An Introductory Course in an Undergraduate E-commerce Technology Degree Program

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Abstract

Despite great demand, undergraduate degrees in electronic commerce technology are just beginning to emerge. In this paper we describe an introductory course in an e-commerce technology bachelor's degree program at DePaul University. "Survey of e-commerce technology" (ECT 250) provides undergraduate e-commerce technology students with an overview of their degree program while it prepares them for the client-side Web application development course that follows. To meet these dual purposes, ECT 250 takes a balanced approach between breadth and depth in its subject matter.

Keywords: E-commerce technology, e-commerce, e-business, undergraduate

1. INTRODUCTION

The School of Computer Science, Telecommunications, and Information Systems (CTI) at DePaul University began offering a graduate degree in e-commerce technology in the Fall quarter 1999. Interest in the degree was strong, and the number of students enrolled in the program went from 50 in its first quarter to over 650 this year (Knight and Chan 2001). The program was based on three curriculum models: IRMA 2000, ISCC '99, and IS '97 and was designed, developed, and implemented over a period of only seven months. The references provide more information on the development of this program (Knight and Chan 2001, 2000).

Interest in e-commerce technology is not limited to graduate students. The prerequisite courses in the Masters level e-commerce technology degree are open to all students, and these courses were in great demand with undergraduates. In response, the CTI faculty developed an undergraduate e-commerce technology degree based on the graduate degree. Students earning a bachelors of science in e-commerce technology learn programming, user-centered interface design, e-commerce system design skills, and the technology of databases, networking, and middleware (Knight 2001). This degree was first offered in the Fall quarter 2000.

A discussion of the entire undergraduate e-commerce curriculum is beyond the scope of this paper. Of interest here is the first course in a sequence of three courses that teach Web development. The introductory course is "Survey of e-commerce technology" (ECT 250). It is intended to provide students with an overview of their degree program as well as prepare them for the client-side Web application development course that follows. "Client-side Web application development" (ECT 270) is an introductory depth course in client-side technologies, similar to other Web development technology courses (Lim 1998). In it students see a comprehensive study of HTML, Cascading Style Sheets, and DHTML using JavaScript. Students create their own Web sites and publish them on a Unix box provided for their use. The third course in the sequence is "Server-side Web application development" (ECT 353) in which students learn application development for e-commerce. This includes the development of small-scale e-commerce transaction applications, which students learn by designing and building a retail Web site that accesses a database for online order processing. The emphasis, as the title suggests, is on server-side technologies, with ASP and VBScript as the choice for the academic year 2000-2001 (DePaul CTI 2001).

As the first course that e-commerce technology students take, ECT 250 has vital role in orienting the students within their major. ECT 250 is also taken by students outside the School of Computer Science,

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Telecommunications, and Information Systems, including students in the Schools of Commerce and Liberal Arts and Sciences. This unique course benefits both e-commerce majors and non-majors by providing them with an introduction to an important and rapidly changing subject. In this paper we discuss ECT 250, giving the purpose of the course, outlining the topics that it covers, and reflecting on its first year and its future in the curriculum at CTI.

2. THE INTRODUCTORY E-COMMERCE COURSE

As mentioned previously, the purpose of ECT 250 within the undergraduate curriculum is twofold. First, it provides students with a general survey of the topics important to the study of e-commerce technology. This provides e-commerce technology students with a survey of the topics they will cover in greater detail in their degree program, and it exposes non-majors to an area that is increasingly important both to their personal and professional lives. The topics of the course range from a history of the Internet to legal issues surrounding e-commerce. A list of topics is given in Table 1, and more details can be found in the next section. This type of breadth-first approach to an introductory course is common in CS and IS undergraduate curricula (Bagert, Marcy, and Calloni 1995; King and Barr 1997; McFall and Stegink 1997).

| Introduction to e-commerce |
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| The Internet and the WWW |
| E-commerce software |
| E-commerce hardware |
| Security |
| Electronic payment systems |
| Marketing, sales, and promotion |
| Purchasing, logistics, and support activities |
| International, ethical, and legal issues |

Table 1: Survey topics

The second purpose of the course is to prepare students for the client-side Web application development course that follows it within the e-commerce technology degree. This preparation entails learning how to create Web pages using FrontPage 2000 and how to publish Web pages on a Unix system. The depth topics covered in ECT 250 are discussed further in the next section. The goal in giving some topics more coverage is to expose students to a deeper knowledge of topics than a survey can provide. Again, this is a common approach taken in introductory courses, with technical topics ranging from Web design (Mercuri, Herrmann, and Popyack 1998) to spreadsheets (Herrmann and Popyack 1994; Kolesar and Allan 1995).

The goal in combining breadth topics and depth topics into a single course is to allow students both to gain a broad perspective, providing a framework within which to place any additional courses they take, and to have sufficient experience to understand the significance of the area. Finding an appropriate balance between breadth and depth can be challenging, although not impossible (Reed 2001). The balance between breadth and depth in ECT 250 is achieved by using a Web development tool, namely FrontPage. Whereas teaching the students to create Web pages by producing HTML would require multiple weeks, students familiar with Microsoft office products and the Windows operating system can learn FrontPage in two or three lectures. In a relatively short period of time they can gain hands-on experience creating and publishing Web pages, leaving ample time for the survey topics of the course.

3. THE COURSE

ECT 250 is taught in one (10 week) quarter, meeting for three hours a week. The sections discussed in this paper took place in the Fall 2000, Winter 2001, and Spring 2001 quarters and met twice a week for 1 ½ hours a lecture. In the Fall 2000 quarter, 71 students enrolled in two sections, with 50 of those being CTI students, 5 Commerce students, and 16 from Liberal Arts and Sciences. In Winter 2001, 76 students were in the two day sections, with 42 in CTI, 28 in Commerce, and 6 in Liberal Arts and Sciences. (Another instructor taught an evening section). In the Spring 2001 quarter, there were 73 students enrolled in the two day sections, with 39 in CTI, 33 in Commerce, and 1 in Liberal Arts and Sciences. (Two evening sections were taught by two other instructors). A graphical representation of the enrollment figures is given below.
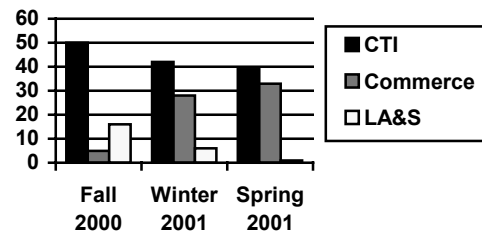
There are no formal prerequisites for ECT 250, and the only assumption made about the background of the students is that they had browsed the Web before and were familiar with e-mail. Although intended as a course for freshman or sophomores, a large number of juniors and seniors took the course in the 2000-2001 academic year. In the Fall 2000 quarter of the 71 students registered, 13 were freshman, 18 sophomores, 19 juniors, 16 seniors, and 5 were graduate students. In Winter 2001, of the 76 students registered, 18 were freshman, 19 sophomores, 24 juniors, and 15 seniors. In the Spring 2001 quarter, 73 students registered with 18 freshman, 22 sophomores, 21 juniors, and 12 seniors. Below is a graph showing these numbers.

30
25
20
15
10
5
0

Freshman
Sophomore
Juniors
Seniors

Fall 2000   Winter 2001   Spring 2001
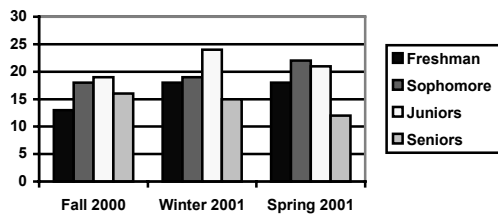
This spread of class levels is due in part to the newness of the e-commerce technology program in the School of CTI and the e-commerce program in the School of Commerce, introduced in the Fall quarter 2000 and the Winter quarter 2001 respectively. A number of CTI and Commerce students in their junior and senior years opted to choose one of the new majors, boosting the upper class enrollment in the course. In a few years the spread of class levels should favor lower level students. It should be noted that some of the spread is due to students outside of CTI and Commerce taking the course as an elective, a situation that is expected to continue.

The textbook for the course is *Electronic Commerce* by Schneider and Perry (2001), and the coverage of topics in that text strongly influenced the choice of survey topics in the course. (Prior to the Winter quarter 2001, an older version of the text (Schneider and Perry 2000) was used). *Electronic Commerce* was the only required textbook for the course. It does not cover the material necessary for the depth topics, and this information was taken from various sources including some supplementary texts (Andersen 2000; Buyens 1999). The supplementary material was provided to the students in the lecture notes made available on the course Web site.

In the remainder of the paper we detail the topics covered and assignments given in the course. For more information, including lecture notes and sample assignments, see the ECT 250 course page at http://facweb.cs.depaul.edu/asettle/research/ect250/

Survey Topics
In this section we discuss the survey topics covered in ECT 250. A detailed summary of the topics covered is given in Table 2. The topics in Table 2 are given in the order in which they appear in the course.

Topic	Details
Introduction to e-commerce	Definitions of e-commerce, e-business, EFT, EDI, traditional commerce. Views of commerce (buyer's, seller's), business processes. What characteristics make a business process well suited or badly suited to e-commerce? Advantages and disadvantages of e-commerce
The Internet and the WWW	Components of data communications systems. Analog and digital signals, piggybacking technology, modems, modem speeds. Types of communication links (wire pairs, coaxial cables, fiber optics, microwave transmission, satellite transmission). Internet connection terminology (POTS, cable connections, T1, T3, ATM). Comparison of connections. Types of networks (LAN, MAN, WAN). Protocols. Intranets, extranets (public network, private network, virtual private network). Definition of the Internet. History of the Internet. Internet applications (E-mail, FTP, Telnet, newsgroups). Control of and commercialization of the Internet. Prehistory and birth of the Web. Factors behind Internet growth. Internet2. Netiquette. Circuit switching and packet switching. Open architecture. Internet protocols (TCP/IP, HTTP, SMTP, POP, IMAP, FTP). Network layers and TCP/IP. Client/server model. IP addresses, URL. Internet utility programs (finger, ping, talk). Searching the Internet (searching tips, advanced search options, limitations).
E-commerce software	Web server software (Apache, IIS, NES). Determining factors in platform solutions (budget, target audience, hosting). E-commerce requirements (catalog display, shopping carts, transaction processing, product tools). Web-hosting services (services provided, advantages, marketing, B2B issues). Levels of packages (basic, middle-tier, enterprise-class). Basic packages (services, banner advertising, mall-style hosting, examples). Mid-range packages (features, examples). Enterprise solutions (features, examples).
E-commerce hardware	Web servers (factors to consider, the role of a Web server, third-party hosting, factors in performance, benchmarking). Web server features (core capabilities, site management, application construction, dynamic content, electronic commerce).

Security	Terminology (physical, logical, threat, countermeasure). Risk analysis. Secrecy, integrity, necessity threats. History of computer security. E-commerce threats (client, communication channel, server). Copyright and intellectual property threats. Protecting copyrights and IP. Steganography, digital watermarks. Client threats (active content, Trojan horse programs, cookies, Java and Java sandbox, JavaScript, ActiveX, graphics, plug-ins, e-mail attachments). Protecting client computers (digital certificates, security in IE and Netscape Navigator). Communication channel threats (secrecy vs. privacy, sniffer programs, information leaks, anonymous browsing, integrity threats, necessity threats). Encryption (terminology, history, modern systems, type of systems). Private-key cryptography (communication, key distribution, DES). Public-key cryptography (communication, authentication, RSA, PGP, key agreement protocols, digital envelopes, key management). Secure protocols (SSL, S-HTTP). SSL (basics, types of communication, key length, limitation). Message digests, digital signatures. Server threats (Web server, databases, CGI, other utility programs). Securing the server (access control, firewalls).		services, selling information or digital content, advertising supported, advertising-subscription mixed, fee-for-transaction, examples).
		Purchasing, logistics, and support activities	Purchasing (activities, procurement, specialized Web sites, MRO supplies). Logistics (objectives, activities). Support activities (finance and administration, human resources, technology development, training, examples). Forms of economic organization (markets, hierarchies, networks, changes in recent years). EDI (definition, early efforts, broader standards, international standards, paper vs. EDI, direct connection, indirect connection, VAN, open EDI, financial EDI, perceived risk, hybrid solutions). Supply chain management (definitions, levels in the supply chain, value creation, impact of technology, advantages, example).
Electronic payment systems	Electronic cash (micropayments, concerns, storage, advantages, disadvantages, obtaining and spending e-cash, security, success, examples). Electronic wallets (advantages, examples, W3C and ECIG architecture, ECML standard). Smart cards (definitions, Mondex). Credit and charge cards (definitions, payment processing, closed vs. open loop systems, online systems, SET protocol).	International, legal, and ethical issues	Barriers to international e-commerce (language, culture, infrastructure). Language (issues, common languages, translating sites, localization, handling requests). Culture (issues, labeling, ways of doing business, Internet access, the law). Infrastructure. Ethical issues (defamation, privacy rights). Borders and jurisdiction (power, effects, legitimacy, notice). Jurisdiction on the Internet (sufficient, subject-matter, personal, long-arm statutes, international issues). Taxation and e-commerce (nexus, types of taxes, federal income tax, state/local income tax, sales tax). Contracting (written contracts, signatures, warranties). Web site content (trademark infringement, deceptive trade practices, regulation of advertising claims, defamation).
Marketing, sales, and promotion	Building a Web presence (definitions, goals, elements, purposes, difficulties, strategies, examples, usability). Finding and reaching customers (approaches, types of interactions, the Web, effectiveness, micromarketing, comparisons, technology and marketing). Branding (differentiation, relevance, perceived value, emotional vs. rational branding, leveraging, affiliate marketing, serving as an intermediary, costs, examples). Business models (selling goods and		

Table 2: Detailed description of survey topics

The more technical topics are covered early in the course, including the survey of the Internet and the WWW, e-commerce hardware and software, and security. This prepares the students for the depth topics and also gives them sufficient technical knowledge to understand the broader topics that come later, such as marketing and promotion strategies and international and legal issues.

The Internet and the WWW and security are given more emphasis than the other topics. The survey of the Internet and the WWW provides perspective on the development of e-commerce, introducing themes that recur throughout the course. These themes include the

importance of standard protocols in e-commerce development and the rapidly changing nature of e-commerce technology. The strong emphasis on security reflects its importance in e-commerce as a whole.

Overall the survey topics deal more with business-to-consumer issues than business-to-business e-commerce and only brush the surface of consumer-to-consumer, peer-to-peer, and mobile e-commerce. In part this reflects the focus of the textbook for the course. In some sense it is a reasonable choice for an introductory survey course. It is the framework students are most familiar with entering the course, as many have been consumers themselves. An attempt is made throughout the quarter to emphasize that business-to-business activities represent a larger portion of e-commerce than business-to-consumer transactions (Schneider and Perry 2001).

Depth Topics
In preparation for ECT 270, ECT 250 students need to know how to access a Unix system using FTP and Telnet, how to execute basic Unix commands to both move up and down directory structures and to create, delete, and move files on the system. In addition, they must understand and be able to manipulate the permissions of files in order to make them viewable by a browser. Believing that 10 weeks did not provide sufficient time to teach undergraduates basic Unix, Telnet, and FTP in addition to the other topics required in ECT 270, basic Unix, Telnet, and FTP were moved to ECT 250.

To motivate the depth topics, it is necessary for the ECT 250 students to create Web pages. To leave as little overlap as possible between the two courses and to make efficient use of time, ECT 250 students create Web pages using an HTML editor, specifically FrontPage 2000. (Originally FrontPage Express was used, but the tool was changed when FrontPage 2000 became widely available in the DePaul University labs). The students also learn about graphic formats, the benefits and disadvantages of frames, the basics of various markup languages, and the fundamentals of information architecture. In more advanced courses, the students implement frames (ECT 270), learn more about XML (ECT 270), and discuss the design and usability of Web pages in greater depth (ECT 270 and HCI 310 "Introduction to human-computer interaction").

A detailed summary of the depth topics covered is given in Table 3. The depth topics are covered between the introduction to the Internet and the WWW and the discussion of e-commerce hardware.

Topic	Details
FrontPage	What is FrontPage? Titles, headings, lists, backgrounds, paragraph formatting, hyperlinks, bookmarks, images, tables.
Graphic formats	GIF, JPG, PNG. Lossy and lossless compression. Bitmapping.
Publishing Web pages	FTP, Telnet, Unix (directory structures, file permissions, commands). Relative paths for files. Unix commands (ls, ls –l, cd, mkdir, rm, rmdir, mv, chmod, man). Access permissions (types of access, types of permissions, values associated with types, various ways to use the chmod command). Text editing on the students.depaul.edu machine (more, pico, moving and deleting files, the image and anchor tags).
Markup languages	SGML, HTML, XML. HTML terminology (opening, closing, one-sided tags, document tags, text structure tags, style tags, image tag, anchor tag, meta tag). History of HTML. History of SGML, advantages and disadvantages of SGML. XML (purpose, benefits).
Frames	What are frames? Problems with frames. Benefits of frames. Alternatives to frames.
Information architecture	Elements of information architecture. Organization systems (schemes and structure). Organization schemes (exact, ambiguous, hybrid). Organization structures (hierarchy, hypertext, database). Navigation systems (purposes, built-in browser features, types of systems, types of elements, building a navigation system). Labeling systems (navigation, indexing, link, heading, iconic). Searching systems (kinds of searches, when to implement a search system). Skills needed for Web design. Organizational challenges (different perspectives, ambiguity, politics). Web problems (poor organization, poor graphic design and layout, gratuitous bells and whistles, lack of attention to detail, under construction, inappropriate tone, designer-centeredness). Rules of thumb for good Web pages.

Table 3: A detailed description of the depth topics

Assignments and Exams
A total of eight assignments are given throughout the quarter. Four of the assignments deal with the depth topics and four are related to the survey topics.

Assignments 1, 3, 4, and 5 all involves the use of their Unix accounts and/or the creation of Web pages. The first assignment asks them to answer questions about

their background and expectations for the course and mail their responses from the student Unix box. This ensures that each student can access his or her student account. Assignments 3, 4, and 5 ask them to create Web pages of increasing complexity. The first is a simple home page from which the other two pages were linked. The other two are a shrine page for a favorite person and an essay on a subject of their choice. The students are expected to provide significant content and to pay attention to the design of their Web pages for these assignments.

Assignments 2, 6, 7, and 8 deal with survey topics. Assignment 2 discusses e-commerce terminology and Internet basics. Assignment 6 asks the students to investigate Web hosting options for a fictional employer. The next assignment instructs students to investigate the topic of computer forensics, and the final assignment requires students to learn about the Vigenere cipher and encrypt a short message using the cipher. As expected, the Internet and the WWW and security are strongly represented in the homework. Students found the Web hosting assignment to be the most difficult, although many understood that it was the most natural exercise of the quarter.

There were two comprehensive exams during the quarter, a midterm after five weeks, and a final exam during the eleventh week. These exams were both cumulative. The type of questions ranged from matching and true/false to short essay questions. As expected, FrontPage, Unix commands, the Internet and the WWW, and security were heavily emphasized.

4. CONCLUSIONS

Students at DePaul University have reacted positively to the undergraduate e-commerce degree as a whole and to ECT 250 specifically. Students find the subject matter more engaging than the material in the survey course for undergraduate computer science majors (CSC 200 "Survey of computer technology"), and their comments indicate that they feel it is relevant to their other courses and their lives outside the classroom. The enrollment numbers support this view. In the Fall quarter 2000, there were two sections of ECT 250 offered, in the Winter there were three sections, and this spring four sections of the course carried. At the present time there are five sections of ECT 250 offered in the Fall quarter 2001. During the same period the number of sections of CSC 200 has remained flat.

The course has been a valuable addition to the curriculum. Changes made to the undergraduate curriculum this year added ECT 250 to the information systems bachelor's degree. Beginning in the Fall quarter 2001, ECT 250 will be a required course in three of the six undergraduate degrees offered in CTI (e-commerce technology, information systems, and network

technologies). The quality of the client-side Web application development course has improved now that undergraduates are required to take ECT 250 as a prerequisite to the course. Instructors have been able to add more material to ECT 270, such as more thorough coverage of XML and Web design.

It would be interesting to conduct a formal study of the differences in outcomes between ECT 250 and CSC 200. Some of the material covered in ECT 250, such as the development of basic Web pages, is also taught in CSC 200. CSC 200 students, however, do not learn as much as the Internet or Web design, and e-commerce is not on the syllabus at all. It is possible that more knowledge about the Internet and e-commerce would motivate students in learning Web page development, enabling them to better retain the concepts. We hope to investigate this hypothesis in the near future.

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