for Undergraduate Degree Program in Information Systems (7). This course consists of client-side JavaScript scripting and server-side Perl programming.

PROTOTYPE: A CASE STUDY

An instructor teaching Web Publishing Programming (WPP) class can easily use the Hypertext Markup Language (HTML) code shown below to create the four-frame learning aid. The HTML frame elements let instructors partition the canvas area of the browser into multiple windows called frames. Each frame can display a separate, independent HTML document. The use of frames can enhance the web site by allowing instructors to consistently display content and example concurrently. Frames can be the right solution for solving specific subject problems or for providing specific supporting learning materials. Based on our cumulative teaching experience on Web publishing courses, we propose this four-frame layout to accommodate the necessary learning materials to improve student effectiveness.

Figure 2. HTML Code for IS335 Learning Aid

```
<HTML>
<HEAD><TITLE>IS335 WPP</TITLE></HEAD>
<FRAMESET COLS="50%,*" ROWS="26%,*">
  <FRAME NAME="lessonMenu" SRC="lessonMenuIS335.html">
  <FRAME NAME="demoMenu" SRC="demoMenuIS335.html">
  <FRAME NAME="lessonFrame" SRC="lessonFrameIS335.html">
  <FRAME NAME="demoFrame" SRC="demoFrameIS335.html">
</FRAMESET>
</HTML>
```

The <HEAD> element identifies the head section of the Web page, which is reserved for information about the document, not document content. The <TITLE> element reflects your website to the user. IS335 WPP here provides the course number and the name for the course. Some search engines read only the contents of the <TITLE> for Web site information. The contents of the <TITLE> also show up in the user’s bookmarks or favorites list. Therefore, instructor should put meaningful and pertinent information in the <TITLE> element.

The <FRAMESET> defines the column and row characteristics of the frames in the frameset. <COLS> separates the frameset into columns and <ROWS> separates the frameset into rows. Both of these attributes use percentage or pixel values to specify the frame width or height. <FRAME NAME> sets a targeting name for the frame while <SRC> specifies the source HTML file for the frame’s content. The <SRC> attributes in the HTML code vary from course to course.

The filename of the learning aid for this class is *IS335.html* and it contains the entire IS335 course material. An example of *IS335.html* with only the main lesson material loaded in the lesson frame is shown in Appendix 1. To bring up an online demonstration session, you have to

logon to the server. This will allow instructor to administer the learning materials to fit students' learning progress. Keep in mind that scrolling, resizing and other operations performed on any of the other frames may result in the minimization of the window into a button on the Task bar, a situation that normally occurs in most other Window applications. Clicking the minimized button will quickly restore the window to the demonstration frame. Hence, instructors can fully utilize these four frames to display all relevant information in some cases or reduce numbers of frames to display example using the entire windows.

Use as a Teaching Aid by Instructors (*Instructor-centered*)

The IS 335 class consists of both classroom lectures and laboratory sections; the lectures provide a forum for the teacher to explain the lesson material while the laboratory sections allow students to have hands-on practice with exercises. The Web-based learning aid makes it possible for a teacher to simultaneously display lesson material and demonstrate its applications on a single screen. The menus enable teachers to bring in new lesson topics and new examples easily and at any time. Because all four frames are displayed on the screen at all times during the teaching hour, the teacher and students alike are able to reference the teaching material as necessary, both teaching and learning effectiveness are enhanced.

The example in Appendix 1 shows that the instructor can easily resize the lesson frame to accommodate more lesson material. All the four frames are resizable and scrollable, giving teachers the flexibility of controlling the amount of information to be presented in each of these frames. Simply dragging a borderline in the desired direction can instantaneously do resizing of a frame.

Using as a Learning Aid by Students (*Learner-centered*)

This web-based frame is a learning aid as well as a teaching tool. Because this tool is Web-based, students can use it online outside of class, anywhere and at any time. Students may use it in dormitory rooms or at homes to review material that may not have been clear during class or to refresh the day's lecture for a more solid understanding of that material. Students may also use this aid to study the supplemental material not presented in class and do additional exercises for mastery of the lesson material. The Web-based learning environment also provides the opportunity for students to experiment with their own thoughts and insights. The learner-centered constructivist model of learning assumes that students learn better when they discover things themselves and when they are in control of the pace of learning (5).

Improved learning hinges on time spent studying the material; mastery of course material and amount of time spent studying that material are directly and positively correlated. The on-line learning environment ensures that students have the full opportunity to engage in numerous outside learning activities that directly relate to class material.

DISCUSSION

Using <FRAME> elements in a standard HTML encompasses instructional materials to related subject. The effective learning happens when learner conduct a self-discovery process at his or her learning pace. We present an easy-built and easy use learning aid for instructors to adopt. All

the HTML codes used to develop this Web-based learning aid are explained in detail and easy to understand. Though HTML is limited to static content, using frame to correlate subject lesson and demonstration adds interactivity in the learning process. If instructors would like to display information that evolves over time, they can easily add a hyperlink to a dynamic website such as a site with changing stock market prices. <SRC> attribute in this aid also enables instructors to inject JavaScript for interactive and animated hypermedia documents.

Technologies by themselves do not automatically alter the nature of teaching and learning. It is the way instructors incorporate IT into the pedagogy that brings about change. The role of the instructor is changed because the advancement of technologies drives teachers to develop learner-based instructions. Most instructors are not used to creating instructional materials into dynamic, interactive, digital data and multimedia presentations (14). Hence, we present a learning aid environment to allow instructors to tailor their educational materials to engage students in a self-paced learning process.

One caution on applying this learning aid is to realize the broadband access to the Internet among U.S. households is low. According to Merrill Lynch, about 4.6% of residences now have DSL and 10.4% have cable Internet access (15). Therefore, instructors should avoid loading a heavy amount of streaming data in the frame if students would access the learning materials through home computers. Most students still access the Internet by dialing the phone line which has limited speed up to 56Kb. Most campus computer laboratories equipped with T1 line which can support 10Mb transmission speed. So instructors should consider students' access environment before develop the media.

Another issue is to measure the learning effectiveness. Besides the regular tests, instructors can add some on-line quizzes to help students evaluate their learning outcomes. We also suggest instructors provide e-mail contact on the learning aid. Students can send their problems and feedback to the instructor.

CONCLUSION

We propose this simple Web-based learning aid that produces many of the same benefits that both the objectivist and constructivist models produce. This frame-based layout can be used as an instructor-centered teaching aid for teachers to improve their teaching effectiveness. It can also be used as a learner-centered learning tool for students to enhance their learning experience. The learning aid is easy for a teacher to create, and it is easy for both the teacher and students to use. It also provides an opportunity toward e-learning.

Courses designed with frameset add value to traditional learning modes by offering self-paced and self-discovered learning environment. Specifically, self-paced courses can be taken at the student's leisure and are good for self-motivated students. These courses have been well-suited for non-traditional students with busy working schedule.

Instructors have to properly weigh the learners and the learning objectives in the media development process. Media will not and should not totally replace instructors. Instructors shall use blending learning solutions, which include instructor-led training, e-learning, and some form

of group learning. This on-line learning aid is to offer another engaging method to improve students' learning effectiveness.

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APPENDIX 1

