Simulating Real World Experience Using Accumulative System Development Projects

Wen-Jang Jih
Department of Computer Information Systems
Jennings A. Jones College of Business
Middle Tennessee State University
Murfreesboro, TN 37132
kjih@mtsu.edu

ABSTRACT

Information technology has been recognized as an essential component of business strategy and major business processes in today's business environment. In order to generate measurable business value, information system professionals must possess a set of capabilities that expand beyond technological areas. Many information system programs have incorporated system development projects in advanced technical courses, expecting that the experience students acquire through these projects would enable them to connect what they learn in class with the real world challenges that await them. These projects mostly are either based on hypothetical textbook cases or well-bounded, localized real world projects. They generally fall short in complexity and difficulty, compared with the kind of projects students have to deal with when they work in the real world. As a result, there is minimal pressure placed on students to exercise such important capabilities as critical thinking, creative thinking, strategic thinking, ethical thinking, and team-working abilities as they work on these projects. The challenge of preparing IS students for the new business environment is especially daunting as businesses in all sectors are now trying to transform their enterprises into innovative and adaptive organizational systems in the Internet era. This article describes an approach taken by a comprehensive university in Taiwan to address this challenge. These projects allow students to acquire serious experience in developing real world systems and running real businesses. The accumulative nature of the systems also provides opportunities for students to learn about system maintenance, an important capability usually ignored in other types of student project assignment.

Keywords: Information Systems Education, Business Education, E-Commerce, Educational Innovation, Knowledge Management, Case Study

1. INTRODUCTION

Information technologies are playing a crucial role in coping with the multi-faceted challenges arguably resulting from the advancement of these same technologies. This dual role of IT has made effective application and management of IT an essential component of the knowledge base of all functional areas (Applegate et al., 1999; Kalakota & Robinson, 2000; Porter, 2001). Companies in all industries have clearly understood the importance of proactive applications of IT in pursuit of sustainable competitive advantage. Recognizing that strategic utilization of IT depends on effective integration of knowledge in both information technology and other elements of the organizational system (e.g., business strategy and business processes), many information system programs have enthusiastically incorporated various kinds of system development projects in their pedagogical processes (Jih et al., 1988; Piplin, 1984). Many of these projects have three deficiencies. Firstly, the use of hypothetical textbook cases inevitably reduces the complexity level of the problem. Even real world system development projects usually are defined and scoped to accommodate students' limited class time and experience. The isolated nature of real world system projects is also understandable given the security concern of the sponsoring organization. It remains a great challenge on the students' part to close the wide gap between the simplistic class projects and the projects they are expected to deal with at work. Secondly, most information systems are linked with their application contexts in a profound manner. Grasping these intricate linkages is important in order for information system professionals to make significant contributions to their organizations. It's difficult to infuse much of the contextual factors into isolated real world projects and even more so with textbook cases. Thirdly, more

www.manaraa.com

information system personnel are assigned to maintaining existing systems than developing new applications in today's organizations. Textbook cases and isolated real world projects usually are designed to deal with new application development. Maintenance projects require unique capabilities and, in many instances, also require capabilities for new application development as the existing systems are modified or expanded (Applegate et al., 1999).

1.1 Dilemma of IS Degree Programs

Information system degree program design must deal with multiple challenges. Traditional information system curricula typically consist of application programming, systems analysis and design, database design and management, data communications, and some managerial courses such as information resource management. Because of the limitation of allowable credit hours for a degree program and the lack of sufficient emphasis on specific industry characteristics in order to prepare students for unanticipated employment demand, acquisition of contextual knowledge is usually left out of students' degree plans. On the demand side, nevertheless, industries are constantly looking for information system talents that can balance technological skills with business senses. IS curriculum designers are being hard pressed to ensure that their graduates possess enough foundation to shorten the learning curve in dealing with the challenges that come their way at work. The advent of the Internet has further increased this tension.

1.2 Impact of the Internet

Internet technologies have been regarded as a de facto standard for corporate information infrastructure development as companies constantly look for new opportunities to offer innovative customer value (Barua et al., 2001; Feeny, 2001; Keeny, 1999; Rea et al., 1999; Turban et al, 2000). A commonly accepted wisdom regarding the commercial deployment of Internet technologies is that merely setting up an e-store or a marketing website is not enough to create much benefit (Kalakota & Robinson, 2000). In order to create truly strategic value, Internet technologies must be viewed as a complementary tool and leveraged in the ways that strengthen a company's strategic positioning (Barua et al., 2001; Porter, 2001). Recognizing the importance of this feature of Internet technologies application, Hagel & Brown (2001) contend that a new IS management environment has arrived that shifts the emphasis on information system architecture from proprietary to open in nature. It is very likely that, given the evolving nature of the current technological environment, no matter how hard an information system educational program tries to add new technologies and management concepts to the curriculum, students still have to be prepared to learn new skills after they are out of school. A major challenge for IS programs, therefore, is to educate college students in such a way that they will be capable of keeping abreast of the fast-moving advancement in both IT and business domains. This is certainly not an easy task given the constraints of available resources in most schools.

1.3 Structure of the Paper

The rest of this paper is structured as follows. The second section discusses some important capabilities required of information system professionals. It then describes how campus e-stores were launched to provide an understanding of what it takes to develop and maintain accumulative, real world information systems and the specific steps of the project implementation using the e-bookstore as the example. It also highlights some unique features of the projects from the IS educational perspective. The rationale for creating an e-bookstore on this campus is explained in the third section, followed by descriptions of the old and new textbook buying processes, the project team's organizational structure, system architecture, the transactional flow of the system represented by four subsystems, and the results of the project. The fourth section discusses some major benefits of the project from student as well as faculty points of view. The fifth section shares two valuable lessons that have been learned from this experience for IS education, and offers two major suggestions for implementation of e-commerce in the real world. The sixth section reports the difficulties that have been encountered in running these ambitious, experimental projects. The last section indicates the value of these projects in supporting IS research, in addition to summarizing on the projects.

2. CREATION OF REAL WORLD EXPOSURE ON CAMMPUS

2.1 Important Generic Capabilities Requirements of IS Profession

Traditionally, the real world experience development process of most full-time business students doesn't begin until they actually join the work force. The field of information system is no exception. Experiential learning is especially important for IS students, since much of the complexity and intricacies involved in system development and maintenance can only be learned by doing the real work. To perform successfully in the knowledge economy that is driven by customer-centric strategy, IS professionals must possess a number of generic capabilities including strategic, ethical, conceptual, critical, creative, collaborative, and contextual thinking. These capabilities take time and practice to develop. Therefore, it is beneficial for an educational program to provide opportunities for students to obtain this training. Conceptual thinking enables distinguishing relevant factors from irrelevant ones and delineation of the relationship among the relevant factors. Information system professionals often deal with ill-structured situations. This ability of abstraction allows for hierarchical decomposition of the problem. The complexity of the problems conducive to developing this capability often goes beyond those

www.manaraa.com

found in textbook cases or isolated projects.

A person with sufficient critical thinking capability does not blindly accept or reject authoritative disciplines or existing frameworks. Creative thinking breaks out of familiar boundaries to look for new solutions that promise substantial value. Both are important intellectual capabilities for innovation, as innovation often requires fresh ideas that challenge existing mental models. Lacking strong motivation, traditional instruction is generally weak in developing students' critical and creative thinking capabilities. Classroom projects are just not challenging or interesting enough to stimulate students' enthusiasm to find radically smart ways to accomplish the objectives. Further, students learn from each other when they work collaboratively sharing their ideas and experiences. Real world IS projects also require context-sensitive thinking, since information systems are usually intriguingly tied to virtually every aspect of business operations. Although programming and system development assignments have been commonly used to prepare students for real world challenges, these assignments simply don't compare with real world projects with regard to the level of challenge. In short, real world situations are difficult to model in the classroom setting due to a multitude of factors that must be taken into consideration.

2.2 Student-developed Campus E-stores

Five years ago, the management school of a comprehensive university in Taiwan launched a series of long-term, experimental projects to provide opportunities for students to acquire real world experience in both technical and managerial aspects of information system development and maintenance. These projects have gone through several phases of implementation since their inception. During the first phase, a group of ten students (mostly IS students) were enlisted, with faculty assistance, to develop an integrated information system to set up an e-bookstore on the Internet. The first version of the system was completed within about five months, including two months in the summer during which student system developers worked full time. This version possessed enough capabilities to facilitate a real e-bookstore that served the school community. The idea of running a campus e-bookstore that is completely developed and operated by students was proved to be feasible.

The second phase took one semester and primarily consisted of two categories of activities: official launching of the store, and modification and expansion of the information system. Launching a campus e-bookstore that was to be completely operated by students involves a number of administrative details. For example, school administrative approval must first be obtained before proceeding further to "go live" with the project. As many as fifty textbook vendors were approached and enlisted to participate in the project. Internal operational procedures were designed. E-mail, flyers, posters, and information meetings were used as advertising methods to reach prospective customers. In the meantime, the development version of the system was continually revised and expanded based on feedback from the store operations. The result of this phase was evaluated and it was determined that the e-bookstore was successful enough to continue its operations and to serve as the model for launching more projects of similar nature.

Since then, more students have participated in maintaining the information system and running the daily operations of the e-bookstore. More e-stores have been opened to sell student-related products and services, such as Cellular phones, CDs, gift items, computer repair, house rental, tutor services, bus tickets, etc.. These e-stores are mostly based on the business model and the technological architecture of the e-bookstore. The experience of these e-stores has led to the subsequent in-house development of a Web-based instruction system. This system has been revised and expanded several times, and is currently used to support most of the IS classes at this institution. These first-hand experiences have proved to be very valuable for all parties involved.

2.3 Unique Project Features

From the IS educational perspective, these projects are characterized by three major unique features. Firstly, they are accumulative in nature. In the case of the e-store systems, the first versions were developed from scratch using a combination of the more structured system development life cycle methodology and the iterative prototyping approach. The systems have been revised and extended continually to accommodate new requirements and to incorporate new technological advancements. The Web-based instruction system also has progressed through several updates and upgrades. Current versions of these systems contain many of the important features found in major commercial systems. The task of maintaining these systems provides great opportunities of both developing new applications (when new modules are added) and altering existing functionalities. It's interesting to note that, through maintaining an existing system, students learn from their predecessors' experience. The students who have participated one of these projects indicate that they have learned even more from this type of hands on experience sharing than from formal class instruction. Our observations in these projects have demonstrated the valuable role played in enterprise knowledge management by the phenomenon of "vertical experience sharing", i.e. experience sharing between layers of organizational hierarchy, complementing the more discussed "horizontal experience sharing", characterized by interactions between organizational units.

Secondly, these systems are developed to work in the real world context and subject to real world challenges.

www.manaraa.com

Rather than making many assumptions about the application context like class projects usually do, student system developers started with a feasibility analysis to identify the kinds of business that are most likely to survive in the real world. They analyzed the functional requirements to implement the automatic business processes, modified system features to accommodate unanticipated requirements, and added new modules to enable implementation of a new business strategy. They tried to test their programs thoroughly to prevent negative business impact caused by undetected system errors. Students are highly motivated in dealing with a wide variety of challenges. These challenges have forced them to think innovatively and to work as teams. They are also constantly reminded by the supervising faculty of the value of ethical behavior in the business setting. Students have learned that business and people factors can be more difficult to deal with than technological factors. The experience of dealing with these challenges also helps each of them to feel more confident, and more humble in recognition of the need of continual learning.

Thirdly, these projects support research as well as education. The Master of Science IS degree programs in Taiwan typically have a thesis component as part of the degree requirement. Some student participants entered the IS graduate program in the same institution after they finished their bachelor degrees. These students continued their participation in the projects in order to experiment with cutting edge technologies in their particular areas of interest such as modeling of intelligent customer relationship management systems, use of software agents in e-business, integrating genetic algorithms with neural networks, object-oriented modeling of e-commerce systems, and wireless networking. Their efforts have added powerful capabilities to these home-grown systems. This has also led to publications in technology-oriented academic journals. These projects also have served as the vehicles for data collection for empirical research conducted by IS and other business faculties. The findings of these empirical researches have been cited in classroom instruction and brought classroom instruction closer to real life. All IS students, including the non-participants, have benefited greatly from the opportunity to closely observe these real systems in action.

The next section describes the rationale for creating an e-bookstore on campus and how it operates. It also outlines the project team organizational structure, system structure, as well as the results of the operation. The other e-commerce businesses on this campus were set up on the basis of the experience obtained from this first project. All e-commerce systems on this campus share similar system architectures, especially the database structures and the menu hierarchies. The major differences usually are associated with logistic and business aspects of the e-store, such as the products sold and suppliers of these products.

3. A STUDENT-DEVELOPED CAMPUS E-BOOKSTORE

3.1 The Idea Conception

The basic premise of the campus e-bookstore project was that the entire school community might be used as a learning lab for the purpose of business education. With proper design and supervision, a special experimental e-commerce business could be set up to provide students with an opportunity to accumulate valuable experience on campus. This idea was especially challenging for information system students, since they would be involved in developing all of the information systems required to run a real e-bookstore. Technical feasibility was substantiated with the strong support and commitment of the IS faculty and the school administration. Since the purpose of the store was to provide a mechanism to simulate real world operation, the financial feasibility and the operational feasibility were also evaluated to ensure that the project would endure the financial and operational pressures that are typical to the real world business.

3.2 Textbook Purchasing Before E-Bookstore

The campus of this university sits in a hillside valley which is pretty remote from a major city (i.e., Taipei) where most textbook vendors are located. For various reasons, a physical bookstore has not been opened until recently. Textbook purchasing, therefore, was a troublesome process. Although e-commerce has been present in Taiwan for many years and most textbook publishers and agents have set up transaction-enabled web sites that provide online shopping and payment capabilities, textbook selling and purchasing have still been done the old-fashioned way. Every semester, over ten thousand students in this institution used telephone and fax communications to order textbooks from about one hundred and fifty publishers and agents. Payments were collected and mailed to the vendors by the class representatives after the books were received. This many-to-many transaction model was inconvenient, expensive, and tedious for both vendors and buyers. Booksellers are especially weary about payment collection.

3.3 New Process

In the new process, the campus e-bookstore plays the role of a broker between the book buyers and the book vendors. Instructors and students can log onto the web page, register for membership, and place their orders. They can check the status of, and receive acknowledgement for their orders. When the books arrive, buyers are notified to pick them up at a site conveniently located on the campus. This location is also where the payments are made. To help the instructors identify the appropriate textbooks, this system provides links to the vendors' product catalogs. A number of back-office applications have also been developed for system administrations to perform a variety of managerial tasks and for the faculty

www.manaraa.com

supervisor to monitor the operational activities. Faculty supervision is crucial in ensuring that the store operation does not deviate from its specified mission, and, thereby, helps in securing trust among the campus community to win their continued support.

The new process of textbook ordering provides substantial value to both buyers and sellers, as illustrated in Figure 1. As a web site with both B2C and B2B capabilities, the campus e-bookstore delivers its value primarily in three areas: cost reduction, convenience, and to ensure service. The B2C aspect of the system allows book buyers to purchase textbooks through a single web interface, and the linkages with the booksellers' order processing system (B2B) makes it possible for the booksellers to interact with a remote market through a single contact point. With the number of interaction lines shrinking from M*N to M+N, the transaction costs are significantly reduced for everyone involved. The convenience and the price discount offer additional appeals to the customers.

3.4 Organizational Structure of the Project Team

The e-bookstore project involves students across classes, with seniors assuming the leadership role. Junior students are heavily involved in store operations and systems development (Figure 2). The participating students are divided into a system development/maintenance sub-team and a store operation sub-team. The entire project team operates much like a professional community and is motivated primarily by the team culture. In a typical community of practices, true influence comes from knowledge, skill, and enthusiasm, rather than seniority or title (Storck & Hill, 2000). Even the customers (book buyers) are viewed as members of the community. Part of the profit from the e-bookstore operation is used to fund student activities. The faculty advisor only functions as both a facilitator and a mentor. Students understand the importance of experience in learning and voluntarily participate. Driven by their own desire to learn, these student entrepreneurs work extremely hard to conquer problems that come their way. Some sophomores drop out once they find that their aptitude does not fit with the field of information system. Most members, however, are excited about the challenges.

In addition to the faculty advisor's assistance, a seasoned industry expert volunteers to provide direction and advice from the industry perspective. The interactions among the student participants, the faculty advisor, and the industry consultant play an instrumental role in stimulating the strategic and innovative thinking processes of everyone involved. The team members work closely together to resolve numerous strategic, managerial and operational issues. Beginning with the first day the project was inaugurated, the project team has been meeting with the faculty advisor on a regular basis. Occasionally, emergency meetings are held to resolve major unexpected problems. In order to provide maximum opportunity for students to learn through experimentation, they are given extensive freedom to run the business and design the systems.

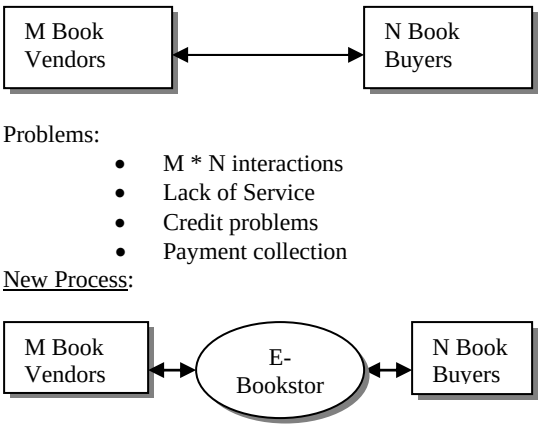

Figure 1 - Old and New Textbook Buying Processes

3.5 System Architecture

The e-bookstore operates on a Web-based storefront supported by an integrated database system. Various software tools are employed to develop the Web site, design the Web pages, define the databases, construct the Web-database interfaces, and the browser menus. The system adopts a three-tiered architecture, with a WWW server managing the members' access to the front office operation systems and the back office systems. A relational database server (SQL) is used to manage three databases and six files to help keep track of daily transactions and customer interaction information. The system architecture is depicted in Figure 3. Since the mission of the project is to support teaching and research, the target market is limited to the campus community. The identification as an eligible customer is validated through an indirect interface with one of the university's student information systems.

3.6 Transaction Flow

The entire transactional process comprises four steps which are represented by four modules: book ordering, logistics, book selling, and payment collection. The integration of these modules essentially simulates the way the store front aspect of a typical e-commerce system operates in the real world. Their linkages are shown in Figure 4.

1. Ordering Flow: Prospective customers must first register with the e-bookstore system. They can find

www.manaraa.com

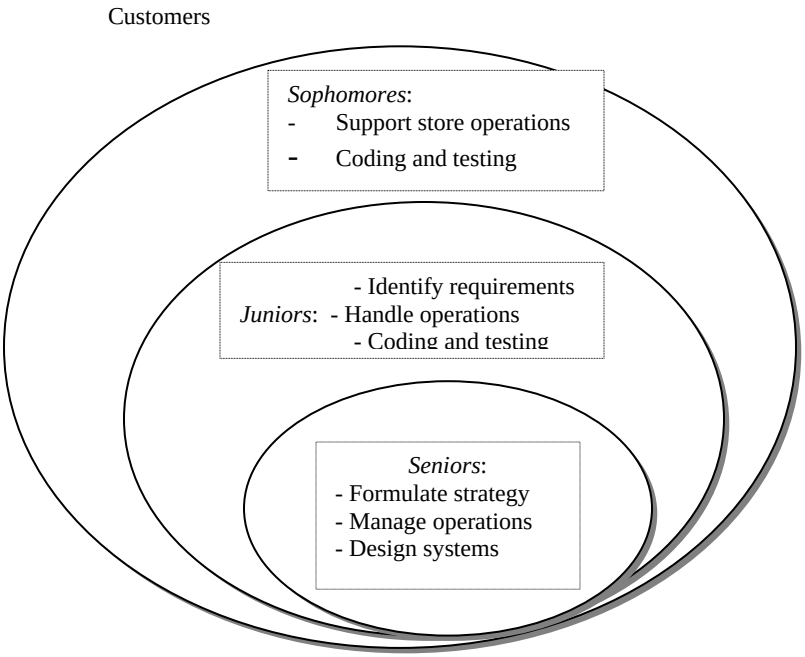

Figure 2 - Organizational Structure of the Project Team

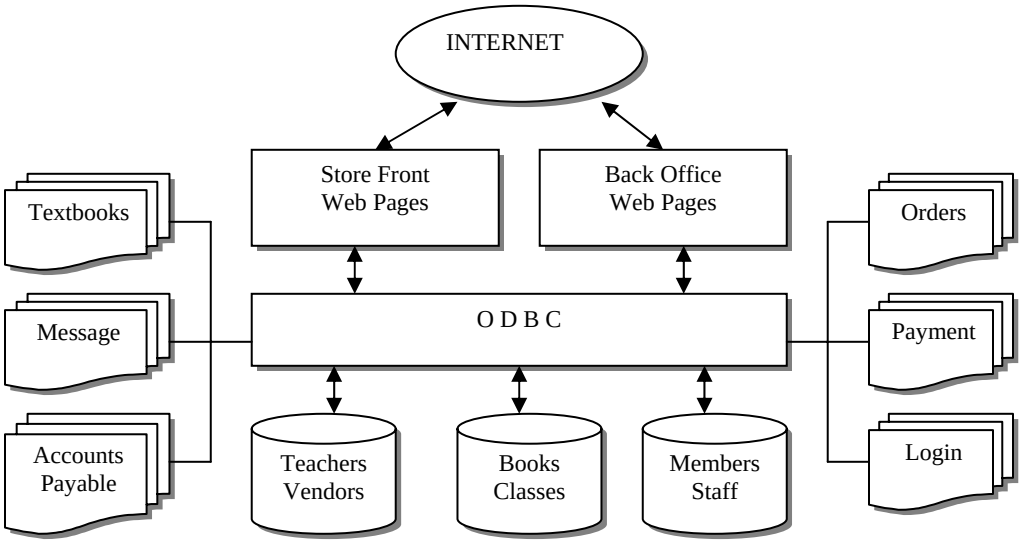

Figure 3 - The Architecture of the Campus e-Bookstore System

www.manaraa.com

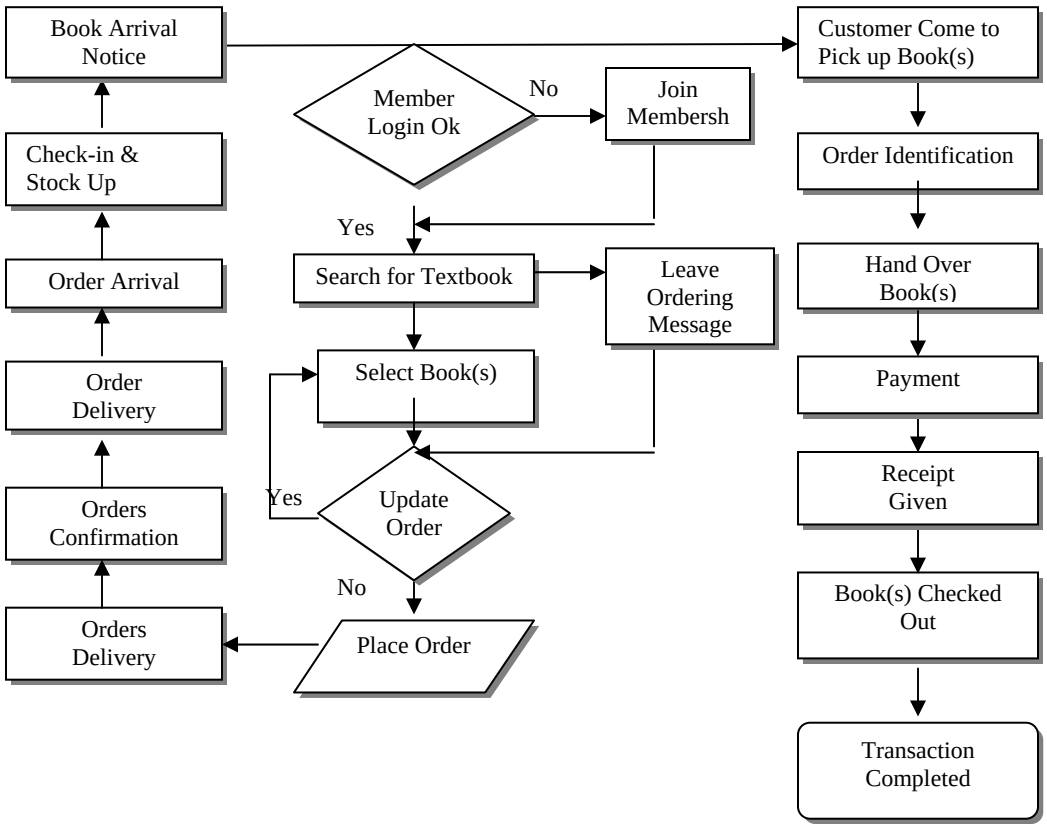

Figure 4 - Transactional Flow

the textbooks for the classes in the system. Either the instructor or the student representative can perform the searches and place orders. Orders may be placed online, by phone/fax, or dropped in the store operation room. Providing multiple ways of interacting with the store increases prospective customers' willingness to purchase their books through the store. This arrangement is made to accommodate individual preferences of customers to various levels of technology. The system module consists of four tasks: Membership Registration and Identification, Textbook Search, Order Placement, and Order Confirmation.

2. Logistic Flow: Soon after receiving confirmation of the orders, customers can track the status of their orders using the confirmation numbers automatically provided by the e-bookstore system. When the shipment arrives at the campus, student workers check the shipment and stock the books in the operation room. This module consists of Tracking, Shipment Arrival, Check-In and Storage Activities.Selling Flow: Customers receive an e-mail message from the bookstore as soon as their orders have arrived and are ready for them to pick up. Customers' identification is verified as they come to pick up their orders. When defective items are returned to the operation room, the same verification process takes place.

3. Payment Flow: Customers pay for their orders at the operation room. Online payment was considered and experimented with, but was delayed for further deliberation in order to reduce the operational burden of having to deal with potential fraudulent behaviors.

In addition to the customer-facing, transaction processing system capabilities, a number of management information systems are also developed to help manage human resources (regular student participants and temporary student workers), document the interactions with book vendors, generate sales reports, perform profit analysis, keep track of accounting and finances, and help with marketing campaign programs. These back office applications are integrated with each other and accessed via the same Web-enabled interface. In other words, the entire e-bookstore system represents a highly integrated system. User passwords are used to protect these systems from

www.manaraa.com

unauthorized access. Only authorized personnel (student managers and the supervising faculty) have access to these back office systems. And there is a security policy in place that requires not only frequent change but also randomness in the making of the passwords.

3.7 Results of the Operations

Over the past five years, about a hundred IS students have participated in the campus e-bookstore project (about five hundred in all of the simulated real world projects). Over ten thousand customers, including students and instructors, have signed up for and used the service. Most college textbook vendors in Taiwan have had their systems connected to this system. The system provides B2C service to its customers and B2B service to the book vendors 24 hours a day throughout the year. Housed in a basement in the management school building, this e-store has become a unique "laboratory" on the campus. Student managers and staff work hard and take pride in their work. The system is maintained and updated continually, and management policy is revised as needed. The system development experience and the program codes are cited as examples in the programming and system design classes. Virtually every single information system class at this institution refers to some aspects of these projects as a convenient source of teaching material. The store also has recruited marketing majors to help with marketing campaigns, and accounting majors to handle accounting and financial management. The involvement of these non-IS students' has caused non-IS instructors' to cite this e-bookstore as an example in their own classes.

Both textbook users and vendors appreciate the value of this e-store due to the remote location of this campus. The system is available where and when the Internet service is available. In addition to transaction cost reduction, the convenience of the service has made book purchasing and selling a much easier task all around. Copies of some back office applications that are developed to facilitate such activities as testing marketing campaigns, monitoring front office operations, tracking book ordering and delivery, examining memberships, analyzing revenue and cost structures, and performing various types of managerial reporting are examined in the supply chain management, marketing management, and managerial accounting classes. Since these systems are all developed from scratch, instead of purchased from the e-commerce tool market, they can be dissected and examined in many ways. There is plenty of opportunity for experiential learning. Throughout these years, these transaction processing systems, management information systems, and decision support systems have been expanded to incorporate the evolution of many Internet technologies, such as data mining, intelligent agent, and Web-enabled wireless communication technologies.

Student managers and developers are strongly encouraged to experiment. Each year, as the new student team takes over the business and the system, new ideas are brought in to revise workflows, information systems, and even business strategies. The faculty advisor only intervenes to resolve major conflicts between student workers or to help break through bottlenecks. Almost every aspect of the business is fine-tuned continually. It's interesting to note that, whereas students' attentions at first are primarily placed on information systems, more improvements actually occur in non-technological areas, such as human resource management, inventory management, and internal control. Since the first semester when this e-bookstore opened, the business has been able to generate a modest profit. The profit continues to increase, with the revenue growing over the years. One third of the profit flows back to the academic departments in a proportional manner to encourage future purchase. One third of the profit is set aside to support faculty and student research projects, and to fund other student activities. The remaining one third is reinvested in the store business. This open information policy and profit sharing practice have helped the store win solid trust from all parties concerned in the campus community.

4. BENEFITS FOR STUDENT LEARNING

4.1 Benefits of Cases

Cases have long been recognized as an excellent tool in business education to bring diverse factors into consideration. Among the many benefits that have been identified from using real-world cases in information systems instruction are:

(1) Understanding real life business situations.
(2) Experience in problem definition.
(3) Experience in decision making with resulting consequences.
(4) Experience with integrated problems.
(5) Understanding information concerns of various levels of management.
(6) Coverage of many organizational issues in one course.
(7) Understanding the impact of individual personalities on decision making and system design.
(8) Understanding the impact of organizational goals and objectives on decision making.
(9) Generation of good class discussion.
(10) Realization of diverse viewpoints and knowledge-bases of fellow classmates.
(11) Development of problem-solving, writing, communications, and group skills.
(12) Exposure to state-of-the-art technology.
(13) Challenging, fun, and confidence building (Piplin, 1984).

4.2 Real Challenges

For information system students, some of these benefits can only be realized to a limited degree with

www.manaraa.com

textbook cases. In contrast, real world projects do not require making unrealistic assumptions that are related to the application context and, therefore, allow for establishment of linkage between what's learned in the classroom and what needs to be dealt with in the real world. These benefits become even more obvious when real world projects are institutionalized on the campus. The accumulative nature of systems enables student involvement in the entire system life cycle. The experience of modifying an existing system helps students better appreciate the value of system maintenance, and reveals to them how they can make strategic contributions to the organization through maintaining existing systems. Furthermore, students learn about such important issues as business strategy, cost control, advertising and promotion, management of information professionals, etc. Knowledge of these issues is important in information system professionals' interaction with users and functional area managers.

4.3 School Reputation

The e-stores were set up for one basic purpose: Providing IS students with real world experience using accumulative projects while they are still in school. However, it is interesting to find these projects also have greatly helped improve the reputation of the university as a model of educational innovation in Taiwan. Several other institutions in Taiwan have attempted to implement similar ideas. Most of these efforts have either failed or achieved only minimal success. Their failures are mostly caused by not properly attending to non-technological aspects, including different campus environment, lack of faculty or administration support, and other strategic reasons. It has been learned first-hand that a competitive advantage is difficult to duplicate when it entails intricate integration of information technology and organizational factors (e.g., business process, organizational culture, and business strategy) under a clear and viable vision (Porter, 2001). The basic strategy behind these accumulative projects is to view the entire campus community as a mini-scale target market as well as a business community, i.e., as a context for information technology applications and IS education.

5. LESSONS LEARNED AND IMPLICATIONS

5.1 For IS Education

Many valuable lessons have been learned along the way about IS education and e-commerce from these experiences. Some major lessons and their implications for IS education are documented here.

(1) In light of the importance of system maintenance in real life, this subject ought to receive serious attention in the IS curriculum. If a dedicated course is not feasible, it can be disseminated into multiple classes, such as system analysis and design, database design, and programming classes. Valuable experience may be passed on and accumulated through generations if system maintenance is done in a systematic manner.

(2) Experiential learning is too valuable to be ignored. However, a hands-on project must be challenging enough to provide solid experience. Given the time constraint of most regular classes, it is advisable to consider combining multiple related classes and running an integrated, cross-class system development and/or maintenance project. The project may even run through more than one semester. This might pose some challenges on the part of IS faculty, for it requires team teaching to a certain degree. Grading methods would have to be adjusted to accommodate the multiple-semester project arrangement as well.

(3) A learning community with as many IS students involved as possible creates a good environment for effective learning. Students can learn a lot from each other. A fruitful student community that is geared toward learning is not easy to come by. Once developed, it offers educational value that is hard to obtain elsewhere and, thereby, may become a valuable component of the IS program itself.

(4) IS students must be exposed to concepts of business strategy and other environmental factors. Technical professionals experience more job satisfaction when they understand the significance of their impact on the entire organization. This sense of significance often represents a powerful motivator especially for those who are assigned to maintain legacy systems.

(5) Administrative support is important in the attempt to transform an IS program for the knowledge economy. The projects described in this article are strongly supported by the president of the hosting university. Since these projects are positioned as an innovative and experimental academic endeavor, they are allowed to run outside the university's regular accounting system. A special-purpose account is set up for these projects. To maintain its credibility, the operational information of the stores is kept open to all concerned school authorities. At the end of each operational cycle, a detailed business report on the result of operations is automatically distributed to the administrative officials. In addition, informational meetings are held for faculty and administration to allow direction interaction with the project teams, as the need arises.

5.2 For E-Commerce and Information Technology Utilization

The observation of the e-stores operations has confirmed a proposition that integration is the key to making the Internet truly work for a business (Useem, 2000). The Internet provides an open and platform-independent infrastructure for all types of organizations. For the first time in history, businesses of all sizes can now reach the global

www.manaraa.com

market and provide their employees easy access to corporate information in a cost effective manner. However, most traditional wisdoms about running a business not only still applies , but are even more important in the Internet era. This is primarily due to the compression of time and the speed at which interactions happen. In a high-speed business world, companies must be very serious about the quality, service, flexibility, and fulfillment of their products. There is not much leeway for mistakes. In other words, both virtuous cycle and vicious cycles could be broken more easily.

Another valuable lesson concerning information systems that has been learned has to do with how strategic benefits from investment in information technology in general are reaped. In seeking different aspects of benefits from information technology application, firms have implemented various types of information systems, including transaction processing systems, management information systems, decision support systems, etc. In addition, insightful frameworks are emerging to guide strategic thinking in the area of e-business (Feeny, 2001). These systems per se, however, are seldom unique enough to sustain competitive advantage. A more viable information strategy enhances its impact by managing the creation, storage, distribution, and application of explicit as well as tacit knowledge available to the organization (Davenport & Prusak, 2000). When subtly integrated with the concepts of knowledge management and online community, utilizations of information technologies can be elevated to a higher level that promises greater benefits.

6. DIFFICULTIES ENCOUNTERED

The first difficulty lies in the very fact that students typically lack the experience to deal with complex problems. They join the work force with marginal knowledge and skills acquired through their information system and business classes. It takes time for them to learn, and to grow in experience. Like most other cases, experiments conducted by inexperienced hands almost invariably entail mistakes and failures. Great care must be taken to ensure that occasional mistakes would not cripple the entire system. It is important to have a management system in place that is capable of localizing all possible errors.

Students' schedules constitute another source of problems. Most students carry fairly heavy course load. Work assignments must be arranged around their class and exam schedules. This issue, however, is not hard to resolve if there is a strong sense of responsibility on the part of the participating students. In the case described herein, students are excited about the opportunity to take on the challenge of creating and running a successful business. The students would not perceive the business as successful unless the customers were happy with their service and enough profits were generated to justify continuing operations. It is one thing to talk about business administration in the classroom, and quite different to actually run a business. Students are happy when everything goes smoothly, and frustrated when a major problem occurs. Timely assistance and generous encouragement from faculty and school administration are critical to keeping student workers' spirits up.

7. SUMMARY AND CONCLUSION

Information system education is facing increasing pressure from multiple sources, including the rapid pace of technological advancement, the intricate interplay of information technology and business strategy, and the inherent limitation of educational programs in experience acquisition. This paper describes an innovative approach to addressing this dilemma shared by most IS degree programs. At the core of the experiment are a number of e-stores that are set up in school as experimental projects that function much like real businesses. Due to the nonprofit nature of educational institutions and the primary emphasis on education rather than any other business concerns, the market scope of these stores is limited to the school community. Supervised and assisted by the IS faculty, student participants learn to analyze market demand, formulate business strategies, design the architecture of the business system, develop and maintain the information systems required to run a Web-based retail store, and actually perform all the store operations. Students gain solid, hands-on real world experience as they participate in the design of the business processes and develop/maintain the systems. The technological experience, business knowledge, and communication skills they acquire over about three years' participation greatly enrich their learning process and apparently make them more attractive to prospective employers when they are ready to enter the job market.

Just like in the business world, Internet technologies are enabling transformation of information system education to meet the needs of the knowledge economy. The projects described in this paper involve innovative uses of Internet technologies, and thereby enrich students' learning experiences. The systems developed and updated over the past five years have become a proprietary resource of vital value for both pedagogical and research purposes. This intellectual property represents an active repository of many people's experience. It will continue to constitute a unique component of the host IS educational program and play a crucial role in producing competent IS professionals. In retrospect, it is not surprising that projects as challenging as these have required unexpectedly substantial amounts of faculty supervision and direction. Nevertheless, the feedback from students, faculty, and employers has clearly indicated that the benefits far outweigh the extra burden taken on by

www.manaraa.com

the faculty. For instruction, the e-store systems and the Web-based instruction system provide plenty of examples for illustration of programming techniques. When addressing high-level issues, it is now quite convenient to refer to these e-stores and to demonstrate how people, process, culture, and technology ought to be properly integrated with overall business strategy. The e-store databases also provide live data to support research projects in neural networks, generic algorithms, fuzzy logic, intelligent agent, Web user interface design, etc. Research and teaching converge beautifully with these accumulative system development projects.

8. REFERENCES

Applegate, L.M., McFarlan, F. W., and J. L. McKenney (1999), *Corporate Information Systems Management: Text and Cases (5th ed.)*. Irwin/McGraw-Hill.

Barua, A., Konana, P., Whinston, A., and F. Yin (2001), "Measures for e-business value assessment," *IT Pro*, Jan/Feb 2001, pp. 35-39.

Davenport, T.H. & L. Prusak (2000), *Working Knowledge: How Organizations Manage What They Know*, Harvard Business School Press.

Feeny, D. (2001), "Making Business Sense of the e-Opportunity," *Sloan Management Review*, Vol. 42, No. 2, Winter 2001, p. 41-51.

Hagel, J. III and J. S. Brown (2001), "Your next IT strategy," *Harvard Business Review*, Oct. 2001, pp. 105-113.

Jih, K., Snyder, C., and B. Galloway (1988), "An Effective Approach to Information Systems Instruction: Conducting Project Assignments in the Real World," *The Journal of Computer Information Systems*, Fall 1988, 19-24.

Kalakota, R. & M. Robinson (2000),*e-Business: Roadmap for Success*, Addison-Wesley Longman.

Keeny, R.L. (1999), "The Value of Internet Commerce to the Customer," *Management Science*, Vol. 45, No. 4, April, pp. 533-542.

Piplin, J. (1984), "Cases Add New Dimension to Information Systems Instruction," *Interface-The Computer Education Quarterly* 6:1, Spring 1984, 58-60.

Porter, M.E. (2001), "Strategy and the Internet," *Harvard Business Review*, March, pp. 63-78.

Rea, A. Jr., Hoger, B., and P. Rooney (1999), "Communication and Technology: Building Bridges across the Chasm," *Business Communication Quarterly*, Vol. 62, No. 2, June, pp. 92-96.

Storck, J. and P. A. Hill (2000), "Knowledge diffusion through 'strategic community'," *Sloan Management Review* 41:(2), pp. 63-74.

Turban, E., Lee, J., King, D., and H. M. Chung (2000), *Electronic Commerce: a Managerial Perspective*, Prentice-Hall.

Useem, J. (2000), "Dot-coms: What have we learned?" *Fortune* 142:10, Oct. 30, pp. 82-96.

Wenger, E. (1998), *Communities of Practice: Learning,Meaning and Identity*, Cambridge University Press.

AUTHOR BIOGRAPHY

Wen-Jang (Kenny) Jih is currently a professor of computer information systems in the Jennings A. Jones College of Business at Middle Tennessee State University, teaching data communications, decision support systems, and new technologies in management information systems. Previously, he has taught at Longwood University, University of Tennessee in Chattanooga, Auburn University, and Southern Methodist University. His overseas teaching experience includes a year at Chung-Yuan Christian University and four years at Da-Yeh University, both in Taiwan. He served as the dean of the School of Management at Da-Yeh University. His current research interests include: knowledge management, electronic commerce, and information strategy.

www.manaraa.com

Information Systems & Computing
Academic Professionals

STATEMENT OF PEER REVIEW INTEGRITY

All papers published in the Journal of Information Systems Education have undergone rigorous peer review. This includes an initial editor screening and double-blind refereeing by three or more expert referees.

Copyright ©2003 by the Information Systems & Computing Academic Professionals, Inc. (ISCAP). Permission to make digital or hard copies of all or part of this journal for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial use. All copies must bear this notice and full citation. Permission from the Editor is required to post to servers, redistribute to lists, or utilize in a for-profit or commercial use. Permission requests should be sent to the Editor-in-Chief, Journal of Information Systems Education, editor@jise.org.

ISSN 1055-3096

المنارة للاستشارات

www.manaraa.com