

DEVELOPMENT OF INTERACTIVE INTERNET-BASED LEARNING ENVIRONMENTS: JUST-IN-TIME INSTRUCTION AND EFFECTIVE COURSE MANAGEMENT

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ABSTRACT

This paper describes our approach to creating an interactive Internet-based learning environment. Our approach incorporates Just-In-Time instruction and reduces the amount of time instructors spend in managing the course.

Keywords: Distance education, interactivity, JIT instruction, course management

INTRODUCTION

Despite all of the technological advancements, instructors face three critical problems in providing students with Internet-based learning environments. These are:

- The difficulty in incorporating or substituting the type of interactions between an instructor and students that occurs in face-to-face classrooms.
- The difficulty in providing appropriate guidance to students in a timely fashion.
- The increased amount of time spent responding to students' general questions regarding course information or assignments.

This paper describes our approach to creating an interactive Internet-based learning environment that supports Just-In-Time (JIT) instruction and reduces the amount of time instructors spend in managing the course. We feel that instructors should spend more time facilitating the individual student's learning, rather than managing the course. We used this approach in developing Internet-based learning environments for two undergraduate courses. The result was significant. The amount of time the instructor spent in answering general questions from students was greatly reduced, which allowed for more time facilitating individual student's learning.

BACKGROUND

This study was conducted as part of our distance learning (DL) research. Figure 1 shows our framework for successful distance education. The first requirement is strategic direction and support from the university, college and departments coupled with an organization-wide system that recognizes and rewards instructors who successfully deliver DL. The second requirement is instructor motivation and enthusiasm. These are the foundations for successful distance education (the two bases in Figure 1). When designing a course, clear course goals must be established first, considering the factors shown on the pillar supporting successful goal setting in Figure 1. Then, appropriate learning activities must be selected to achieve these goals, considering the factors shown on the pillar supporting successful learning activity development. Next, appropriate technology tools must be chosen for each learning activity, considering the factors shown on the pillar supporting successful technology selection. These three pillars are critical to successful course design. Once a course is designed, instructional materials must be developed, considering the factors shown on the pillar supporting successful material development. Successful delivery and evaluation, along with successful material development, contribute to successful course delivery and, eventually, successful distance education.

This paper focuses on our approach to adding interactive components to the instructional materials (part of the material development pillar in Figure 1) and providing timely guidance (part of the delivery pillar in Figure 1). This approach incorporates the concepts of JIT instruction, interactive learning, and humanization of computerized instructional materials. JIT learning generally refers to having the content and materials available when students need them (8). It enables students to perceive that they are interacting with instructors because instructions and guidance are available whenever they want. This approach reduces the amount of time the instructor spends in handling general questions about the course and assignments.

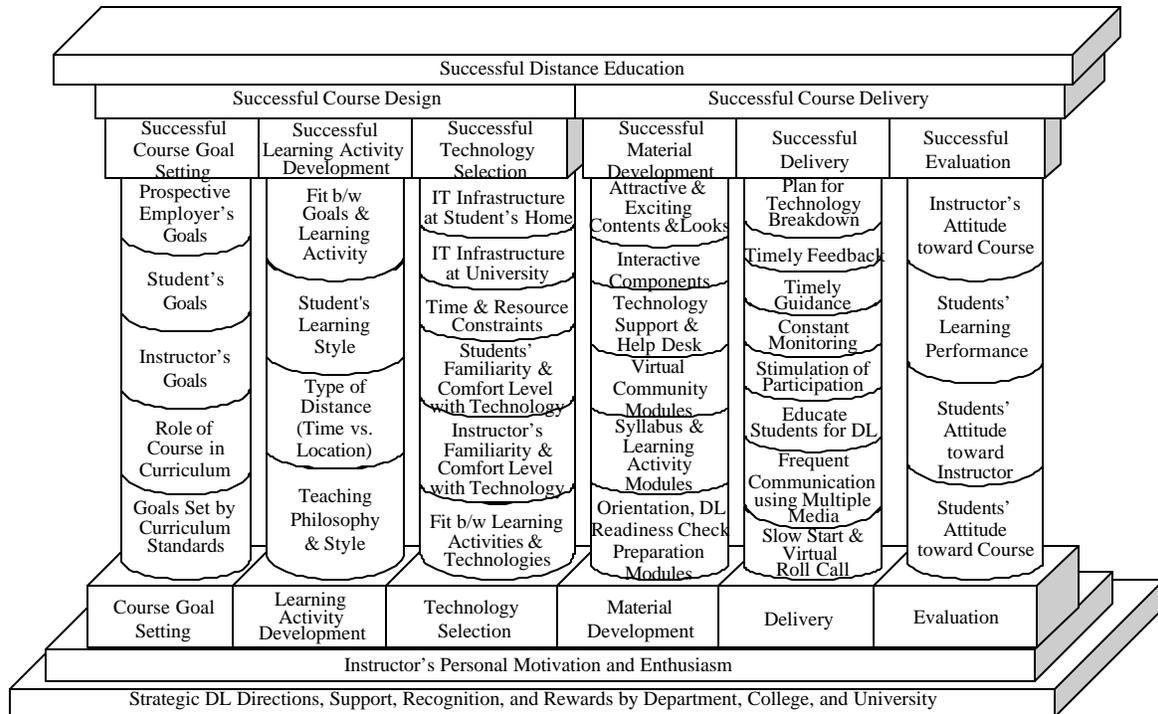


Figure 1. A Framework of Successful Distance Education

AN APPROACH TO CREATING INTERACTIVE INTERNET-BASED LEARNING ENVIRONMENTS

To create an effective Internet-based learning environment, three issues should be resolved.

They are:

- How can an Internet-based learning environment provide efficient and effective interaction?
- How can an Internet-based learning environment support JIT instruction?
- How can an Internet-based learning environment be designed to minimize the amount of time an instructor must spend managing his/her course?

We believe an Internet-based learning environment with the following two characteristics can resolve the aforementioned issues. These characteristics are:

- Instruction that uses a more conversational tone.
- Course delivery that incorporates JIT instruction.

Using a more conversational tone instead of a formal style when writing the course content enables students to sense the instructor's personality and teaching style. For example, instead of using "Review of Last Week" as a heading, a phrase, such as "Last week you learned ...", is

more personal and informal as if the instructor were speaking to the student. The conversational tone used in the instructional content humanizes the Internet-based learning environment (6, 9).

In any type of learning environment, there is more interaction when students are given chances to ask questions and have the instructor respond to them. It is important to let students decide when to ask questions, rather than force them to ask questions (4). Some students do not want constant guidance from instructors. They may need guidance only when they have difficulty in applying concepts or integrating several concepts into a higher-level concept. Other students want continuous and detailed guidance from instructors (3, 4). The asynchronous Internet-based learning environment does not provide an easy answer to this critical instructional issue (2).

Many instructors use discussion boards, in addition to e-mails, to add interactive components to their courses. A common problem in discussion boards is the large amount of redundant postings. Several students often post the same question because they cannot find the answer in previous postings due to information overload. It is easier for them to post questions and wait for the instructor to respond. This makes it difficult for the instructor to decipher all concerns of students and respond to them in an organized fashion. Moreover, students who have difficulty finding information in a conference due to information overload often stop using it and revert to emailing the instructor directly with questions. Once again the instructor's time can be taken up responding to similar questions on an individual basis.

Our approach to preventing this redundancy is to predict possible questions from students about each learning activity and provide additional guidance through a series of pop-up windows. These predictions are based on an analysis of student academic background/previous knowledge and the instructor's previous teaching experience with the course. While reading the course material on the Internet, students can select a link activating a pop-up window with more detailed guidance from the instructor. It is each student's option as to how much additional guidance is needed. At the end of the series of pop-ups, each of which provides more detailed information, a link to a discussion board or an e-mail link to the instructor is provided for the student needing even more assistance. Voluntarily obtained guidance conveys more meaningful information to students, as compared to a situation where students are forced to read information that they may not need (7). This makes the course more interactive, as opposed to typical course web sites that deliver all information to every student regardless of their needs.

Our approach requires extensive preparation, which can be done during the off-semester. Once completed, it reduces the amount of time the instructor spends in handling students' general questions about the course and assignments during the semester. When the course is presented again in subsequent semesters, much of the material can be reused. Thus, in the long run, instructors can save a significant amount of time in delivering DL courses using this method.

AN EXAMPLE OF INTERNET-BASED LEARNING ENVIROMENTS

This section presents the Internet-based learning environment we developed for an undergraduate database management course using our approach. We developed it by following our goal-oriented course design approach (5). Our online course content, which is contained in WebCT, uses a conversational tone and has a series of pop-up windows. (To see the results of our course development, visit <http://garnet.fgc.edu>, log on as knguest (Password is knguest), and click on "Database Concepts and Administration".) Figure 2 shows the structure of our

Internet-based learning environment and recommended page access sequence. The left-most column in Figure 2 shows pages that consist of our course site. By following the arrows from left to right in Figure 2, a student can obtain all necessary guidance in the appropriate sequence.

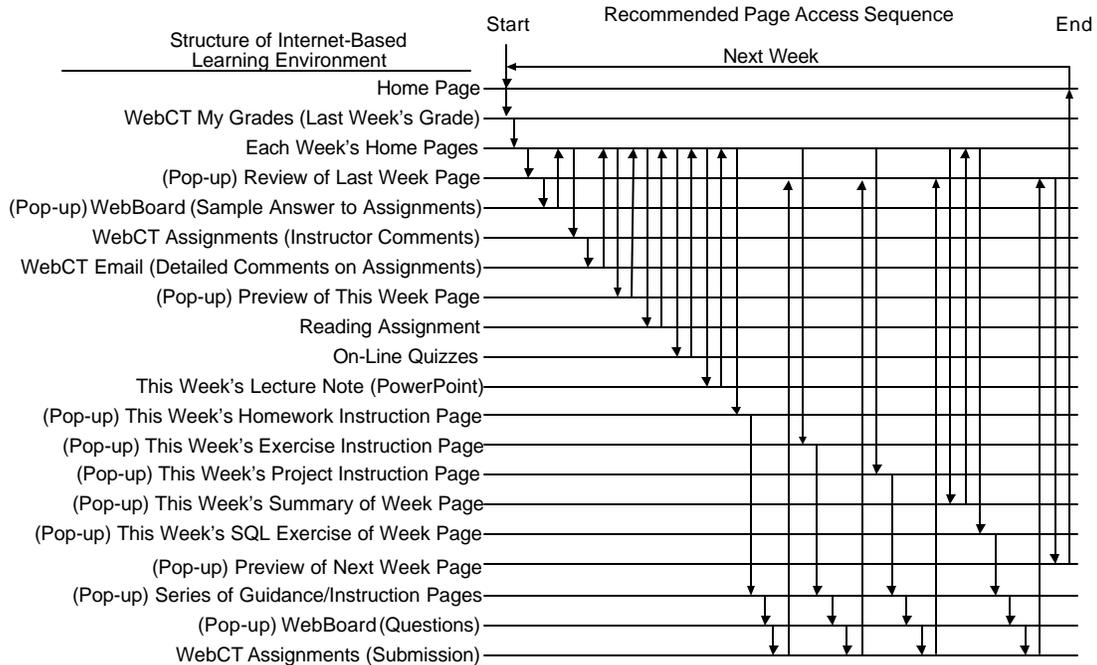


Figure 2. Structure of Internet-based Learning Environment & Suggested Page Access Sequence

Figure 3 shows a sample page of our Internet-based learning environment hosted in WebCT. We use WebCT left-hand navigation bar to display links to other pages, such as Home, Site Map, Announcements, On-line Quizzes, Assignments, Group List, WebBoard, Schedule, Week 1 through Week 15 (each is added as a single page), WebCT Mail, and My Grade.

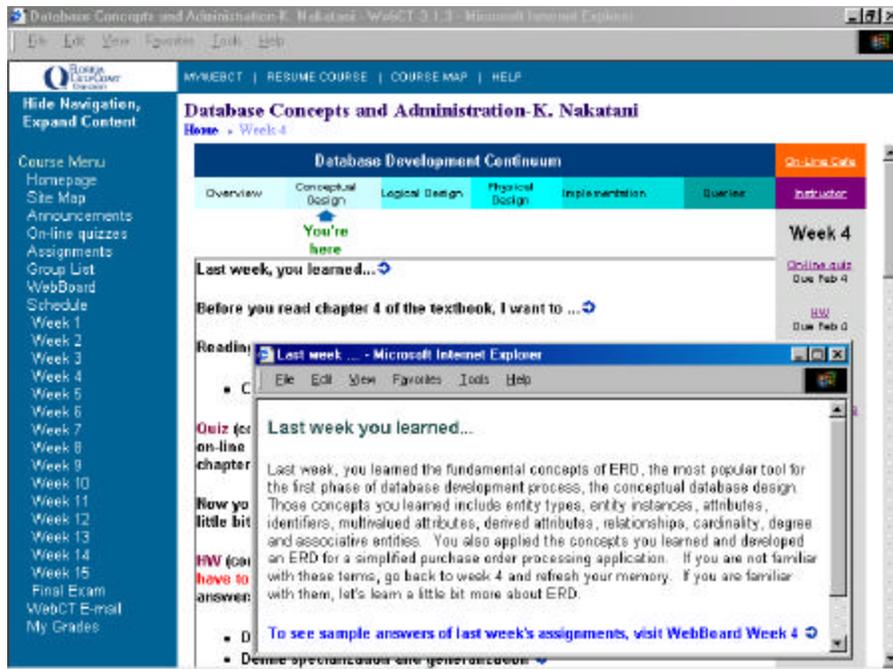


Figure 3. A Sample Course Page in WebCT Frame

Each of the fifteen pages developed to deliver instructions has three components (Figure 3). These are the header, right-side navigation bar, and content section. The header of each page shows the database development process and its phases. An arrow pointing to the phases shows where students are and what they are learning in the database development process. The right-hand bar shows the assignments students must complete for the week. The overall structure of the content section reflects the instructor's teaching style. This section is used to provide an overall picture of each week's learning activities much like the instructor writing the agenda at the beginning of a "live" class.

As shown in Figure 3, the content section typically starts with a review of what students learned in the previous week. The heading of this review has a conversational tone, "Last week, you learned ...". When a student clicks on an arrow image next to the heading, a pop-up window is displayed and the students can read the rest of the comments (see a pop-up window in Figure 3). In this window, there is a link to sample answers to the last week's assignments posted in WebBoard. A student can close the pop-up window, go back to the main page, and continue to study. Advanced students who do not need this type of review can ignore this link.

The next part of the content section is the overview and expected outcomes of the week's learning activities. Again, the heading of this part is described with a more conversational tone, "Before you read chapter 4 of the textbook, I want to ...". When a student clicks on an arrow image, the rest of the comments will be displayed in a pop-up window. The following two parts of the content section show reading assignments and a link to the WebCT on-line quiz page. After completing the reading assignments and on-line quiz, students can view the Microsoft PowerPoint slides developed by the instructor. With the fundamental knowledge already acquired, they should be able to understand the slides.

The assignments are displayed next. The first assignment is designed to help students learn terminology and fundamental concepts of the course topic. This "concept-level" learning activity helps students recall concepts and principles in the approximate form in which they were learned. Each question has an arrow image, which students can click and get guidance about the question. This new information is displayed in a pop-up window. In developing these guidance pages, we anticipated what questions students might ask. By providing clear guidance with a conversational tone, we wanted to make students feel as if they were interacting with the instructor. We felt that this type of JIT guidance (i.e., students can receive guidance whenever they need it) reduces the number of emails sent between students and the instructor and lessens student frustration. Advanced students who do not need guidance for this level of assignments can ignore this link. The second and third assignments require students to apply the previously learned concepts to a new situation (application-level learning activities). We used exercises and a group project for these assignments. For this type of assignment, students typically need more guidance from the instructor, so more detailed guidance was developed. Since it is sometimes difficult to anticipate questions students may ask for these assignments, we developed a series of pop-up windows with each window containing a specific concept. A link to the discussion board was added at the end of the pop-up windows to handle students' questions dynamically so that questions can be posted and then answered by either the instructor or other students.

The next part is the summary of what students learned that week. The heading of this part has a conversational tone. Students can read the rest of the summary by clicking on an arrow image or ignore this if they feel they do not need to read it. An SQL exercise follows this summary part. This exercise is designed to expose students to SQL commands gradually. A pop-up window explains the syntax of SQL commands and provides examples. The last part is the preview of the following week. A pop-up window briefly describes learning topics for the following week. The content section ends with a reminder of required assignments.

Our approach separates guidance and instructions from the main page. We felt it would reduce the possibility of providing too much information at one time. We designed each page, including the main page and pop-up windows, to include a small amount of information so students who need more guidance can obtain it when they want.

EVALUTION OF INTERACTIVE INTERNET-BASED LEARNING ENVIRONMENTS

We are evaluating the effectiveness of our approach. Specifically, we want to know:

- Does a conversational tone in an Internet-based learning environment add a sense of interactive feeling to the course?
- Do pop-up windows containing discreet “bits” of information and guidance add a more interactive feeling to the course?
- Do pop-up windows help reduce information overload?
- Do pop-up windows provide information in a more timely fashion?
- Do students prefer an Internet-based learning environment with the above characteristics?
- Do students perceive an Internet-based learning environment with the above characteristics to be more effective?
- Does an Internet-based learning environment with the above characteristics reduce the amount of time an instructor spends handling routine questions?

Presently we are conducting our evaluation. Before the formal evaluation, we gathered information about how students perceived our Internet-based learning environment as an initial validation of our approach. This paper reports the results of this initial validation only.

Our interactive component, guidance in pop-up windows, was evaluated in an undergraduate Systems Analysis course taught in Fall 2000 at Florida Gulf Coast University (FGCU). All instructional materials, including web pages, were developed prior to the semester. The main page looked a little different from Figure 3 because each section was placed in a tabular format. Also, the course site was maintained outside WebCT. However, each section had the same arrow image as one displayed in Figure 3 and the guidance was displayed in pop-up windows as illustrated in this paper. Eight students took this course as a flexible-attendance course (students take a course as a DL class but meet several times on campus if possible). They evaluated the feature of guidance and instructions in pop-up windows in terms of preference, frequency of use, and effectiveness. An anonymous survey was used to collect data.

Table 1 summarizes the evaluation. Average scores are approximately 4.5 out of 5, indicating that students liked the pop-up window feature. Students also expressed informally that our Internet-based learning environment was very interactive. The instructor received less than five e-mail messages from students per week. The instructor used his time for this course primarily grading homework assignments and providing guidance and feedback about group projects.

Table 1. Fall 2000 Evaluation of Feature of Guidance and Instructions in a Pop-up Window

	How much do you like?	How frequently did you use?	How effective do you think it is?
Pop-Up Guidance for Orientation	4.25	4.88	4.63
Pop-Up Guidance for Conceptual-Level Learning Activities	4.38	4.50	4.63
Pop-Up Guidance for Application-Level Learning Activities	4.63	4.88	4.63
Pop-Up Guidance for Knowledge-Level Learning Activities*	4.50	4.00	4.00
Overall Average Scores	4.44	4.57	4.47

Note: 5 point Likert scale was used (5 for the highest score and 1 for the lowest score).

*Knowledge-Level learning activities (defined in (5)) were designed for making students criticize the existing theories and create new knowledge through discussions. The activities are highly cognitive and require higher-order thinking and problem-solving skills.

A more formal validation is currently being designed using two undergraduate courses taught as on-campus computer-enhanced courses in Spring 2001 at FGCU. This validation will be reported in another paper.

CONCLUSIONS

Our approach to adding interactive components to an Internet-based learning environment was considered successful. The instructor and students were satisfied with the result. The preliminary evaluation suggests the potential of our approach. By adding interactive components to an Internet-based learning environment using our approach, it is possible to resolve three critical issues in delivering educational materials on the Internet: achieving effective interaction between an instructor and students; providing appropriate guidance in a timely fashion; and decreasing the amount of time required to manage courses.

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