An Investigation Of Advanced Web Educational Applications In Accounting

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Introduction

The Accounting Education Series monograph (Albrecht and Sack 2001) is only the most recent call for changes in accounting education. The authors emphasize that the current model of accounting education is broken; as illustrated by the following characteristics: It involves too much lecture, dependence on textbooks, is too bound by class time, and maintains a "faculty knows best" attitude; It lacks creativity, does not develop students' ability to learn new skills, and does not exploit modern technology (Albrecht and Sack 2001).

As the world becomes the Web envisioned by Tim Burners-Lee (1999) and college campuses become experimental laboratories for advanced information technologies, AIS educators have an opportunity, and in the opinion of the authors, a responsibility to lead by example in the creation of Web-based applications to help fix the problems with accounting education. In this paper, the authors identify a number of advanced Web-based accounting educational applications, classify them according to a model of synchronous or asynchronous activities and three forms of learner interaction developed at Rensselear Polytechnic Institute, describe the tools and techniques being used, and discuss implications for the future of technology and accounting education.

Background

Advanced Web-based educational applications exhibit characteristics that are different from those of the majority of Web-based educational applications. Referred to in one study as "dynamic, interactive applications" (Debreceny and White 1999), such applications are described as having the following characteristics:

- Involve students dynamically in an interactive learning process;
- Provide knowledge, integration, and feedback to students;
- Involve faculty, students, and the wider accounting community in relationship and trust building (Debreceny and White 1999).

In an assessment of over 1,500 randomly selected Web-based accounting applications, Hofferd and White (2000) found precisely zero that met all of the characteristics in this definition. They did, however, find a total of 10 sites that exhibited online quizzes and tests; which, depending on their level of interactivity and feedback, could qualify for consideration under two of them. The study reported herein represents an attempt to identify Web-based educational applications that meet these criteria, discuss them in reference to other models of educational activities, and describe and classify them in such a way as to provide useful information to future Web-based educational application developers.

Readers with comments or questions are encouraged to contact the authors via email.

Discussion of perspectives on education

The traditional approach to higher education is often referred to as the synchronous model - students and a professor meet at a designated time, in a physical location, and the professor delivers a lecture or directs activities for a designated period of time. An opposite approach, the asynchronous model, has students working individually or in groups at anytime, anywhere, accessing pre-prepared instructional materials, typically on the Web, and communicating when necessary using e-mail or other forms of Web-enabled communication. Advanced Web-enabled educational applications allow us to create hybrid models that utilize the best features of both of these approaches.

What we are advocating in this paper is to break the mold of traditional accounting education by developing a mix of Web-enabled synchronous and asynchronous educational events. Synchronous educational events are characterized as those that take place simultaneously (e.g. instructor and student at the same place at the same time). Asynchronous educational events are characterized as taking place anytime, anywhere (e.g. instructor responding to a student's question by way of e-mail). A model that we suggest for consideration is that of the Rensselear Polytechnic Institute. In 1995, RPI pioneered the "studio course" - a multimedia enhanced model in which emphasis is placed on problem solving interaction among students with mini-lectures when necessary (Pipes and Wilson 1995). In such courses, the professor becomes a "Guide on the Side" as opposed to "The Sage on the Stage." From this beginning, RPI researchers have developed the Web-based RPI 80/20 Model which states that " ... some time should be allocated to asynchronous activities and some time to synchronous" with the mix depending on the course material (Lister, et.al. 1999). The 80/20 model advocates that "learning, the acquisition of knowledge, is a combination of information and interaction." The model is based on a systems view of education which advocates that "information can be presented in a variety of ways" and "interaction comes in three forms: learner-instructor, learner-learner, and learner-content" (Moore and Kearsley 1996). Combining this view of interaction with the synchronous/ asynchronous mix, they produce the matrix illustrated in Figure 1 to help design course activities.

Table 1
RPI Learner Interaction and Asynchronous & Synchronous Activities

	Information Presentation	
Description of Interaction	**Asynchronous Activities**	**Synchronous Activities**
Learner – Instructor Interaction		
Learner – Learner Interaction		
Learner – Content Interaction		

(Lister 1999)

As referenced in our opening paragraph (Albrecht & Sack 2001), the current model of accounting education would fall into the cell characterized by synchronous learner-instructor interaction - the upper right-hand cell of the matrix. In previous research on Web-based accounting educational applications, Hofferd and White (2000) classified applications based on the number of instructional resources that they contained. They classified Web-based educational applications as being "basic" if they exhibited a class home page with assignments, "intermediate" if they also contained links to other Web-based materials, and handouts, and "advanced" if they contained PowerPoint slides, Lecture notes, and online quizzes and tests. In reference to the RPI matrix, the majority of these Web-based accounting applications would fall into the cell characterized by asynchronous learner-content interaction; with the sites that provided online quizzes and tests with feedback falling into the cell characterized as synchronous learner-content interaction. In other surveys of Web-based accounting educational applications, researchers found that the most frequently used tool for asynchronous communication between learners and instructors was e-mail (Debreceny, et.al. 1996) with a small minority of accounting educators using Web chat rooms for synchronous communication between learners and instructors (Baker and White, 1999). In Table 2, we fill in the RPI matrix with this information from previous accounting educational research.

Table 2
Learner Interaction and Asynchronous and Synchronous Activities:
As Found In Previous Accounting Educational Research

	Information Presentation	
Description Interaction	**Asynchronous Activities**	**Synchronous Activities**
Learner – Instructor	e-mail	Traditional accounting classes
Learner – Learner	e-mail	Chat rooms
Learner – Content	Web-based class home page: with links, PowerPoint slides, class notes	Online quizzes and tests with immediate feedback

In the remainder of this paper, we discusses our methodology for discovering advanced Web-based educational applications, where they fit in this model, how they contribute to educational objectives, and implications for the future.

Methodology & Results

The research methodology utilized in this research involved discovering Web-based educational applications that would meet the characteristics previously discussed, visiting and evaluating them against these characteristics, using e-mail where necessary to discuss applications with their developers, researching the technologies used, and classifying the applications. Discovery of potential sites tends to be problematic at best. However, based on prior research conducted both jointly and independently, we

became aware of several dynamic, interactive educational applications. These served as our starting point. In addition, we utilized the Accounting Curriculum Exchange (ACE) database provided by the American Accounting Association (AAA) and directed e-mails to other professors who might have knowledge of such applications. Though this methodology is selective, it should provide interested accounting information systems educators with a significant amount of information about dynamic, interactive educational applications and the tools and techniques used in their development.

The remainder of this paper discusses our results and contributions and implications for the future. For various reasons including locked and password protected applications and the limitations of search engines, our methodology did not allow us to be exhaustive. We will focus our discussion on the examples of advanced Web-based accounting applications that we discovered and several applications in other disciplines that go beyond those in accounting. As explained in our discussions, some of these examples exhibit characteristics that allow them to fit into several different cells of the RPI model.

Example one, "Information Systems Assurance" by A. Faye Borthick, Georgia State University (http://www.gsu.edu/~accafb/ac863.htm), is a course that is conducted synchronously in a totally online environment. In reality, this course has features that would allow it to be classified into each cell in our matrix. What makes it an outstanding example of advanced Web-based technology is its mix of synchronous and asynchronous features. It is described by its author as being "taught as discovery learning through web-enabled collaboration" (Borthick 2001). Further:

"Learning through web-enabled collaboration means that students and teacher share a common workspace in which they work together to solve problems. The learning space in this course is implemented with real-time (synchronous) discussion coupled with a web-based presentation frame for text and other objects, as supported by WebCT. Between class sessions, participants' conversations can continue - in the bulletin board" (Borthick 2001).

In terms of educational events characterized by synchronous and asynchronous activities and learner interaction, we see the following:

- Students prepare for class by accessing readings, cases, and assignment materials posted on a WebCT-enabled course home page - an asynchronous learner-content interaction;
- Students participate in class sessions by logging on to WebCT and joining instructor- facilitated discussions, occasionally with guest participants, using chat tools - a synchronous learner-instructor interaction;
- Students individually and in teams post solutions to the class Web space for discussion and sharing of potential solutions - a synchronous learner-learner interaction;
- During class sessions, students participate by discussing cases, considering more information, alternative approaches to problem solving, and other potential solutions - a synchronous learner-content interaction;
- Out of class, students work in groups to discuss problem solutions and then post them to the class Web space - an asynchronous learner-learner interaction.

This course was developed using a Web-based course management package known as WebCT – an acronym for Web Course Tools (http://www.webct.com). Initially developed by computer science faculty at The University of British Columbia, it includes a number of programs combined into a package that handles classroom management in a virtual space. While the program is written in Java, both the instructor and the learners can interact with it using a common Internet browser. WebCT implements various online items including a course homepage, syllabus, calendar, assignments, bookmarks, class

announcements and a grade book. An electronic drop box is also included that allows students to submit assignments. Finally, communication is facilitated by providing students with bulletin boards, whiteboards, chat rooms, and threaded discussion groups. Though primarily designed for asynchronous education, Professor Borthick uses WebCT's tools to facilitate both asynchronous and synchronous activities.

Example two, "AC101: Financial Accounting, AC102: Managerial Accounting, and GB613: Financial Reporting & Analysis" by Barry Rice, Loyola University (http://www.barryrice.com/), are courses that utilize a combination of virtual lectures, classroom-based problem solving sessions, and classroom-based exams. As Professor Rice states in his objectives: "Students sitting in a classroom are typically quite heterogeneous [and] the virtual classroom approach allows all students to master the lecture material at their own pace" (Rice, http://www.barryrice.com/).

The features we see in this advanced Web-based educational application are the following:

- Students prepare for virtual lectures by reading textbook chapters assigned by way of a course home page;
- Students access virtual lectures which closely follow the assigned text material by logging on and accessing a PowerPoint file with added voice media - an asynchronous learner-instructor interaction;
- In addition to virtual classes, students can discuss course material by way of a class listserv - an asynchronous learner-learner and learner-instructor interaction;
- Students also attend physical problem solving sessions and can schedule physical office hours.

This course was developed using a combination of MS PowerPoint and ReadAudio (http://www.realaudio.com). PowerPoint slides can be created as usual then with the RealAudio Creation Kit (http://www.realnetworks.com) you can capture or create audio files to accompany each slide. The entire file is then saved as an HTML file for posting to a Web server. Similar files can be created using any of the Microsoft Office Suite of applications; instructions can be found at: http://www.microsoft.com/education/tutorial/online/pptHome.asp.

Example three, "Financial Accounting 2000: A Financial Accounting Tutorial" by Richard Campbell, Rio Grande University (http://www.virtualpublishing.net/fa2000.htm), is an example of an e-book with an associated virtual practice set. Students pay an access fee, login and work their way through the text and electronic practice set making journal entries to reflect setting up a company, process transactions, and perform typical general ledger activities.

Some interesting features include the following:

- Students access and read an e-book accounting text - an asynchronous learner-content interaction;
- Students work through an electronic practice set and get immediate feedback and assistance with answers - a synchronous learner-content interaction.

Example four, "Accounting Information Systems: A Database Approach" by Uday Murthy, Texas A&M University, and Mike Groomer, Indiana University, is an example of a virtual textbook (http://www.cybertext.com/index.html). Students purchase a copy of the text and receive a user ID and password. When logged on they get frequently updated materials, links to other relevant material, and access to an on-line quizzing system. As in example three above, Cybertexts are an example of both an

asynchronous and synchronous learner-content interaction.

Example five, "Stevie: An Internet Tool For Studying Cardinalities " by Guido Geerts, University of Delaware (http://www.aisvillage.com/stevie/), is best characterized as an interactive environment for the creation of dynamic tutorials for teaching and learning cardinalities. Teaching and learning cardinalities is difficult at best. From an instructor's point of view, Stevie is a collaboration tool through which to create, share, and improve teaching and learning exercises. From a learner's point of view, Stevie is an interactive tutorial through which to practice and test understanding of the difficult subject of cardinalities. Stevie is designed as a Web interface into a relational database populated with cardinality exercises. Each cardinality problem is made up of a narrative description, a picture description, a set of answer buttons representing cardinality choices, and feedback advice for all possible combinations of answers. In this sense, Stevie is an interactive tutorial by which students practice and learn cardinalities.

Stevie represents a virtual teaching and learning community. Instructors who join the community collaborate with others to use already created exercises or create their own. To create assignments for their students, instructors choose sets of cardinality exercises and provide logon IDs for their students. Students logon, choose problems from their assignment, try to solve them, and get immediate feedback including an explanation of why their thinking may be right or wrong. Students using Stevie become part of a teaching and learning community in which they dynamically interact with educational material and get real-time feedback - a synchronous learner-content interaction.

Stevie was created using a combination of technologies including ColdFusion and Access. Users access the Stevie environment using standard Web browsers. All cardinality exercises, user identifications, assignments, etc. are stored in a number of Access tables. In between the Web browser and the Access database is ColdFusion (http://www.allaire.com). ColdFusion is specialized software referred to as a database-to-Web gateway. Its function is to act as middle-ware that provides a developer with the ability to create templates that turn Web form information into SQL queries that an Access database can understand and then process the SQL query results back into HTML for delivery to a Web browser. Stevie users see pages (actually ColdFusion templates) containing images, buttons, and narratives that have been dynamically created through the magic of ColdFusion templates from material stored in the Access databases. For an excellent tutorial on ColdFusion, see:
http://www.hotwired.com/webmonkey (and search on ColdFusion).

Other examples of advanced Web-based applications which extend what this research found outside of accounting education include:

- The use of streaming video to tutor students in introductory physics by Walter Lewin of MIT (http://caes.mit.edu/mvp/html/lewin.html) - an example of asynchronous learner-instructor interaction with asynchronous and synchronous learner-content interaction.
- A virtual simulation called the Virtual Circuit Board by George Watson of the University of Delaware (http://www.udel.edu/present/showcase/watson/circuit.html) allows students to carry on virtual simulations - an example of asynchronous and synchronous learner-content interaction.

Either of these applications could be effectively applied in accounting education.

Table 3 presents a summary of the Web-based tools illustrated in these applications and others that AIS educators may find useful for developing advanced educational applications.

Table 3
Summary of Advanced Web-based Application Tools

	Information Presentation	
Description Interaction	**Asynchronous Activities**	**Synchronous Activities**
Learner – Instructor	**E-mail** **Threaded discussion groups** 1. WebCT 2. FrontPage 2000 **Grade books** 1. WebCT 2. FrontPage 2000 **Message boards** 1. icqWebCT 2. mIRC 3. WebCT 4. FrontPage 2000	**Online office hours – chat:** 1. icq 2. mIRC 3. WebCT **Online office hrs – conferencing:** 1. Exchange 2000 Server 2. NetMeeting 3 3. WebCT
Learner – Learner	**E-mail** **Threaded discussion groups** **Message boards**	**Chat** **Conferencing**
Learner – Content	**Static Web based content** (syllabus, handouts, slides, etc.) 1. Microsoft Office Suite Applications 2. WordPerfect Office 2002 3. PDF files - Adobe 4. Adobe Web Content Tools 5. Macromedia Web Content Tools **E-books** 1. Financial Accounting 2000 2. Cybertext books **Streaming media content** 1. Real Video 2. WebCT	**Online quizzes or tests** 1. WebCT 2. FrontPage 2000 Quizzing Engine 3. ActiveExam **Online Content with Feedback** 1. Stevie

Contributions and Conclusions

Previous research indicates that the current model of accounting education can be characterized as involving too much in-class lecture, dependency on textbooks, lack of creativity, little use of new technologies, and does not develop students ability to learn new skills (Albrecht and Sack 2001). And,

when Web-based applications are involved, the use of static home pages containing assignments with links to supplemental materials (Hofferd and White 2000). The research reported in this study extends this previous research by selectively identifying advanced Web-based educational applications and classifying them using the RPI model of learner interaction as synchronous vs. asynchronous activities. This research provides a look at a few advanced accounting and other educational applications that use Web-enabled technologies creatively in combination to accomplish educational events.

While the design of the delivery of any course needs to be done on the basis of teaching and learning objectives, the use of the RPI model with examples of actual applications allows educators to think about the use of Web-based tools and their contribution to learner interaction and synchronous vs. asynchronous educational events. Since learning (the acquisition of knowledge) is an activity that occurs through interaction with an instructor, other learners, and actual content, it is important to look for ways to leverage Web-based technologies to support educational events. In addition, our examples may help AIS educators to consider ways to better prepare our students to utilize technology synchronously and asynchronously to find information, create their own educational events, and become active learners. AIS educators can and should lead the way in this pursuit.

As described by Debreceny and White (1999), first generation Internet applications are static, asynchronous applications. The examples of advanced Web-based applications that we have reported in this research exhibit dynamic, interactive characteristics described as second generation applications. Because of the limitations of our methodology, we do not claim that our examples are in any way exhaustive. They are however representative of advanced Web-based educational applications in accounting.

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