

Integration of Enterprise System Software in the Undergraduate Curriculum

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Abstract

While recognized as an important element of Information Systems (IS) curriculum, Enterprise Resources Planning (ERP) remains absent from many universities and at most schools, or is only discussed at a theoretical level. However, the benefit of exposing students to a hands-on, enterprise wide system that integrates business and technology course content makes it attractive for adoption in undergraduate IS curriculum. Several obstacles make ERP difficult to implement in undergraduate curriculum. Among these are cost, hardware restrictions, lack of data, re-education of faculty and the tremendous task of integrating ERP into existing course content. This paper explores three of the leading Enterprise Systems (ES) programs within Universities, and provides examples of how they are being implemented. Data was collected from vendor representatives, publicly available corporate information and from faculty experienced in ERP implementations. This paper suggests five levels of immersiveness that can be used as a guide to match resource availability and academic program for the adopting institution. We conclude by suggesting an investigation and adoption model that can be used to guide product selection and course adaptation.

Keywords: Enterprise Resource Planning, ERP, training, SAP, PeopleSoft, Oracle, curriculum

1. INTRODUCTION

Since the mid-1990's, large businesses across America have been replacing their fragmented ad-hoc information architectures with large single-vendor Enterprise-wide Systems. These systems are often inaccurately referred to as Enterprise Resource Planning (ERP) systems. In reality, they are transaction processing systems that are intended to provide a complete information architecture that includes accounting, finance, human resources, sales, purchasing, manufacturing, inventory and shipping functions. The promise of ERP is that the integrated information will reduce transaction costs and improve decision making,

which ultimately contributes to increased profit. At the firm level, implementation of these large systems has been characterized by long implementation times and unprecedented cost.

A large Enterprise System (ES) may cost tens or even hundreds of millions of dollars and several years to implement. This cost and complexity has been a significant barrier to adoption of hands-on ERP project experience within the university Information Systems curriculum. Recently, several of the largest ES firms have begun to sponsor alliance programs with large universities which brings the software into the IS classroom. These

programs provide the participating university with full-scale versions of ES software along with a demonstration database at very low cost, along with materials and training for faculty and system administration personnel.

This paper will address the current status of several of the larger programs and will provide examples of how the programs are being used in the IS curriculum of several large universities. We will also suggest a model detailing five levels of immersion that a college or university might consider when deciding to integrate ERP with their current curriculum. Existing reports on university ERP implementations are not comprehensive. In 1998, an early SAP alliance was reported by Central Michigan University (Gust & Okonkwo, 1998). More recently in Communications of the ACM, Becerra-Fernandez, et al. (2000) reported on Florida International University's implementation of ERP. These articles tend to report details of a particular implementation. Broader issues of implementation and curriculum development are rarely addressed.

2. UNIVERSITY EXPERIENCE WITH ERP INTEGRATION

Recent implementations of university ERP systems have taken the following forms:

- California State University Bakersfield (CSUB) has been using PeopleSoft in their HR classes for approximately 12 months. Students use PCs running stand-alone applications to create and manage employee records. Through completion of a number laboratory projects, students become familiar with navigating the PeopleSoft interface and with creating and managing employee records. CSUB will be expanding PeopleSoft into the Accounting curriculum starting in Fall 2000.
- Florida International University offers an "Enterprise Resource Management" track in their school of Business consisting of ten courses that provides experience with both SAP and Oracle products (Becerra-Fernandez,2000).
- California State University - Fullerton uses SAP in accounting, management, finance, and MIS courses, primarily as class-demonstration, but some limited hands-on projects have been developed in a few courses.

3. IMPORTANCE OF ES-RELATED LEARNING

An Enterprise System is a database driven model of a firm's business processes. Mapping a firm's processes to the various ES modules creates a tangible knowledge in which the relationship and importance of any single business process to every other process in the organization is knowable and is documented. The ES software

installation is in fact an extremely complex computer-based model of the firm which operates in real-time and which can respond to changes in its operational environment. If this model can be brought into the teaching environment, then it provides a very useful tool in demonstrating the relevance of course content to the real world. This concept is very powerful and adds practical relevance beyond teaching a student how to navigate, write queries and produce reports using any specific brand of software.

In recent years, adoption of ESs has been wide-spread. Almost all of the Fortune 1000 firms have adopted ES's in some form or another (Bingi, et al., 1999), and the next wave is expected to take place within mid-size firms. As a result, the supply of technical personnel with experience with the ES products is very low relative to the demand. Anecdotal evidence suggests that people with only one or two years of experience maintaining an SAP or PeopleSoft system often command salaries far above those experienced in other information technologies with similar experience. Until very recently, the only place to obtain instruction in ES systems have either been on-the-job or at private training seminars sponsored by the ES vendors or third-party training firms.

An important consideration in evaluating the effectiveness of education is the ability of the student to find employment after completion of a course of study. Given the present shortage of experienced ES systems personnel, there is clearly an opportunity for the comprehensive University to enhance the perceived value of its IS curriculum and at the same time increase the market value of the student's education by offering some kind of ES-related learning.

It should be noted that the various ES vendors do not want the traditional Universities to set up curriculum that competes with commercial certificate training programs. Their motive appears to be more in line with increasing name recognition and developing synergies with educational institutions. For this reason, vendor support focuses primarily on installation and keeping the system running, rather than on customization.

4. ES SOFTWARE IMPLEMENTATION CHALLENGES

Educators wishing to add a hands-on ES component to their curriculum face challenges similar to many of the challenges faced in industry. Attempting to face these challenges in an academic setting further complicates the process. These challenges include:

- need for dedicated high-end hardware
- lack of IT department experience and/or support
- extensive training commitment for faculty members
- time commitment to modify course content
- lack of academic recognition for effort

- autonomy of faculty / departments in creation of curriculum
- policies relating to changing curriculum

One of the first challenges that faculty face in adopting ES software is the need to negotiate a license for its use. Details vary from university to university, but essentially the terms strictly dictate usage and distribution, and compliance is monitored. Negotiating the agreement typically requires the involvement of college administration. The \$10,000 license fee only makes the software and training available and is fixed regardless of the level of immersiveness or implementation time-frame.

Generally, technical support requirements are generally small, however, the SAP contract typically requires a commitment of at 1/2 time, on-site, support person. PeopleSoft has indicated that their stand-alone installation requires at least a Pentium 166MHz, 64MB RAM, and 1.6GB hard drive space, however a much more powerful platform is suggested to improve system response times and student productivity. SAP R/3 software is client /server based, and requires a server installation.

Formal training for each of the three products is provided off-site and commercial training facilities. Since subject courses range from 1 to 5 days. Many are offered on weekends. Implementing faculty are generally required to attend some training, and it is highly recommended that campus technical personnel receive training as well.

Many universities have formal curriculum policies that require coordination and approval of any significant additions or changes. Coordination with curriculum committees should be a parallel effort within the ES implementation process.

Successful implementation of ES content into the undergraduate curriculum will require a large time commitment by at least one faculty member, and typical merit structures may not recognize the value of the commitment compared to publishing or other university service. The implementing IS faculty and / department should seriously weigh the benefits of implementing an ES component into the college curriculum against the political realities of the RTP environment and understand the degree of recognition likely to be granted. In a research oriented environment, it may be necessary to "sell" the RTP committee on the merits of implementing an ES component in order to get a commensurate amount of recognition for the time invested.

5. THE LEADING ES VENDORS - UNIVERSITY PROGRAMS

Three vendors comprise the majority of ESs on College and University campuses. Each of these programs fills a distinct niche. SAP offers an expensive, high-end approach requiring significant university commitment. PeopleSoft while still offering an integrated complete

package, allows universities to do a scaled implementation at a more modest level than SAP. The Oracle product offers complete flexibility to colleges and universities. Data collected from these three vendors (Figure 1) reveals that SAP, the industry market leader (Bylinsky, 1999), is also the academic leader.

Figure 1. University Implementations of ERP by Vendor

SAP	PeopleSoft	Oracle
71	20	18

At the present time this numbers are approximate and increasing. The three vendors collectively report that an additional 12-20 universities are formally in the process of deciding to adopt or adopting formal ERP programs.

SAP introduced their "University Alliance Program" in 1997. Universities who participate leverage SAP's preeminence in the ES market. The high demand for SAP-related skills has a strong positive influence on the attractiveness of university programs that provide any significant degree of practical experience with the product.

SAP's University Alliance program can be characterized as a high-end, high-immersion program requiring commensurate levels of time and infrastructure investment on the part of faculty and staff. The annual cost of the license is \$10,000 and SAP requires the commitment of a server and an at least 1/2 time technician to maintain it. California State University at Chico recently estimated that their annual budget to support their SAP program is in excess of \$190K. The program includes a fixed number of training hours for faculty. After the allocated training hours have been used, additional training can be obtained at half the commercial rate. CSU-Chico's experience indicates that the training is excellent, but the number hours provided are small relative to the amount of training needed for a comprehensive campus implementation.

PeopleSoft started their "OnCampus" ES program in 1998. PeopleSoft has a more scalable approach that can be operated on stand-alone PC platforms of moderate computing power but still provides access to the full suite of product options. The \$10,000 annual fee provides software licenses and free unlimited access to local PeopleSoft training classes for faculty members on an "available-space" basis. The product is provided with a small demonstration database that can be used for instructional purposes. PeopleSoft expects to roll-out an Internet version at the end of this year in which students will be able to access a central database via their regular web-browsers from home. It is uncertain whether PeopleSoft will allow hosting on local school servers or from a third-party "Applications Service Provider" (ASP).

Oracle: For a number of years Oracle had supported on-campus training programs through their "Academic

Initiative" program which focuses on their financial database products. In 1999 they created an ES-specific program called the "Applications" program. Compared to the other ES products, Oracles product is extremely easy to install, configure and manage. The Oracle product could be very appealing to business departments who are already familiar with some of the Oracle financial products, but want to expand to an ES scope but don't have either the department or college resources to commit to a large-scale project. The annual license fee of ten-thousand dollars includes three weeks of training, factory installation support, 3 computer-based training (CBT) CDs, and a comprehensive multi-enterprise demonstration database that can be used for developing class/laboratory hands-on projects.

6. FIVE LEVELS OF TECHNICAL IMMERSION

Colleges and universities can choose to integrate ERP systems with their curriculum in several ways. The most immersive means of bringing ERP education into the classroom is with a full ERP system, requiring students to use hands-on exercises with integrated assignments merging business disciplines. The least immersive means would be to discuss ERP at a theoretical level, requiring students to understand conceptually what ERP does but, not requiring them to actually use an ERP system. Five different immersion strategies are described below. Decisions about how to integrate ERP into existing curriculum depend upon the product choice, the resources available to support the product, the commitment of faculty towards integrating ERP into the classroom and the level of learning and expertise of faculty and students. These levels can be called "enterprise model", "tutorial", "lab project", "dedicated class", and "integrated practicum", where "enterprise model" represents the lowest level of immersion and "integrated practicum" represents the highest. Figure 2 shows the implementation trades that might be made in determining an ERP strategy.

Enterprise Model: In the enterprise model, the software is used primarily for classroom demonstration and lectures. Students have little or no actual hands on experience with the software except perhaps to browse or navigate. The ES software is used to demonstrate the interrelationship of business processes throughout the firm.

Tutorial: Tutorials are self-guided learning activities that the student completes outside of the formal classroom environment. PeopleSoft has an introductory "pre-course" tutorial on their public web site that they encourage anyone who is schedule to take formal training to complete before attending the training. SAP and Oracle provide Computer Based Training (CBT) CD ROMs as part of their University programs. These low-impact training experiences provide a brief exposure to the ES interface and functionality. They require no experience on the part of the faculty, and yet can be implemented very quickly into most curricula while more formal programs are in the process of being implemented.

Laboratory Project: A laboratory project is typically a "hands-on" assignment in a simulated ES environment, typically requiring a number of hours of student time at a computer "lab" using the actual ES software. The student uses a pre-supplied "demonstration" database and completes a series of structured activities that give them both exposure to the day-to-day activities of a working business enterprise, and at the same time provides hands-on experience with the software. Often the scope of the assignment will be limited to the domain of the course; e.g. Accounting or Human Resource Management. Extensive use of networked resources is not necessarily required, as in the case of PeopleSoft that currently supports stand-alone installations of their ES software on single PCs.

Dedicated Course: A dedicated course is one specifically designed to teach skills relating to the ES software. These courses may be included in a formally recognized certification program, and the course content and instructor training are dictated by the software vendor. These types of courses are usually outside of the formal business school curriculum, but some polytechnic programs might find them attractive. Generally, offering a course of this kind is out of scope of the intended use of the software and would require a separate license agreement and extensive instructor training.

Integrated Practicum: The Integrated Practicum is a semester-long student team project that either places the student in a live business environment, or in an immersive game/simulation environment in which the ES software plays an integral part. While the implementation of most ES systems is beyond the scope of a semester or quarter long program, either hands-on experience in an internship type of environment, or the implementation of a small ES package from a second-tier ES vendor might be appropriate. Especially promising are projects that are attempting to create strategy game simulations using ES as a platform. Earlier this year SAP has awarded a \$75,000 to the University of Texas at Austin to develop a strategic supply chain simulation game.

7. THE IMPORTANCE OF CROSS-CURRICULUM INTEGRATION

At the heart of every ES system is a central database. The various functional organizations of the firm access the database through specialized "modules". These modules consist of a series of customized menus and reports that provide controlled access to those parts of the database relating to the functional organization and the roles and responsibilities of its members. Typical modules include accounting, purchasing, human resources, finance, manufacturing, sales, inventory and most recently, customer relationship management (CRM). In a real business environment, each module is customized to a lesser or greater degree to reflect the business processes of the firm. In the class room environment, little or no customization is needed or perhaps is even desirable. In Industry, a student's major will result in a specialization

that is closely tied to a single functional organization. Knowledge of modules not related to the specialization might therefore be of limited value at an entry level. For example, there would be little value of a student majoring in Accounting to learn details relating a Human Resource Management module. However, cross-functional knowledge is certainly a factor that helps in communication and future promotion. Entry level Information Systems students might find it very useful to be familiar with a wide range of modules, since it is more likely that "Systems" students may eventually be involved in ES implementation or module maintenance activities supporting organizations across the business enterprise.

There are three types of integration that are possible: cross-module integration and cross-curriculum and cross-functional integration. In cross-module integration, students are exposed to various modules in either a single course or series of related courses with the emphasis on system implementation or system maintenance. These types of courses would be offered to students majoring in an IS program. In cross-curriculum integration, students learn a module in relationship to its reference business discipline: Accounting module as part of an Accounting course. As the business student moves through the required curriculum, she might be exposed to other modules in other courses such as Human Resources or Finance. In cross-functional integration, all participating courses access a single "live" database in a quasi-realistic setting. Students see the enterprise from the perspective of the functional specialization, but must react and adapt to the changes introduced by other students in other classes relating to other disciplines.

8. CONCLUSIONS

California State Polytechnic University - Pomona had meetings with both SAP and PeopleSoft before deciding to adopt PeopleSoft. The decision was based in part because of the California State University's decision to use PeopleSoft in their administrative systems, and it was felt that synergies could be leveraged within the technical support departments. The decision to adopt was also based on the fact that the PeopleSoft appeared to be more flexible with respect to the amount of training provided, and seemed to provide the ability to start on a much smaller scale than SAP. As a result of recently receiving \$60K grant for course innovation, Cal Poly Pomona will begin training and course development Summer 2000.

Figure 3 depicts a decision flow chart that gives an integration strategy based upon level of resources committed to an ERP endeavor. The primary decision is to carefully examine whether integrating ERP is truly consistent with the goals and future endeavors of the institution.

If a program emphasizes theory and has few resources for hands-on pedagogy, an ERP implementation may be highly inappropriate. The second decision is largely

financial. Does the institution support the \$10,000 purchase of an ERP license and the support costs (hardware, maintenance, training) that accompany it. If not, a "Tutorial" approach may be appropriate for teaching ERP. Instructional CD-ROMs and web based training can provide students with minimal hands-on experience at very low cost.

If the institution prefers to have their own ERP system, they must carefully consider whether lab facilities and support for curriculum development exists. If this is not the case, faculty can incorporate instruction in ERP through lectures and demonstrations. This approach does not give students hands-on expertise with ESs. If the resources, support and commitment exist, a Lab approach to teaching ERP may be possible. One approach may be to consider adding an entire discipline specific course to the business school curriculum, requiring faculty training and commitment to developing an entire course. The advantage is that students become fluent in an ERP system in an environment integrated with their curriculum.

Lastly, an opportunity exists to give students near, real-life experience on an ERP system. This can be done as practicum projects with industry or as group class projects using an ERP throughout the term. This approach requires a great deal of faculty training and involvement with practicum projects. Once the ERP system is adopted and in place, the greatest obstacle to this approach is faculty training and time.

The decision to implement an ERP at a University is a difficult one. It is timely and expensive and requires faculty and staff training to be successful. The benefit is that students can use leading edge technology and witness the integration of business processes first hand. A broad measure of ERP's beneficial impact on undergraduate education is difficult to produce. This study will be followed by a survey of colleges and universities, attempting to measure and categorize ERP success and its impact of learning goals and marketability of IS graduates.

9. REFERENCES

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Figure 2. Levels of Immersion

Level of Immersion	Description	Advantages	Disadvantages
Enterprise Model	Exposure to ERP through class lectures and demonstrations.	<ul style="list-style-type: none"> • Requires only individual faculty expertise. • Does not require massive installation or databases to support student work. • Cost Effective. 	<ul style="list-style-type: none"> • Students lack hands-on exposure to integrated functional areas. • Program lacks prestige of having ERP integrated curriculum.
Tutorial	Web and CD-ROM based training in specific systems that students perform outside of the classroom.	<ul style="list-style-type: none"> • Requires little faculty expertise. • No ERP installation necessary. • Students gain near hands-on, exposure to ERP without a massive investment in resources. • Cost Effective. 	<ul style="list-style-type: none"> • Assignments and exposure is tertiary to course experience. • Inflexible materials.
Laboratory Project	Some level of ERP is implemented so that student's perform hands-on assignments, requiring them to access, manipulate and report information using the ERP system.	<ul style="list-style-type: none"> • Offers hands-on, relevant exposure to ERP. • Students acquire marketable ERP skills. • Provides practical integration of business disciplines in the classroom. 	<ul style="list-style-type: none"> • Requires higher level of faculty and organizational support. • Need integrated database to support assignments. • Need to restyle existing curriculum to integrate ERP.
Dedicated Course	An entire course dedicated to teaching the particular skills and concepts associated with the ERP system.	<ul style="list-style-type: none"> • Offers hands-on, relevant exposure to ERP. • Students acquire marketable ERP skills. • Provides practical integration of business disciplines in the classroom. 	<ul style="list-style-type: none"> • Requires higher level of faculty and organizational support. • Need integrated database to support assignments. • Need to add new course to existing curriculum.
Integrated Practicum	Integrated, term-long project in which students use ERP systems as they would in industry.	<ul style="list-style-type: none"> • Offers hands-on, relevant exposure to ERP. • Students acquire marketable ERP skills. • Provides practical integration of business disciplines in the classroom. 	<ul style="list-style-type: none"> • Requires higher level of faculty and organizational support. • Need integrated database to support assignments. • Need to add new course to existing curriculum.

Figure 3. Decisions for Adopting ERP

