

# ENTERPRISE SYSTEMS IN THE BUSINESS CURRICULUM: IMPLEMENTATION CONSIDERATIONS AND RECOMMENDATIONS FOR ORGANIZATIONAL AND END-USER INFORMATION SYSTEMS PROGRAMS

CHIA-AN CHAO

*Enterprise resource planning (ERP) systems have been widely adopted by large, multi-national corporations and mid-sized businesses in the U.S. and abroad. The increasing number of organizations running enterprise systems has prompted business schools to implement enterprise systems in their curricula. In addition to increasing graduates' marketability, the integrated nature of enterprise systems and the positive impact they may have on students' learning is another attraction for schools seeking ways to enhance their students' learning experience. This article provides an overview of ERP systems and ERP vendors and university partnerships. ERP curriculum integration models and implementation status, challenges, and benefits are also examined. Finally, implications of ERP systems for Organizational and End-user Information Systems (OEIS) programs and recommendations for integrating ERP systems into OEIS courses are offered.*

In recent years, enterprise resource planning (ERP) systems have been implemented in businesses, government agencies, and higher education institutions in the U.S. and abroad. Businesses ranging from those in the aerospace and defense to high tech to utility companies spent millions of dollars migrating from mainframe to ERP systems in the years preceding 2000, partly due to concerns for the "millennium bug." Since then, ERP system adoptions have slowed down among large corporations according to the Gartner Group ("Gartner says," 2003), but medium-sized corporations continue to adopt ERP systems (Woodie, 2005). With the popularity of ERP systems in the industry and with increasing employer demands, business schools in the U.S. have begun incorporating ERP systems in their curricula to enhance students' learning experience and to increase their graduates' marketability. This article provides an overview of ERP systems, the status of ERP curriculum adoption in U.S. business schools, enterprise systems implementation considerations, and implications of enterprise systems curriculum for OEIS programs.

## ENTERPRISE SYSTEMS OVERVIEW

As an enterprise-wide information system, ERP integrates a range of business functions and data—accounting and controlling, human resources management, sales and distribution, production planning, and materials management—in a single system. ERP systems are "comprehensive, packaged software solutions [that] seek to integrate the complete range of a business's processes and functions in order to present a holistic view of the business from a single information and IT architecture" (Klaus, Rosemann, & Gable, 2000, p. 141). ERP systems have been implemented to replace multiple information systems used in various departments. While these disparate systems may have features custom made for specific business functions, many of them have incompatible architecture, and keeping them working together is inefficient and expensive. As a comprehensive

*Chia-An Chao is Assistant Professor, College of Business, Indiana State University, Terre Haute, Indiana.*

system based on a single underlying database, ERP allows users in different departments across an organization to access business data in real time via a standard user interface.

According to Gartner Group research (as cited in Gonsalves, 2003), the top five ERP vendors in 2003 were SAP, Oracle, PeopleSoft, Microsoft-Great Plains, and Sage (the maker of Best Software, including Peachtree, MAS series, CPA series, and Act!). In 2002, the market leader, SAP, garnered 25% of the sales revenue, while Oracle and PeopleSoft had 7% and 6.5%, respectively. From a customer-base perspective, SAP has over 12 million users in over 120 countries. The worldwide market for ERP software totaled \$23.6 billion in 2004 according to AMR Research (Woodie, 2005). Also in 2004, SAP's market share increased to 40 percent, partly due to the uncertainty created by the takeover of PeopleSoft by Oracle.

#### *FROM MRP TO ERP II*

While ERP product names, such as SAP and Baan, began to appear in information systems trade and academic journals only in the recent past, the roots of enterprise systems can be traced as far back as the 1950s (Klaus et al., 2000; Lederer-Antonucci, Corbitt, Stewart, & Harris, 2004). When examining an ERP system, it is apparent that the name and the underlying concepts of its design evolved from systems used in manufacturing and production planning back in the 50s and 60s. In the late 1950s, Material Requirements Planning (MRP) software was developed to support calculation of material consumption. Raw materials, product parts, and bills of material used for manufacturing were created and maintained in the software. Combining material master and bill-of-material data with bill-of-material processors and forecasting algorithms, MRP software increased the efficiency in the computation of materials required for production.

In the 1970s, MRP packages evolved into Manufacturing Resource Planning (MRP II) software with the addition of capacity planning and scheduling functions. These new functions extended the support beyond material

requirements planning into production planning and control. Then, in the 1980s, a host of computer-aided systems emerged. Collectively, these tools were known as Computer Integrated Manufacturing (CIM) software. Once again, these computer-based tools broadened support beyond manufacturing planning into the product design and production processes. In the product development cycle, CIM tools included computer-aided engineering, computer-aided design, and computer-aided planning software. In the production process, companies made use of computer-aided manufacturing and computer-aided quality assurance software.

As the data and process modeling techniques developed in CIM software and the ability to integrate complex business processes became more mature, the concept of extending support beyond the manufacturing functions to the entire organization led to the development of enterprise-wide systems. In addition to managing production logistics, ERP systems also support functions, such as accounting, controlling, and human resources. Now that organizations have been using ERP for several years, they wanted to get more out of their investment in ERP systems. In the late 1990s to early 2000s, demands for IT support beyond operational efficiency prompted ERP vendors to add new modules, such as customer relationship management (CRM) and supply-chain management (SCM) to the core ERP system. The second wave ERP, or ERP II (a term coined by the Gartner Group), supports inter-organization communication and customer and partner relationship improvement (Hawking, McCarthy, & Stein, 2004; Lederer-Antonucci et al., 2004). In addition, business intelligence functionalities are added to ERP systems to support the strategic use of information. From ERP to ERP II, the focus shifted from back office efficiency to improving inter-organizational collaboration and better decision making through optimized business processes across organizational boundaries.

#### *CHARACTERISTICS OF ERP*

While there are a number of ERP packages on the market, they share certain common

characteristics. First, to be classified as enterprise software, an ERP system must be able to support all the basic functions of a business, such as procurement, sales order processing, payment processing, production planning and execution, accounting and controlling, and human resources management. Another characteristic of ERP software is that the systems are packaged software and do not require coding; however, they do require configuration. Configuration, or selecting appropriate functionalities from ones provided by the software vendor, enables ERP software to adapt to specific business requirements. In order to configure the system correctly, detailed documentation of business processes and requirements is an important part of the system implementation process. In addition to business process analysis, job roles and responsibilities of all system users are documented and analyzed to create user profiles. Employees are then assigned profiles and granted access to appropriate system functions.

The third characteristic of ERP systems is the use of a single database for storing both master and transaction data across functional areas. The database is typically very large; SAP R/3 release 4.7 has close to 40,000 tables. Master data (such as customer master, vendor master, material master, general ledger, pricing, etc.) minimizes data entry and enables employees' access to consistent and accurate data. Access to master data is tightly controlled to ensure data security. Another characteristic of ERP systems is the costly and challenging implementation process. ERP implementation projects are multi-million dollar capital investments. Besides tackling a very complex system and coordinating the involvement of a multitude of business units, dealing with culture change is an important part of the challenge (Davenport, 1998). For many business units, they had to adjust from having almost a free rein over selecting and managing their own information system to working with a centrally defined and controlled system. The prohibitive costs and high risks involved in the implementation may have deterred some businesses from adopting an enterprise solution; however, companies that have successfully

implemented ERP have reported numerous benefits.

#### *BUSINESS BENEFITS OF ERP*

An ERP system is, in essence, an online transaction processing system; thus, higher system and operational efficiency can be expected from ERP systems. In a study conducted by Spathis and Constantinides (2003), the top four ERP system benefits reported by 45 companies were as follows: (1) increased flexibility in information generation; (2) improved quality of financial reporting; (3) increased integration of applications; and (4) easy maintenance of databases. In another study of 163 organizations that have implemented enterprise systems, Davenport, Harris, and Cantrell (2002) identified benefits achieved by those organizations. The top 10 benefits were: (1) improved financial management; (2) faster and more accurate transactions; (3) improved management decision making; (4) improved inventory and asset management; (5) ease of expansion/growth and increased flexibility; (6) fewer physical resources and better logistics; (7) cycle time reduction; (8) improved customer service and retention; (9) headcount reduction; and (10) increased revenue.

Users in these organizations reported significant reductions in transaction processing time and errors and elimination of the hassle of maintaining legacy systems. With access to accurate and real-time data on an integrated system with a standard user interface, there are benefits besides system and operational efficiency. Users in these studies reported better management processes, such as improved coordination between departments, increased internal communication, and improved management decision making.

#### ENTERPRISE SYSTEMS IN THE BUSINESS CURRICULUM

With a large number of Fortune 500 companies running enterprise systems, along with many medium-sized businesses, the popularity of ERP has prompted business schools in the U.S. and abroad to implement enterprise systems in their

curricula. Besides keeping pace with information technology developments in the business world, some business schools added ERP systems to their curricula to overcome two challenges of business education: fragmented curricula and passive learning. The following are reviews of the business education challenges, the potential of enterprise systems as an enabler of curriculum integration and active learning, and the current status of ERP implementation in the business curriculum.

#### *ARTIFICIAL BUSINESS CURRICULUM BOUNDARIES*

Since the 1980s, researchers have pointed out that the way the business curriculum is structured does not reflect business practice (Behrman & Levin, 1984; Buckley, Peach, & Weitzel, 1989; Mandt, 1982). More recently, the preparedness of business graduates for a work environment that has been redefined by the networked economy is in question (Candy & Crebert, 1991; Corbitt & Mensching, 2000; Holter & Kopka, 2001; Linder et al., 1992; Selen; 2001). Business graduates' knowledge and skill deficiencies identified in the literature range from general competencies, such as communication, teamwork, critical thinking, and problem solving, to business specific knowledge, i.e., how businesses work in real life.

Critics attributed such deficiencies to the lack of systematic, cross-functional integration in the curriculum until the capstone course in the students' senior year. In many business schools, students acquire knowledge and skills in individual business areas: accounting, finance, information systems, management, marketing, and operations management. While many progressive business schools have moved toward an integrated curriculum where students learn how a business operates—not in isolation but how one business function affects the other—other programs still follow the “stovepipe” approach to educating business students (Albrecht & Sacks, 2000; Corbitt & Mensching, 2000).

As a result of limited interdisciplinary learning, students may not understand how various business areas relate to one another. For example, they may be able to explain a basic

pricing process and accounting principles, but they may not understand how pricing affects order processing and account settlement. Critics of the “stovepipe” curriculum structure point out that the artificial boundaries are a reflection of the faculty's training and specialization areas, instead of real-world business practice. However, breaking down the boundaries is not easy, given the unique culture of individual disciplines and complex politics.

#### *PASSIVE LEARNING*

In addition to the curriculum structure, another business education challenge is the knowledge transmission model of teaching in many professional schools (business schools included). Under the knowledge transmission model, professors impart knowledge to students through lectures, case studies, and examinations. While there are exceptions—as more and more schools are recognizing the importance of experiential learning—lectures, case studies, and exams are still the prevalent modes of instruction in many classrooms. Hands-on, real-world experiences are often limited to internships. However, without a heavy emphasis on experimentation and critical reflection throughout the students' academic study, active construction of comprehensive understanding of business processes and functions is difficult. As a result, many students may experience the three learning pathologies that Shulman (1999) identified: amnesia (forgetting what one has learned), fantasia (misunderstanding what one has learned), and/or inertia (inability to apply what one has learned).

In all fairness, the lack of experiential learning opportunities during the semester may not necessarily be a reflection of the professors' teaching philosophies and pedagogical choices. The difficulty in scheduling field trips or other activities outside of regular class time because of schedule conflicts may have limited or even discouraged many professors' efforts to add more concrete learning experiences to enhance students' learning. Nevertheless, the results of the combined effect of the silo curriculum structure and the lack of concrete, real-world experiences are reflected in less-than-satisfactory

employer surveys and post-graduation adjustment problems among college graduates (Linder et al., 1992; Siegel & Sorensen, 1994; Perrone & Vickers, 2003; Polach, 2004). Employers in these studies criticized new hires' lack of understanding of the "big picture" and their tendency to make decisions that are too simplistic or decisions that do not take into consideration all the constraints and long-term consequences.

The criticisms and challenges of traditional business education where students' learning is structured along artificial boundaries of academic disciplines and where there is generally a lack of experiential learning opportunities have prompted many business schools to look for ways to overcome such challenges. One such initiative is forming partnerships with enterprise system vendors to help students develop a holistic understanding of business with the support of information technology currently used in the workplace.

#### *ERP VENDORS AND UNIVERSITY PARTNERSHIPS*

All top three ERP vendors—SAP, Oracle, and PeopleSoft—offer academic alliance programs. They are the SAP University Alliance, PeopleSoft On Campus, and Oracle Academic Initiative. Of the three, the SAP University Alliance Program is the largest and most well established.

SAP formed the SAP University Alliance Program in 1996. Members in the Program are made up of universities in North and South America, Asia, and Europe. In the United States and Canada alone, there are over 130 member universities. Besides research partnerships with these universities, the University Alliance Program enables SAP to gain a presence in the college and university curriculum, thereby ensuring a continual supply of personnel in the workforce who are familiar with the enterprise system. For an annual fee of about \$8,000, the Alliance Program offers its members access to its core program (SAP R/3) and three specialized programs (e.g., SCM, CRM, Advanced Production Optimizer, Business Intelligence, etc.) and/or

industry solutions. In addition to the licensing fee, the annual membership fee covers faculty training. Along with the R/3 system are sample data of a model enterprise called IDES (International Demonstration and Education System) that consists of a multinational corporation with subsidiaries across several continents. Curriculum materials, including PowerPoint slides and student exercises based on the IDES Company, are also available.

While the original members of the Alliance Program were required to install and manage the SAP system on their own servers, SAP began offering a hosting option in the past few years. Universities that do not have the resources or choose not to maintain the SAP system on their own can work with a designated hosting center that supports all application server and database needs. In addition, the hosting center can create student accounts and handle system upgrades and database refresh every semester. The hosting option should attract more universities because faculty can now focus on pedagogical issues, instead of dealing with technical and logistical issues relating to implementing a complex system, such as SAP.

Similar to SAP's University Alliance Program, PeopleSoft On Campus and Oracle Academic Initiative were established to assist universities integrate the respective enterprise systems into university curricula (Bradford, Vijayaraman, & Chandra, 2003). Both programs were established in 1999. Benefits for universities that enter into industry-academic partnerships with PeopleSoft are similar to those offered by SAP University Alliance; they include access to enterprise management software, educational materials, faculty training, and technical support. In addition, remote access to PeopleSoft applications hosted at a hosting center was available beginning in 2003. Oracle Academic Initiative also offers its member universities access to its software and discounts for attending training classes. However, Oracle Academic Initiative does not offer curriculum support or a hosting option. Given the purchase of PeopleSoft by Oracle, the future of either program might be uncertain.

### IMPLEMENTATION STATUS AND APPROACHES

While there have been numerous case studies reporting ERP system adoptions in colleges, there is a lack of systematic research on enterprise system education in business curriculum. Published studies on ERP adoption indicate that curriculum integration varied from using the enterprise system in a single course that includes multiple disciplines (Shtub, 2001) to using SAP in sequential, interrelated classes (Corbitt & Mensching, 2000) to building an entire enterprise resources management track (Becerra-Fernandez, Murphy, & Simon, 2000) that covers business process design and implementation, enterprise system administration, and project management. These studies provide invaluable, detailed information on the background, process, and outcomes of ERP adoption at various universities. However, without systematic and extensive research, the breadth and depth of ERP curriculum integration in the U.S. is unknown. The *Journal of Information Systems Education* published an enterprise system education special issue in fall 2004. Authors of one of the articles (Lederer-Antonucci et al., 2004) called for studies that would produce empirical evidence of ERP implementation in colleges and universities, including a more comprehensive understanding of the levels of adoption and objective measures of curriculum integration outcomes, such as what worked and what did not.

Besides basic descriptive statistics, such as the number of universities, academic disciplines, and courses that have included enterprise systems in instruction, an understanding of the approaches or models used in integrating ERP in the business curriculum would be useful. For example, Hawking et al. (2004) identified five possible approaches for integrating ERP into the business curriculum. The first, and least preferred, approach is training students to use a specific enterprise system. This model focuses on proficiency in using various functions and executing transactions. The second approach aims at enhancing students' understanding of business processes with the support of an enterprise system. The ERP system is used to illustrate the interrelationships among business

processes. The third approach focuses on information system concepts; the enterprise system is used as an exemplary system from which students can analyze and assess the infrastructure and design of a state-of-the-art business information system. The fourth approach emphasizes students' understanding of enterprise computing and related concepts, such as ERP system implementation and its impact on organizations. The last approach is a combination of the four previously mentioned approaches.

In another study, Bradford et al. (2003) surveyed 94 universities, 35 of which have integrated ERP in their curricula. Among these universities, some adopted multiple ERP systems, but most schools implemented a single ERP system. Of the systems selected, SAP was the most commonly adopted (56%), followed by Oracle (31%), PeopleSoft (19%), and Microsoft Great Plains (8%). ERP integration was the most common in accounting (69%) and IS (58%) courses, followed by courses offered by management (33%), marketing (14%), and finance (3%) departments. Among the 59 non-adopting universities, the top three reasons for non-adoption were insufficient funds, insufficient IT support staff, and lack of ERP knowledge among faculty. Lack of interest and support from administration and lack of interest among faculty were other reasons.

The survey (Bradford et al., 2003) also found that the most common teaching approach (31%) was to focus on a particular ERP module (e.g., the material management module in a supply chain management course or the HR module in a human resources management course). Relationships between the selected module and other modules might be discussed, but the primary focus was the process and function within the specific module. The fact that 17 out of the 35 ERP-adopting universities had only a single department using ERP and only 5 universities reported ERP adoption in more than 2 academic departments corroborated the predominance of the single-discipline adoption model. In the next popular teaching approach (28%), students learned to execute selected transactions using an enterprise system (e.g., create a purchase order or process payments). This approach gave

students a taste of the system functionality and some exposure to business process without significant time investment on the instructor's part; however, students were not given the benefit of learning the interconnectedness of an integrated system. Other less frequently adopted approaches were teaching a sub-module, such as the accounts payable function within the accounting module (16%); covering all core modules of the enterprise system with the focus on the interrelationship of multiple business processes across modules (13%); and focusing on ERP II solutions, such as supply chain management and customer-relationship management (13%).

While the ideal enterprise system education is to integrate the ERP system across multiple disciplines, such effort would require a significant time commitment for faculty collaboration and consensus building when determining the direction and emphasis of the courses (Corbitt & Mensching, 2000). Besides time investment, the traditional departmental structure makes curriculum integration across disciplines difficult (Becerra-Fernandez et al., 2000). Such findings were consistent with the survey data (Bradford et al., 2000) that showed enterprise software adoption happens mostly within individual disciplines, instead of across the business curriculum. The challenges of ERP curriculum implementation are discussed in the next section.

#### *IMPLEMENTATION CHALLENGES*

Besides the difficulty in integrating an ERP system across multiple disciplines, funding, faculty commitment, and administrative support are challenges (Becerra-Fernandez et al., 2000; Bradford et al., 2003; Corbitt & Mensching, 2000). Given that ERP university alliance membership alone costs between \$3,000 and \$12,000 a year, securing continual funding for the software license fee, faculty training, and technical support is imperative.

The second challenge is faculty interest and commitment. ERP systems are complex and have a steep learning curve. To integrate the system into their classes, faculty must be willing to spend extra hours learning the system and to develop

instructional materials for their classes. Given all the demands for their time, some faculty members, while interested, are hesitant to invest a great deal of time learning the system and developing course materials. The uncertainty of whether their curriculum development effort would be recognized by their peers and administrators is another concern. In some cases, there is a lack of recognition of the amount of time and effort required to implement an ERP system in the classroom. Without strong administrative support and incentives (curriculum development grants, release time, and the inclusion of ERP-related contributions in faculty assessment), successful enterprise system integration is unlikely.

#### *BENEFITS OF ERP IN BUSINESS CURRICULUM*

With the support of an enterprise system, a more holistic and in-depth understanding of business processes would be possible. The ERP system can be a common platform that integrates traditionally separated business disciplines and upon which students can obtain a better grasp of the complex and interconnected nature of business. From basic business processes, such as understanding the order fulfillment process from a sales quote to payment settlement to understanding the supply chain and analyzing the impact of different material sourcing strategies on profitability, the ERP system can promote students' understanding of the interdependencies among business functions. Also, enterprise systems can support higher-level learning, such as analyzing a company's performance (product and service profitability or pricing and marketing campaign outcomes). Such interdisciplinary learning could remedy the problem of a fragmented curriculum which often leads to students "...miss[ing] the big picture where interdependencies and interconnectedness among business processes create efficient synergies in achieving business targets" (Bradford et al., 2003, p. 439).

The second benefit of the ERP system is that it can be used to create an ideal learning environment for cross-functional work teams; students assigned to different job roles can

examine and debate an issue from different vantage points. With learning activities designed to encourage active experimentation, articulation and discussion of ideas and opinions, and application of business concepts, a learning environment supported by an ERP system should correct the problems of amnesia, fantasia, and inertia that Shulman (1999) identified.

Another benefit of integrating an ERP system is students' increased marketability (Watson & Schneider, 1999). Many universities adopted an enterprise system with the expectation of better career prospects for their graduates and increased visibility and reputation of the university. California State University in Chico, the first member of the SAP University Alliance, reported numerous positive outcomes. According to Corbitt and Mensching (2000), the salary difference between SAP-trained and non-SAP-trained students was approximately \$10,000. Furthermore, they reported an increased number of recruiters and higher enrollments in classes using SAP. In addition, faculty that used SAP in their classes reported their inclusion of more functional dependencies and more holistic presentation of business operations in their teaching, which led to improvements in students' understanding of business processes and test scores. Another ERP-adopting university, Florida International University, received positive feedback from employers. Also, the University attributed the success of its faculty and student internship program to its enterprise system education program (Becerra-Fernandez et al., 2000).

#### IMPLICATIONS AND RECOMMENDATIONS FOR OEIS PROGRAMS

With the pervasiveness of enterprise systems in large, multi-national corporations and mid-sized businesses, these systems have become an integral part of the computing environment for many end-users. To become productive members of end-user support functions, organizational and end-user information systems (OEIS) graduates must be familiar with enterprise computing concepts, technologies, and issues. The following is a review of ERP-related career opportunities

and knowledge and skill requirements of OEIS majors.

The proliferation of enterprise systems has added new requirements to the knowledge and skills end-user computing professionals must possess. Additionally, it has created new career opportunities for which OEIS graduates are well suited. As previously mentioned, one of the characteristics of enterprise systems is that it is packaged software, and business process analysis and system configuration take precedence over programming. Some of the responsibilities on ERP implementation projects and post-implementation maintenance include business process documentation and analysis, job role analysis, project management, system configuration, change management, and end-user training. While several of these job tasks require extensive ERP training, work experience, and even certification, others focus more on the job candidate's general business knowledge and technical aptitude. Given that many OEIS programs combine advanced technological training and solid business education by adding an enterprise system into the curriculum, OEIS graduates should be qualified to pursue careers, such as business analysts, consultants, project coordinators, and technical trainers with ERP experience requirements.

#### *OSRA'S 2004 OEIS MODEL CURRICULUM*

To enable non-programming IT graduates to pursue these new career options or for the general purpose of enhancing student learning by providing experiential learning opportunities, some suggestions for integrating an ERP system into various OEIS courses are provided in the following section. These courses are based on the 2004 OEIS Model Curriculum developed by the Organizational Systems Research Association (OSRA). The OEIS Curriculum contains seven core courses and six elective courses; detailed course descriptions, learning outcomes, and resources are provided for each course.

Flexibility and ease of customization are a part of the OEIS Curriculum design considerations (Daniels & Feather-Gannon, 2003). The same consideration of flexibility has

been adopted here; OEIS departments and programs interested in ERP can select the appropriate OEIS courses that would fit into their curriculum and use the following suggestions in integrating an enterprise system in the courses. The instructor can determine the breadth and depth of ERP coverage in each course; however, as described below, using ERP as a tool to illustrate and support students' learning of certain business and technology concepts and principles is recommended over focusing solely on the system itself.

#### *SUGGESTIONS FOR INTEGRATING ERP IN OEIS COURSES*

An enterprise system can be used to help students achieve learning objectives in several of the core courses as well as two of the electives. The following are some suggestions.

*OEIS 1—Organizational and End-User Information Systems:* ERP systems are excellent tools for helping students understand end-user computing from both individual user and organizational perspectives. As an integrated system that combines multiple business functions, the system can be used to demonstrate how one business process affects another, explain system concepts, and illustrate end-user roles and responsibilities in various business functions. In addition, ERP exercises can provide students with firsthand experience on how information technology is being used to support workplace performance and employee productivity.

*OEIS 2—Computer User Support:* Many ERP systems include customer/technical support functions. For example, in the Logistics/Customer Service module in SAP R/3, there are a variety of support center functions, such as problem tracking, computer-telephony integration, and asset and configuration management. Also included in the module are knowledge base and management reporting functions. Hands-on practice using these ERP functions can enhance students' comprehension of support center operations, service-level agreement fulfillment tracking, and performance management. Another benefit of using the technical support functions in an enterprise system is its integration with other

business functions, such as material management, facility management, human resource management (e.g., support staff skills inventory and work schedules), and accounting (e.g., service billing). These integrated functions can reinforce knowledge students learned in business core courses and promote a holistic understanding of how businesses operate.

*OEIS 3—Assessment, Design, Implementation, and Evaluation:* Given that the design of an enterprise system is based on best business practices (e.g., SAP R/3 has over 1,000 best practices embedded in its design for virtually every business function), students can gain valuable experience from observing and analyzing how business processes should be designed and streamlined to support business objectives. Besides learning business process analysis and design, students assigned to various project team roles on a simulated project can learn to configure the enterprise system based on the outcomes of business process and end-user work analyses. Furthermore, important project management lessons to ensure project completion within time, scope, and budget can be learned from the simulated project.

*OEIS 4—OEIS Technical Training and Delivery Methods:* The ERP system provides a meaningful context for learning different aspects of technical training. Given that the deployment of an ERP system affects end-users at all organizational levels and functions, the ERP system can be integrated to support a variety of learning activities in this course, from helping students understand the complexity of planning a large-scale end-user training program to discussing appropriate delivery technologies to developing training materials for certain modules of the system. Furthermore, case studies of ERP implementation can be used to enhance students' knowledge of effective change-management strategies for facilitating end-user acceptance of the new system.

*OEIS 6—Cases in Information Technology:* ERP supports both online transaction processing (OLTP) and online analytical processing (OLAP). In previous OEIS courses, students learn how a wide array of end-users—from customer support staff and other front office users to production

operators to back office employees—use OLTP to record, process, and review information. In this capstone course, students can focus on the OLAP functions in an enterprise system, such as SAP's Business Warehouse (a business intelligence solution) and Strategic Enterprise Management (a management cockpit solution). Students can learn to leverage these advanced modules to support effective decision making by providing management-level end-users with aggregated, long-range, multidimensional information for strategic planning and performance measurement.

In addition to the core courses, ERP systems can be integrated into optional courses, such as OEIS 8—eBusiness and Web Technologies and OEIS 9—Collaborative Technologies and Knowledge Management. In the second wave ERP, or ERP II, many enterprise systems have expanded upon their primary purpose of integrating all business functions within a corporation, and they have begun to include IT support for communication and collaboration with suppliers and customers. ERP II enterprise modules, such as supply chain management, customer relationship management, business warehouse, and enterprise portal, can be incorporated into these optional courses.

#### *POST-IMPLEMENTATION ASSESSMENT AND LESSONS LEARNED*

In the existing literature, systematic assessment of learning outcomes after ERP implementation is very limited (Davis & Comeau, 2004). In current research on ERP in the business curriculum, many are implementation case studies (e.g., Becerra-Fernandez et al., 2000; Corbitt & Mensching, 2000). While these studies reported positive outcomes as a result of integrating ERP in the curricula, such findings are more or less anecdotal (based on faculty and student self-reporting), and it is not clear if such results can be generalized. Nevertheless, these case studies and teaching best practices provide invaluable instructional resources (e.g., Watson & Schneider, 1999, identified 10 ERP knowledge modules and offered detailed descriptions of module content and suggestions for incorporating them into both

undergraduate and graduate IS courses); implementation lessons learned (e.g., Fedorowicz, Gelinas, Usoff, & Hachey, 2004, offered 12 tips for successful implementation), and post-implementation curriculum assessments. Besides successful completion of assigned ERP exercises and projects, students' learning outcome assessment should include improved comprehension of the subject matter and refined understanding of business operations beyond students' own areas of specialization (Corbitt & Mensching, 2000; Davis & Comeau, 2004). Furthermore, students' marketability (e.g., job placement rates and salaries) and feedback from recruiters and employers are also important measurements of the effectiveness of the ERP curriculum.

While incorporating ERP systems in OEIS courses requires significant time commitment and financial resources, such investments will benefit not only the students but also the faculty. From developing a more holistic understanding of how businesses operate to gaining firsthand experience with a state-of-the-art organizational and end-user system, OEIS students will be better prepared academically and have an advantage over other graduates in the job market. Given the current labor market trends, IT graduates who are business process savvy and understand how technology can be applied to support individual, as well as organizational, performance will have an advantage over others with only technical training.

Besides implementing ERP in the OEIS curriculum, OEIS faculty members can take a leadership role in ERP system integration in their respective business school curriculum. With their expertise in pedagogy and curriculum development, OEIS faculty can lead the effort in coordinating the design of an interdisciplinary enterprise system education that encourages active experimentation and the development of higher-order thinking skills. The ERP curriculum integration effort will increase the visibility of the faculty and the OEIS program within the school and university community, as well as provide research and external outreach opportunities.

## REFERENCES

- Albrecht, W. S., & Sacks, R. J. (2000, March). The perilous future of accounting education. *The CPA Journal*, 17-23.
- Becerra-Fernandez, I., Murphy, K. E., & Simon, S. J. (2000). Integrating ERP in business school curriculum. *Communications of the Association for Information Systems*, 43(4), 39-41.
- Behrman, J. N., & Levin, R. I. (1984). Are business schools doing their job. *Harvard Business Review*, 62(1), 140-142, 144, 147.
- Bradford, M., Vijayaraman, B. S., & Chandra, A. (2003). The status of ERP integration in business school curricula: Results of a survey of business schools. *Communications of the Association for Information Systems*, 12, 437-456.
- Buckley, R. M., Peach, E. B., & Weitzel, W. (1989). Are collegiate business programs adequately preparing students for the business world? *Journal of Education for Business*, 65(3), 101-105.
- Candy, P. C., & Crebert, R. G. (1991). Ivory tower to concrete jungle: The difficult transition from the academy to the workplace as learning environments. *The Journal of Higher Education*, 62(5), 570-592.
- Corbitt, G., & Mensching, J. (2000). Integrating SAP R/3 into a college of business curriculum: Lessons learned. *Information Technology and Management*, 1(4), 247-258.
- Daniels, K., & Feather-Gannon, S. (2003). The development and revision of a model curriculum in organizational and end-user information systems. Paper presented at the 2003 Information Systems Education Conference. Proceedings retrieved June 26, 2005, from <http://isedj.org/isecon/2003/2221/ISECON.2003.Daniels.pdf>
- Davenport, T. H. (1998). Putting the enterprise into the enterprise system. *Harvard Business Review*, 76(4), 121-130.
- Davenport, T. H., Harris, J. & Cantrell, S. (2002). The return of enterprise solutions: The directors' cut. Retrieved November 10, 2004, from [http://www.business.vu.edu.au/staff/paulhawking/Return\\_of\\_Enterprise\\_Solutions.pdf](http://www.business.vu.edu.au/staff/paulhawking/Return_of_Enterprise_Solutions.pdf)
- Davis, C. H., & Comeau, J. (2004). Enterprise integration in business education: Design and outcomes of a capstone ERP-based undergraduate e-Business management course. *Journal of Information Systems Education*, 15(3), 287-299.
- Fedorowicz, J., Gelinias, U. J. Jr., Usoff, C., & Hachey, G. (2004). Twelve tips for successfully integrating enterprise systems across the curriculum. *Journal of Information Systems Education*, 15(3), 235-244.
- Gartner says worldwide ERP new license revenue decreased 9 percent in 2002. (2003, June 19). *Directions Magazine*. Retrieved September 18, 2004, from <http://www.directionsmag.com/press.releases/index.php?duty=Show&id=7319&ltrv=1&P>
- Gonsalves, A. (2003, June 18). ERP market shrinks as buyers decide small is better. *TechWeb News*. Retrieved March 31, 2004, from [http://www.techweb.com/wire/story/TW20030618S0012?fb=20030624\\_software](http://www.techweb.com/wire/story/TW20030618S0012?fb=20030624_software)
- Hawking, P., McCarthy, B., & Stein, A. (2004). Second wave ERP education. *Journal of Information Systems Education*, 15(3), 327-332.
- Holter, N. C., & Kopka, D. J. (2001). Developing a workplace skills course: Lessons learned. *Journal of Education for Business*, 76(3), 138-143.
- Klaus, H., Rosemann, M., & Gable, G. C. (2000). What is ERP? *Information System Frontiers*, 2(2), 141-162.
- Lederer-Antonucci, Y., Corbitt, G., Stewart, G., & Harris, A. L. (2004). Enterprise systems education: Where are we? Where are we going? *Journal of Information Systems Education*, 15(3), 227-234.
- Linder, J. C., Smith, H. J., Iverson, F. K., Leavitt, H. J., Simon, H., de Meyer, A., et al. (1992). The complex case of management education. *Harvard Business Review*, 70(5), 16-33.
- Mandt, E. J. (1982). The failure of business education—and what to do about it. *Management Review*, 71(8), 47-52.
- Organizational Systems Research Association. (2004). Organizational and End-User Information Systems 2004 Curriculum Model. Retrieved March 15, 2004 from <http://www.osra.org/curriculum2004.pdf>
- Perrone, L., & Vickers, M. (2003). Life after graduation as a “very uncomfortable world”: An Australian case study. *Education + Training*, 45(2), 69-78.
- Polach, J. L. (2004). Understanding the experience of college graduates during their first year of employment. *Human Resource Development Quarterly*, 15(1), 5-23.
- Selen, W. (2001). Learning in the new business school setting: A collaborative model. *The Learning Organization*, 8(3/4), 106-113.
- Shulman, L. S. (1999). Taking learning seriously. *Change*, 31(4), 11-17.

- Shtub, A. (2001). A framework for teaching and training in the enterprise resource planning era. *International Journal of Production Research*, 39(3), 567-576.
- Siegel, G., & Sorensen, J. E. (1994). *What corporate America wants in entry-level accountants: Results of research*. Montvale, NJ: Institute of Management Accounts.
- Spathis, C., & Constantinides, S. (2003). The usefulness of ERP systems for effective management. *Industrial Management & Data Systems*, 103(9), 677-685.
- Watson, E. E., & Schneider, H. (1999). Using ERP systems in education. *Communications of the Association for Information Systems*, 1(2), 1-48. Retrieved July 1, 2005, from <http://cais.isworld.org/articles/default.asp?vol=1&art=9>
- Woodie, A. (2005, June 22). ERP market grew solidly in 2004, AMR research says. *IT Jungle*. Retrieved July 1, 2005, from <http://www.itjungle.com/two/two062205-story04.html>

Material published as part of this journal, either on-line or in print, is copyrighted by the Organizational Systems Research Association. Permission to make digital or paper copy of part or all of these works for personal or classroom use is granted without fee provided that the copies are not made or distributed for profit or commercial advantage AND that copies 1) bear this notice in full and 2) give the full citation. It is permissible to abstract these works so long as credit is given. To copy in all other cases or to republish or to post on a server or to redistribute to lists requires specific permission and payment of a fee. Contact Donna Everett, [d.everett@moreheadstate.edu](mailto:d.everett@moreheadstate.edu) to request redistribution permission.