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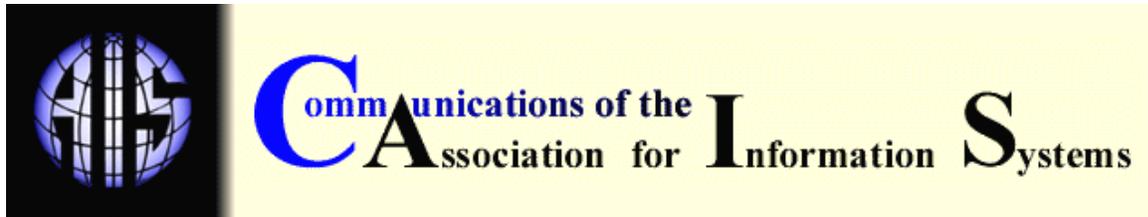
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## THE STATUS OF ERP INTEGRATION IN BUSINESS SCHOOL CURRICULA: RESULTS OF A SURVEY OF BUSINESS SCHOOLS

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### ABSTRACT

Although a growing number of business graduates are involved in the selection, implementation, and use of enterprise resource planning (ERP) systems, many schools are slow in adopting and integrating these systems into their business curricula. Anecdotal evidence suggests that many schools perceive the integration of ERP software into curricula to be too complex, and the resulting costs to outweigh the benefits derived. Other schools question the relevance of ERP skills and knowledge to students. However, an increasing number of schools are joining ERP vendor alliance programs, offering ERP tracks in various departments or even building their business programs around ERP software.

The apparent divergence of opinions regarding incorporating ERP into business curricula lends itself to a fruitful area of inquiry. The current study presents the results of a survey administered to information systems faculty at 94 colleges and universities that examines the current status of ERP integration in the classroom. All but three of these schools are in the US. Topics addressed in the survey include extent of ERP use in the classroom, reasons why schools did not adopt ERP for teaching purposes, implementation issues, and pedagogical uses. In addition, based on the authors' recent experiences in implementing ERP for classroom use, benefits and challenges of ERP integration into curricula are discussed.

The study's results are informative to those schools wanting to benchmark their efforts against other schools, as well as to non-adopting schools that are considering undertaking this initiative.

**Keywords:** ERP, business curriculum, information systems curriculum

## I. INTRODUCTION

In today's society, it is important that schools stay abreast of advances in information technology (IT) and strive to integrate current concepts and tools into curricula. This objective is a difficult one to achieve because generally IT practice tends to stay ahead of academia. One such technology, which made a major impact on the business world, is enterprise resource planning (ERP) systems. For example, SAP/3 was introduced in 1992. However, according to Kumar and Hillesberg [2000] writing in the *Communications of ACM*, up until 1998, when the ERP phenomenon first appeared on the "radar of the trade press", most information systems (IS) academics were not aware of this change in corporate computing. But with high growth rates, fueled with media attention in the 1990s, academics took notice.

In education, many universities and colleges, recognizing the multidimensional, integrative, and normative nature of ERP, are integrating these systems into their business curriculum [Kumar and Hillegersberg, 2000]. Administrators and faculty realize that these systems represent the tools that graduates ultimately will work with in their chosen professions. Thus, exposing students to ERP could be value-added for both the school and the students [Webster, 2003].

However, incorporating ERP into business curricula can be a daunting task - one that many schools have yet to undertake. Anecdotal evidence suggests many schools perceive the inclusion of ERP software into curricula to be too complex and the resulting costs to outweigh the benefits derived. Other schools question the relevance of ERP knowledge to students, believing that ERP is only applicable to graduates who will work for large corporations [Peoplesoft, 2003]. However, a growing number of schools are joining ERP vendor alliance programs, offering ERP tracks in various departments or even building their business programs around ERP software. These schools see ERP as the vehicle that will enable change in education delivery from a functional orientation to a business process orientation, with the ultimate goal of integration of the curriculum across functions [Becerra-Fernandez et. al., 2000].

The apparent divergence of opinions regarding incorporating ERP into business curricula lends itself to a fruitful area of inquiry. The current study presents the results of a survey administered to Information Systems (IS) faculty at colleges and universities across the country that examines the current status of ERP integration in the classroom. Topics addressed in the survey include extent of ERP use in the classroom, reasons schools have not adopted an ERP system for teaching, implementation issues, and pedagogical uses. Additionally, based on the authors' recent experiences in implementing ERP for classroom use, benefits and challenges of ERP integration are discussed.

The study's results are informative to those schools wanting to benchmark their efforts against other schools, as well as to non-adopting schools that are considering undertaking this initiative.

## II. THE IMPORTANCE OF ERP IN BUSINESS AND RELEVANCE TO BUSINESS CURRICULA

ERP systems are information systems that help manage business processes such as sales, purchasing, logistics, human resources, customer relations, performance measurement and management [Davenport, 1998]. The significance of ERP is its integrative nature and incorporation of a thousand or more best practice business processes [O'Leary, 2000]. From a practical and application standpoint, ERP uses a single information and IT framework to provide a holistic view of the enterprise [Gable and Rosemann, 1999]. When fully implemented, ERP's appeal is its cross-functional integration of business processes, which provides a comprehensive and timely view for the managerial decision-making process.

From an academic standpoint, use of ERP software in business courses affords a unique opportunity to learn concepts through process analysis. In an ideal situation, when ERP is implemented and integrated across courses, students are better able to visualize the business

process view of organization, identify and eliminate non-value added activities, and enrich value-added processes.

Historically, business education is fragmented with different bodies of knowledge taught in separate departments. Although students become specialized in their area, they can sometimes miss the big picture where interdependencies and interconnectedness among business processes create efficient synergies in achieving business targets.

### **III. BENEFITS OF INTEGRATING ERP INTO BUSINESS CURRICULA**

One of the major reasons for incorporating ERP systems into the classroom is to give students the skills they need in new technologies so that they can get better jobs when they graduate [Webster, 2003]. Schools are often criticized for their lack of adequate knowledge of current trends and their isolation from industry. Students knowledgeable about ERP systems and who graduate with the much sought after combination of business management and IT skills can help enhance the credibility of a business school in the eyes of industry [Watson and Schneider, 1999]. Schools with ERP systems in place can also use the software as a marketing tool to attract potential students, and individual departments can attract potential majors interested in hands-on knowledge of a real-world application. Many business students realize the demand for these skills and the importance of exposure to ERP systems. For example, at Bryant College (the former affiliation of one of the authors) the ERP graduate course was popular, and students that could not take the course because of scheduling conflicts sought directed studies.

While it is true that most of the Fortune 500 already implemented ERP systems, and thus the initial wave of the demand for ERP skills is past, the next wave of growth, the small and medium enterprises (SMEs) market and industry-specific solution market, is underway. Thus, the fundamental ERP skill set is still in demand by employers.

Another benefit of incorporating ERP systems into business curricula is to expose students to important concepts of enterprise systems and their business process focus. Enterprise systems enable today's companies to transform themselves from a functional orientation towards a business process orientation. Therefore, one of the main reasons to introduce ERP systems into curricula is to expose students to how business processes extend across the organization and the organization's information value chain. Generally, business students think in terms of how a functional area affects business, to the detriment of grasping the entire picture of what makes a company work. Students need to gain a broader understanding of the strategic goals of a company and the business processes that support these goals.

In addition, introducing ERP into curricula can enable students to appreciate better important concepts surrounding the adoption and implementation of enterprise-wide systems. Over the last few years, the computer press was saturated with accounts of enterprise system implementations (including ERP, customer relationship management (CRM) and supply chain management (SCM)), both successful and unsuccessful. Factors leading to the successful implementation of these systems are the focal point of many research studies and practitioner articles [Bingi et. al., 1999; Paar and Shanks, 2000]. Students should be aware of the problems firms experience as they undertake a major enterprise software implementation and how, as a business or systems professional, they can help minimize threats to successful projects. As students interact with the vendor-provided database that serves as a hypothetical company, they can see first-hand how complex and truly integrated these systems are.

Other concepts surrounding the implementation of an enterprise system include the difficulties that stem from the significant changes to business processes to match best practices of the software, configuring ERP systems, customization of software, and training issues [O'Leary, 2000]. It is difficult to impress upon students the relevance of these concepts unless students are exposed to an ERP application. By incorporating ERP into higher education, students can identify

better with the real world as they transfer learned concepts and principles from the classroom into real-life business practice and complexity [Rosemann and Watson, 2002].

ERP systems also can effect changes to the type of management skills needed [Hammer and Stanton, 1999]. Enterprises focusing on business processes require new career models that are not based on traditional hierarchical advancement, but on mastering disciplines that offer career paths throughout many parts of the company [Hammer and Stanton, 1999]. This change in career paths requires that IT and business professionals understand the business processes and the technology to carry out their jobs.

Not only can students benefit from ERP integration into coursework, but faculty members can as well. Faculty leverage ERP as a platform for interdepartmental and multi-university collaboration and curriculum initiatives [Rosemann and Watson, 2002]. Curriculum initiatives can include exercises using role playing for students in various disciplines. For example, business students could assume the role of users or decision makers and IS students could assume the role of systems analysts, designers, or programmers, supporting the users' needs [Peoplesoft, 2003]. In a cross-functional exercise, for example accounting students could develop requirements for inventory cost flows (e.g. FIFO or LIFO) or depreciation (e.g. straight line or double declining balance), and IS students could manipulate the configuration tables of the system to enable these requirements. Then, accounting students could process (execute) transactions using the different methods and see the results on financial statements.

Integrating ERP into curricula can be a "win-win" situation for all the stakeholders involved. However, these benefits are not without the challenges, as discussed in Section IV.

#### **IV. CHALLENGES TO INTEGRATING ERP INTO BUSINESS CURRICULA**

A successful ERP implementation, even for academic users, involves a significant investment in time and resources [Webster, 2003]. One of the first hurdles that schools must overcome is monetary. Training is always a cost that needs to be considered [O'Leary, 2000]. In the real world, the training budget can be 10% of the total project budget [Stedman, 1998a]. Many schools find that training costs are also incurred in the academic environment. Some universities do not install the ERP software on their campus because they find the out-of-pocket costs for hardware, installation, and maintenance are prohibitive for them.

Another challenge is the lack of teaching materials suitable for classroom use [Morrison and Morrison, 2001]. Some ERP vendors provide a limited amount of teaching materials, but others do not. For example, SAP and Peoplesoft currently provide access to resources appropriate for higher education, whereas Oracle does not provide teaching materials for their E-Business Suite. Therefore, faculty at schools that adopted Oracle E-Business Suite, such as Bryant College and University of Akron, developed their own teaching materials. Such development is not only time consuming but requires intimate knowledge of a complex program.

Knowledge-sharing among faculty, who are developing their own material, is also been a problem because the same ideas are constantly re-invented. In 2000 however, alliance programs began setting up mechanisms to share pedagogical materials developed by business faculty with other members of the alliance. Members of the SAP Education Alliance program are linked with hundreds of other institutions and share instructional materials, case studies, and student exercises apart from curriculum materials developed by Alliance scholars [SAP, 2002]. In addition, SAP's Innovation Watch portal, launched in 2002, helps facilitate the exchange of research proposals, project ideas, and other information between SAP personnel and external researchers. Besides exchanging ideas and information, researchers are also encouraged to submit proposals for white papers and case studies [Nagel, 2003]. Peoplesoft's On Campus program participants receive access to resources including white papers, case studies, cyber-seminars, and access to the "Customer Connection" extranet that enables them to update and enrich their curriculum [Peoplesoft, 2002]. The On Campus program also provides a list-serve to

facilitate communications among participating faculty [Peoplesoft, 2002]. In 2003, Peoplesoft initiated an On Campus track in their Higher Education Users Group (HEUG) conference to encourage dialog among member schools. This forum enables faculty who are teaching with Peoplesoft's ERP software to share their experiences and course materials. Similarly, SAP's Innovation Congress brings together academicians, practitioners and experts together for a two-three day conference that includes research on a variety of topics, including e-business, mobile computing, innovation, and associated topics. In addition, the Congress incorporates discussions on business curricula (functional and technical) for the 21st century, demonstrations of new SAP solutions for faculty, hands-on sessions, and roundtable discussions with distinguished scholars.

Still another ERP integration challenge is borne by university administrators. Like successful ERP implementations in the business world, the presence of strong leadership and support is one of the most important factors in enabling ERP integration into curricula [Becerra-Fernandez et al., 2000]. It is administrators' responsibility to identify key faculty members to be part of a team that will carry the project to completion and to provide incentives to faculty commensurate with the effort that must be invested [Becerra-Fernandez et. al., 2000]. Having a reward system in place is very important in motivating faculty to incorporate ERP into their courses. Some ways to attract faculty are to:

- (1) offer curriculum development grants to faculty members;
- (2) grant course releases to faculty members to provide them time to develop or change their curriculum in order to include ERP systems;
- (3) incorporate goals or points of evaluation related to ERP integration into faculty assessment practices and procedures [Peoplesoft, 2003].

Since ERP skills are highly valued in the marketplace, it is often difficult for schools to find adequate IT support staff if they want to implement locally. Therefore, some schools hire a consultant to train internal support staff on a weekly basis [Bradford et al., 2002]. A growing number of schools are moving towards an outsourcing option, thus circumventing the need for major technical support. In 2003, only two ERP vendors (i.e., SAP and Peoplesoft) offer an outsourcing model. Pricing models for ERP outsourcing can vary among hosting centers, but many times is a function of the number of courses using the software and the number of students accessing the software in a given time period (such as a semester). Outsourcing is an attractive option for schools that lack the resources to administer a package in-house. For schools planning to embrace ERP into their curriculum, outsourcing is generally the most viable and only economic option. Further, courses now place more of a focus on the use of ERP and less emphasis on its technological details.

Because of the complexity of ERP systems, training is an issue that must be addressed by all adopting schools. Faculty must be trained in both technical and functional aspects of ERP. Several ERP vendors provide free or discounted training, including vendor-led training. The main challenge with vendor-led training is that usually the material learned is not easily transferable into curriculum. Therefore, faculty spend a considerable amount of time in converting the vendor training material into classroom-based laboratory materials.

Finally, many administrators and faculty do not see the relevance of ERP in the classroom. Changing this perception can be a challenge for proponents of ERP adoption. For example, some administrators and faculty may not realize that ERP concepts are applicable to any size organization, as evidenced by recent entrances into the business software market for SME and industry-specific solutions. Mid-market software does not offer the breadth of options that ERP software offers, but in many ways is acquiring "ERP characteristics." Students exposed to ERP concepts can learn about a large information system with many capabilities and transfer this knowledge to organizations of any size [Peoplesoft, 2003].

## V. ERP ALLIANCE PROGRAMS: THE STARTING POINT

Four of the top ERP vendors, SAP, Oracle, Peoplesoft, and J.D. Edwards, offer academic alliance programs in which universities can become members for a nominal fee and receive the vendor software for academic use. These alliance programs are initiatives that:

- (1) recognize the business implications of the shortage of qualified IT workers and
- (2) the challenges faced by higher education to keep faculty and programs current with the pace of the IT industry [Peoplesoft, 2002].

From both a theoretical and practical standpoint, education alliance programs are a critical forward-looking component of vendor business strategy. By targeting potential users of the product, such programs can translate into a healthy investment in the future. ERP vendors view these programs as the means to introduce future business leaders to their software, with the goal of selling more systems.

The value proposition of SAP, for example, (Figure 1) is derived from six distinct factors: software donation, hosting options, curriculum development and support, research support, professional development opportunities, and network possibilities [Watson, 2001]. In theory, the generality of these factors make them equally applicable to other ERP vendor alliance programs. Software donation includes the process of licensing the software to member schools. Hosting options are made available in SAP and Peoplesoft's alliance programs.

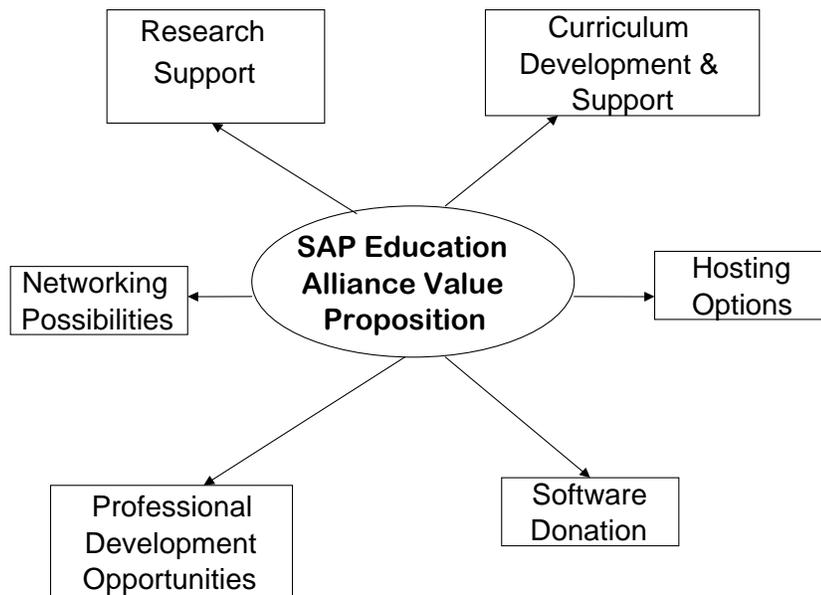


Figure 1. SAP Education Alliance Value Proposition [Watson, 2001]

Curriculum development and support includes training faculty and sponsoring distinguished scholars. Research support includes awards programs, user conferences, and funding research projects. Professional development includes executive education, and networking possibilities that enable the collaboration of multidisciplinary academics to leverage learning, research and education.

Overall, the six factors illustrated in Figure 1 play a critical role in keeping faculty members aware of current and emerging developments via training and education programs. Also, these factors act as catalysts in supporting curriculum development and curriculum repository activities.

Table 1 (on the next page) compares the four ERP alliance programs available in October 2003. It should be noted, however, that Peoplesoft is purchasing J.D. Edwards, and thus the future of the J.D. Edwards' alliance program is uncertain. In 2001, both J.D. Edwards and Oracle suspended adding any more schools to their alliance programs, although they insist that they will continue to support schools that are already members. Therefore, the only major alliance programs moving forward are SAP's and Peoplesoft's. All four are included in our analyses for comparison purposes.

As can be seen from Table 1, the programs differ in terms of cost, curriculum features, and the amount and type of support they provide to faculty. For example, SAP and Peoplesoft provide pedagogical materials to faculty including syllabi, exercises, projects, and lab manuals, whereas Oracle does not provide any curriculum. Also, Peoplesoft offers unlimited classroom training for faculty as long as there is room after all paid trainees are accommodated first, while Oracle offers a 50% discount on their technology-based training (TBT) CDs and vendor-led training classes. The programs also differ in terms of hosting options. Schools that use SAP can now participate in the alliance program through a University Competency Center (UCC) hosted by another school that provides support and access to ERP software via the Internet. UCCs also serve as repositories for curriculum materials [SAP, 2002]. In 2003, Peoplesoft announced a remote applications hosting partnership with Dakota State University that enables colleges and universities to access Peoplesoft through its Center for Remote Enterprise Systems Hosting (CRESH) [Webster, 2003]. Due to the differences among vendor alliance programs, schools should examine support and service in addition to initial cost and hardware requirements before deciding on which ERP software to adopt.

## VI. STATUS OF ERP INTEGRATION IN BUSINESS CURRICULA

To ascertain the extent of ERP integration in business curricula, a survey (Appendix I) was sent to one accounting systems professor at each school listed in the 2002 Hasselback directory and to IS professors who subscribe to the ISWorld list serve. A brief introduction to the survey promised anonymity and described the objectives of the study. As an inducement to reply, respondents were promised summarized results of the study. Ninety-four responses were received over a three month period. Of these, 64 were public and 30 were private. A total of 35 schools in the sample were ERP adopters.

Demographic data of adopting and non-adopting schools is shown in Table 2. Appendix II lists the schools responding. A bivariate correlation between ERP adoption and business school size

Table 2. Demographics of Responding Schools

		Adopting	Non-Adopting
Number of schools responding		35	59
Percent of schools responding that are public institutions		65%(23)	73%(43) <sup>1</sup>
Percent of adopting and non-adopting schools responding that are AACSB Accredited		94% (33)	69%(41)
AACSB Carnegie Classification	Intensive Doctoral/Research Universities	17%(6)	19%(11)
	Extensive Doctoral/Research Universities	20%(7)	29%(17)
	Master's Colleges and Universities I	63%(22)	52%(31)
Business School Size	Minimum	695	546
	Maximum	8164	8559
	Mean	2931	2117
	Standard Deviation	2006	1610

<sup>1</sup> These percentages can be explained as follows: 65% of adopting schools were public institutions, while 73% of non-adopting schools were public. No correlation exists between public/private designation and adoption of an ERP system for academic use.

Table 1. ERP Academic Alliance Program Information (as of 10/30/2003)

Vendor Program	Year Started	US School Membership	Cost	Training	Hosting Offered?
SAP Education Alliance	1996	100	\$8K includes membership, access to mySAP solutions, and faculty workshops (only for faculty) with focus on functionality (e.g. how to integrate into supply chain). Includes a plug/play solution of course materials from other faculty, which is recommend to be used as a baseline. There are no limits to size or additional costs to grow in course numbers or students. Recurring annual cost: \$8K	The SAP University Competency Centers (UCCs) offer a number of training courses for faculty at their campuses. These courses are free and are usually one week long. Training is usually offered at all UCC locations (i.e. University of Wisconsin at Milwaukee, California State University at Chico, University of Missouri, Louisiana State University, and Drexel University) each year. Faculty can attend training at any of the locations. It is possible to attend more than one class during the year as the UCCs hold training classes at different times.	Yes; UCCs offer hosting services and provide support to Universities that are members of the SAP Educational Alliance. Access is available from one of five hosting centers. One will be assigned upon acceptance to the program.
Peoplesoft On Campus	1999	22	Ranges from \$5K - \$12K depending on number of modules or courses. Includes database, technical support and curriculum support. Recurring annual cost: \$5K.	Two-three week training classes are offered by PeopleSoft education on a stand-by basis. Unlimited training thereafter available. Courses are classical training courses for practitioners.	Yes. This is a new program that has been running under pilot for four months and was just announced 3/17/03. Hosting is managed by Dakota State University in their new Center for Remote Enterprise Systems Hosting (CRESH).
Oracle Academic Initiative	1999	20	\$500 for membership; \$3,000 for EBusiness Suite. \$3000/year thereafter. No curriculum support.	50% off vendor-led training classes and technology-based training CDs. Courses are classical training courses for practitioners.	No
J.D. Edwards University Relations Initiative	1998	20	No cost. J.D. Edwards is very selective in what schools join. Acceptance includes free installation, training and a maintenance program.	80 days free training included.	No

showed a significant relationship at 0.278 ( $p < .05$ ). ERP adoption and AACSB accreditation was also positively correlated at 0.292 ( $p < .01$ ). This finding may result from the requirement that AACSB accredited schools must continuously evaluating their curriculum and adjust it to reflect changes in industry practices. The association between whether a school was public or private was not significantly correlated with ERP adoption.

The first question on the survey asked whether the responding school was actually teaching ERP systems in courses. Only 37% (35 schools) of our sample stated they were integrating ERP systems into courses. Twenty-three schools incorporate ERP into both undergraduate and graduate classes. Six schools were using more than one ERP software package for teaching purposes. The earliest adoption took place in 1997 by Arizona State University. University of North Texas was the only school in our sample to adopt ERP in 1998. The remainder of the schools adopted between 1999 and 2002 (the final year of data collection) with approximately 25% adopting each year.

The 59 schools that were not using an ERP system in the classroom were asked to state their reason(s) for not adopting (more than one answer was allowable). Table 3 reports the results.

Table 3. Primary Reasons for Not Adopting ERP for Teaching Purposes (59 schools)

No. of Schools	Percent	Reason
37	63%	Insufficient Funds
34	58%	Insufficient IT support staff
32	54%	Lack of knowledge by faculty
24	40%	Lack of interest by administration
23	39%	Lack of interest by faculty

According to our sample, the second largest inhibitor to ERP adoption is insufficient IT support staff, particularly for schools that are implementing and maintaining ERP software in-house on their own servers. Maintaining ERP software in-house requires significant hardware investment and dedicated IT support staff [Becerra-Fernandez et al., 2000]. IT staff must be able to partition hard drives according to its vendors' recommendations, install the operating system platform, database and application tiers and create the environment. In addition, staff must be able to apply patches to maintain the database and application levels, set up instructor and student accounts, monitor database and application activity for performance, fine-tune the software, and reset the database and user accounts at the end of every semester [Bradford et. al., 2002]. In many cases, personnel with the necessary IT skills and knowledge may be on the school's staff, but resources are stretched so thin that assigning them to the project on even a part-time basis is difficult. Furthermore, hiring IT staff with the necessary skills is costly (e.g. the current market rate for an Oracle consultant is \$2,000/day). Thus, hiring a consultant or a full-time employee with the necessary ERP skills is cost prohibitive for many schools. Additional barriers to ERP adoption by schools include lack of knowledge (54%) and interest (39%) by faculty and lack of interest by administration (40%).

Question seven in the survey asked which ERP system each adopting school used for teaching purposes (with more than one answer allowable). Table 4 shows that most schools in our sample of adopters selected SAP (56%) followed by Oracle (31%) and Peoplesoft (19%). In the "Other" category, 8% responded that they used Great Plains, thus these schools are shown separately from the remainder of this category, which includes various products. Great Plains is a new entrant in the ERP mid-tier market (not considered suitable for companies the size of the Fortune 500). Six percent of schools adopted J.D. Edwards for teaching.

Table 4. Distribution of ERP Packages by Adopting Schools for Classroom Use  
(35 schools)

ERP Package	Percentage of Sample Using Package	Number of Schools
SAP	56%	22
Oracle	31%	11
Peoplesoft	19%	6
Great Plains	8%	3
JD Edwards	6%	2
Other	6%	2

Note: More than 1 response permitted

We also asked about the satisfaction with each product. We were interested in satisfaction on four dimensions:

- vendor support,
- ease of use,
- training, and
- course materials.

No significant correlations were found between a particular ERP package and these satisfaction criteria, suggesting that the schools' experiences were similar regardless of the vendor.

When asked which departments were currently integrating ERP into their courses (with more than one answer allowable), accounting (69%) was most often cited followed by IS departments (58%). Other departments included management (33%), marketing (14%), and finance (3%). Only five of the 94 schools responding reported more than two academic departments currently using ERP in their courses. This statistic indicates that although a growing number of schools are teaching ERP in their curricula, a very small percentage of schools truly integrate the software across disciplines. Realizing maximum value from using ERP systems in the classroom requires that ERP-related curriculum is coordinated across departments [Bradford et. al., 2002]. Generally it is difficult to integrate curriculum across departments; however, an ERP forces this learning, offering a hands-on experience for students to grasp the interrelationship of processes and the effects modules have on one another [Gable and Rosemann, 1999].

Survey results suggest that the majority of ERP initiatives originate from accounting departments (66%) followed by MIS/CIS departments (45%). Very few initiatives were originated by management departments (22%), marketing (13%) or finance (7%).<sup>2</sup> In only four schools, three or more departments were involved in the effort to integrate ERP into the curriculum, which indicates that ERP initiatives are not championed by the entire school. The average number of faculty involved in teaching ERP at a school is four, with a minimum of one (23% of responses) and a maximum of 12 (one response). If only one faculty member is championing the effort to integrate ERP into curricula, the chances of the program really reaching its full potential (i.e. used for cross functional problems that explore true business process integration) is diminished.

### ERP TRAINING

In the corporate world, ample evidence exists that companies cut corners when it comes to training, even though the importance of training is widely acknowledged [Wheatley, 2000]. The same issues are equally applicable to higher education, where the availability of funds for training faculty is usually limited or nonexistent. Some ERP alliance programs do offer a fixed and limited

<sup>2</sup> These numbers do not correspond to actual usage since some advocates had not yet brought the software into the classroom

amount of training; however, the breadth and depth of this training depends on the particular vendor (Table 1).

Our survey found much diversity among the types of training methods faculty received (Table 5).

Table 5. Training Methods Used by Faculty

No. of Schools	Percent	Training Method
26	74 %	Self taught
23	66 %	Vendor led classes
13	37 %	Technology based training via CD-ROMs
10	29 %	Documentation that came with the software
9	26 %	Documentation available on the Internet

When asked what type of training was received (with more than one answer allowable), a majority of adopting schools reported that faculty taught themselves (74%). Vendor-led training classes were ranked second at 66%. Generally, vendor-led classes (especially those that are on-site based) are a relatively expensive mode of training. In addition, the goal of these classes is not to train academics to build curriculum. Typical vendor-led training classes focus on training users of companies how to perform their specific job function and can be technical. If the classes are taught by vendors and academics, such as those administered by SAP's UCCs, these classes can be very effective for faculty. The market value of this training ranges from \$500-\$3,500 per week and can significantly update the skill set and enhance the marketability of faculty [Peoplesoft, 2003]. However, although the classes are free at the UCCs, faculty will still need funding for travel and living expenses while they learn the software.

Technology-based training (TBT) via CD-ROM (37%) was the third most widely used training method for faculty. Compared to vendor-provided training, the technology-based mode (37%) is less expensive, is self-paced, and is a definite option of retaining knowledge for future reference<sup>3</sup>.

The number of days required for training depends on the extent of faculty and staff involved in the initiative, the capacity of faculty and staff to learn independently, and the degree to which the enterprise system will be used in the curriculum [Watson and Schneider, 1999]. On average, faculty in our sample received 10 days of training ranging from none to 70 days total. Fifteen percent of faculty did not receive any training at all.

Both IT staff who are assigned to support the software and the faculty who are planning on using the software in their classroom should be knowledgeable in both the technical and functional aspects of ERP software. Such training not only helps in understanding how the software works, but also helps in troubleshooting when problems occur.

**IMPLEMENTATION OF ERP SOFTWARE**

The decision on which operating platform the ERP software should be installed depends on systems requirements, in-house IT expertise, existing hardware platform, budget constraints, and operating efficiency. Most adopting schools in our survey (71%) operate their ERP system in a Windows environment, while 27% use UNIX. Anecdotal evidence suggests that the dominance of a Windows environment results from its convenience, wider usage, relative simplicity, and cost efficiency. The convenience and high computing capability of today's PCs make them a favorable alternative over mainframe-based platforms such as UNIX. Only 3% of our sample operates the ERP system in a LINUX environment.

<sup>3</sup> It is possible that the data includes some overlap between self-taught and TBT modes of training. The overlap (if any) might misstate the frequencies reported.

Most of the 35 adopting schools (88%) chose to install ERP locally rather than to use a hosted solution (12%). All schools in our sample that were using the hosted solution were using SAP. It is not surprising that so few schools in our sample are outsourcing ERP, because this option only became available in 2000. ERP vendors are introducing application hosting for universities in their academic alliance for two main reasons:

- (1) A hosting center practically eliminates the required investments in infrastructure and administration as well as ongoing maintenance and upgrade efforts, and
- (2) A hosting center can be an important information and services intermediary between an outsourcing university and the enterprise systems vendor [Rosemann and Watson, 2002].

Through the hosting concept, it is expected that universities will soon simulate e-Business scenarios collaboratively using enterprise systems [Rosemann and Watson, 2002]. For schools whose main impediments to adopting ERP are lack of funding and insufficient IT support staff, the hosting concept is an attractive solution.

Because ERP applications are complex information systems, the resulting difficulty with user understanding and implementation is widely acknowledged [Paar and Shanks, 2000]. Many times companies experience both time and cost overruns because of system complexity. Some companies reportedly went into actual or near bankruptcy in the process of implementation [Jenson and Johnson, 1999]. Consistent with corporate experience, the data suggests that ERP installation in universities is generally perceived to be difficult. Respondents were asked the degree of difficulty experienced from installing an ERP system as compared to other major systems projects undertaken by their school. On a Likert scale with endpoints of (1) representing the least amount of difficulty and (5) representing the most difficult, 32% of the adopting schools reported that ERP installation was a most difficult project, while no respondent viewed it as least difficult. There was no significant correlation between package adopted by schools and degree of difficulty with installation ( $-0.083$   $p=.663$ ).

### **PEDAGOGY**

We found no consensus on the best way to integrate ERP software into courses; however the optimal use of an ERP system would be to coordinate ERP-related curricula across academic departments [Bradford et. al., 2002]. Since ERP extends across functional boundaries, it should ideally transcend academic departments within a university or college. ERP integration should be coordinated among instructors, so that an entire business process could be initiated in one class and followed through in another class or analyzed in more detail. This approach would enable the students to see that a business process is really a series of events that must be coordinated for a company to be efficient and productive.

Our survey data shows that many schools that adopted ERP software do not yet integrate it across business curriculum. This failure to integrate could be the result that not enough time has yet elapsed for cross-functional curriculum to develop. Indeed, the measured correlation between extent of ERP use in the classroom (question 18) and when a school actually began using the software for instructional purposes (question 8) was significant at  $-0.433$  ( $p<.05$ ).

From a system-related viewpoint, ERP education can be characterized by the breadth of the solutions used in the program [Rosemann and Watson, 2002]. Breadth of the educational experience will increase as the involved team grows from a single faculty member to a team of faculty from different departments. When discussing breadth of ERP education, Rosemann and Watson [2002] propose several levels ranging from the lowest to the highest breadth. At the lowest level, only selected transactions are executed (e.g. entering a purchase order or running a payment process). The principal advantage of using this method is that system complexity and potential problems with inter-relationships among modules are avoided. However, this method also offers the least value to the student, because the integration capabilities of ERP are not visible. Breadth of ERP usage increases as students are exposed to an entire sub-module (e.g. accounts payable) or module (e.g. financials). Exposure to an entire module is currently the dominant use in business programs [Rosemann and Watson, 2002]. At the highest level,

utilization of an ERP can broaden to include the entire core of the ERP system, with the goal of showing true business process integration. Another perspective is to focus on extended enterprise solutions such as CRM, SCM, and e-Procurement [Rosemann and Watson, 2002].

To ascertain current pedagogical uses of ERP in the classroom, survey respondents were asked what level of breadth reflects both their school's current and desired integration of ERP. Like Rosemann and Watson's [2002] finding that the teaching of entire modules is the dominant approach in business schools, the most frequent response of our adopting schools (31%) indicated this was their school's primary pedagogical use (Table 6). In 28% of adopting schools students only execute limited transactions, reflecting the lowest level of ERP usage. Future plans for nearly half the adopting schools (47%) included teaching the entire core of ERP using a process orientation. Significant correlations were found between pedagogy (question 18) and satisfaction with vendor training and support (question 20). The higher the pedagogical breadth achieved by adopting schools, the higher the schools ranked satisfaction with training (0.426  $p < .05$ ) and vendor support (0.420  $p < .05$ ). This finding highlights the importance of a well-established alliance program in fully integrating ERP packages into curricula.

Table 6. Pedagogical Uses of ERP

	Current Integration	Desired Integration
Execute only selected transactions	28% (9)	13% (5)
Teach processes in sub-modules	16% (5)	3% (1)
Teach entire module	13% (5)	17% (6)
Teach entire ERP core	31% (11)	47% (16)
Teach extended Enterprise Systems (e.g. CRM, Supply Chain)	13% (5)	20% (7)

Nearly fifty percent (17) of adopting schools reported that only one department at their school was using ERP in the classroom. Therefore, it would stand to reason that the particular department would only teach one module. However, if the ERP team is made up of faculty from various departments, more possibilities exist for integrated curricula. One method is to use the ERP system in sequential, inter-related classes (such as accounting and operations), to augment the learning of ERP-enabled business processes incrementally. Another possibility is to design/use a comprehensive project in a semester with the joint cooperation of instructors, each instructor receiving "deliverables" from their students directed toward certain learning goals of each discipline. Introducing such a project requires coordination among instructors overseeing the project and careful planning in curriculum to ensure that all students have the necessary prerequisites/knowledge prior to participation.

**VII. CONCLUSIONS**

This paper describes the current status of ERP integration in business schools. Adopting an ERP system for classroom use is not for the "faint of heart". The time commitment alone in researching packages, arriving at a consensus, purchasing and configuring hardware and software (if implementing locally), training faculty, and developing course materials is substantial.<sup>4</sup> Only if schools are aware of the many challenges and undertake a thoughtful and directed approach to ERP dissemination within their schools can the benefits begin to accrue.

<sup>4</sup> For instance, at Bryant College, administration purchased a \$30,000 Sun Server dedicated to Oracle. To train faculty, administration hired an Oracle consultant for \$15,000 to offer several half-day workshops. In addition, a free-lance Oracle DBA was hired to install the system at a cost of \$6,000.

Overall, there seems to be an eagerness on the part of academia to embrace this technology. However, technical, operational and budgetary issues act as constraints towards this objective. As these issues diminish over time, schools will increasingly adopt ERP to provide hands-on expertise to their students. Furthermore, the application hosting concept that is now available will make it easier for more schools to integrate ERP into curricula. However, before embarking on this voyage, it is imperative that schools carefully think through the following critical issues for ERP adoption:

1. Is the ERP initiative strongly supported by the administration?
2. Is the ERP initiative supported by key faculty members, who are part of a team and dedicated to carrying the project to completion?
3. Is the college or school willing to provide adequate initial and continued financial support for the ERP initiative?
4. Which courses will involve an ERP component, and what pedagogical approach to integrating ERP into curricula will be used?
5. Who will maintain the system?
6. How will faculty be trained? Are training materials (and/or courses) available from the ERP vendor and if so how much do they cost? What is the time commitment for faculty?
7. What will be the incentive for faculty that invest time and effort into this endeavor?

### **LIMITATIONS AND FUTURE RESEARCH DIRECTIONS**

Two limitations of the study should be acknowledged. First, only three schools in our sample were non-US schools. It is well known that many international programs (e.g. in Germany and Australia) are ahead of the ERP/curriculum curve [Gable and Rosemann, 1999]; therefore, our results cannot be generalized to business programs outside the United States. Second, the authors collected much of the data at an accounting information systems research conference. Thus some of our findings (e.g., the percentage of adoptions that are championed by accounting departments) may be biased.

The current study can be extended in a number of ways. While the costs associated with an ERP implementation can easily be measured, the benefits are less clear. One study [Bradford et. al., 2002] obtained feedback from students to determine if integrating ERP into courses increased student knowledge of core concepts such as cross functional business processes and training and implementation issues. Future research could measure these dimensions on a longitudinal basis. Surveying graduates to see if their knowledge of ERP systems gained during school gave them an advantage in the workplace would also be of interest. Because the study by Bradford et. al. [2002] only measured student satisfaction with a particular ERP package, Oracle, the results cannot be generalized to all ERP packages. Future research could examine relative satisfaction with the various ERP packages available for academia.

Pedagogical issues should also be explored. A study that compares different methods and the ensuing student progress is needed so that faculty can make the best use of the software. Future research could examine the curriculum-based features of various ERP packages. A comparative analysis of competing ERP products and student feedback would be helpful in assessing the strengths and weaknesses of each product. Such an analysis would help evolve standards for best practices from a curriculum standpoint and provide a framework for product-based integration into business curriculum.

Finally, the extent of integration is a determining factor in ascertaining the quality of the value to be derived from ERP systems. Very few schools integrate ERP across disciplines. A study that highlights why progress in this area is slow and finds some resolution of the related contentious issues is essential in making integration a reality.

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EDITOR'S NOTE: The following reference list contains the address of World Wide Web pages. Readers who have the ability to access the Web directly from their computer or are reading the paper on the Web, can gain direct access to these references. Readers are warned, however, that

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## APPENDIX I. INTEGRATING ERP INTO BUSINESS CURRICULA SURVEY

**Please answer the following questions regarding your institution's integration of ERP systems into business curricula:**

1. University/College Name: \_\_\_\_\_
2. Has your school begun teaching ERP systems in business courses?  
 Undergraduate Program: Yes \_\_\_\_\_ No \_\_\_\_\_  
 Graduate Program: Yes \_\_\_\_\_ No \_\_\_\_\_

**If Yes to either program, please skip to Question # 7**

3. If your school has NOT implemented ERP software into business curricula, in your opinion, what are the reasons? (Please rank order the reasons. Number the most important reason as (1), next important reason as (2) and so forth).

Lack of interest by IS faculty \_\_\_\_\_  
 Lack of interest by non-IS faculty \_\_\_\_\_  
 Lack of interest by administration \_\_\_\_\_  
 Lack of sufficient IT support staff \_\_\_\_\_  
 Insufficient funds \_\_\_\_\_  
 Lack of knowledge by faculty \_\_\_\_\_  
 Lack of knowledge by administration \_\_\_\_\_  
 Doesn't fit with current curriculum \_\_\_\_\_  
 Other (Please list) \_\_\_\_\_

4. Is your school planning on implementing an ERP system for instructional purposes in the near future?  
 \_\_\_\_\_ Yes – we are currently implementing  
 \_\_\_\_\_ Yes – next year  
 \_\_\_\_\_ Yes – within 2-3 years  
 \_\_\_\_\_ Yes – much later down the road  
 \_\_\_\_\_ No

5. What department(s) do you think will champion the effort to integrate an ERP system into business curriculum? (Please check all that apply, putting a star (\*) next to the main champion.)

Accounting \_\_\_\_\_  
 MIS/CIS \_\_\_\_\_  
 Management \_\_\_\_\_  
 Marketing \_\_\_\_\_  
 Finance \_\_\_\_\_  
 Other \_\_\_\_\_ Describe: \_\_\_\_\_

6. Which ERP package do you think your school will adopt for instructional purposes?  
 Check all that apply.

SAP \_\_\_\_\_ Peoplesoft \_\_\_\_\_  
 J.D. Edwards \_\_\_\_\_ Other \_\_\_\_\_  
 Oracle \_\_\_\_\_ Don't Know \_\_\_\_\_

\*\*\*\*\***Stop Here. Thank you for your time.**\*\*\*\*\*

7. Which ERP package does your school use for instructional purposes? Check all that apply.  
 SAP\_\_\_\_ Oracle\_\_\_\_ Peoplesoft\_\_\_\_ J.D.Edwards\_\_\_\_  
 Other (Please describe) \_\_\_\_\_
  
8. When did your school begin actually using the ERP software for instructional purposes?  
 Month\_\_\_\_ Year \_\_\_\_\_
  
9. What departments currently integrate ERP into their courses? Please check all that apply.  
 Accounting \_\_\_ MIS/CIS \_\_\_ Management \_\_\_ Marketing \_\_\_\_\_ Finance \_\_\_\_\_  
 Other (Please describe) \_\_\_\_\_
  
10. What department(s) championed the effort to integrate an enterprise system into your school's curriculum? Please check all that apply, putting a star (\*) next to the main champion.  
 Accounting \_\_\_ MIS/CIS \_\_\_ Management \_\_\_ Marketing \_\_\_\_\_ Finance \_\_\_\_\_  
 Other (Please describe) \_\_\_\_\_
  
11. Approximately how many faculty at your school teach/use the ERP software in their courses?  
 \_\_\_\_\_ # of faculty teaching ERP
  
12. What type of training did faculty receive? Check all that apply.  
 Self taught \_\_\_\_\_  
 Technology based training – Internet \_\_\_\_\_  
 Technology based training – CD ROMs \_\_\_\_\_  
 Vendor led classes \_\_\_\_\_  
 Onsite training by consultants \_\_\_\_\_  
 Onsite training by vendor \_\_\_\_\_  
 Training by other faculty in the school \_\_\_\_\_  
 Documentation that came with software \_\_\_\_\_  
 Documentation over Internet \_\_\_\_\_  
 Other (please list) \_\_\_\_\_
  
13. On an average, how much training did faculty (who teach ERP) get?  
 \_\_\_\_\_ days
  
14. What operating system is the ERP application running on?  
 Unix \_\_\_\_\_ Windows NT \_\_\_\_\_ Linux \_\_\_\_\_
  
15. Does your school use a hosted ERP solution, or did your school actually install the package on location?  
 Hosted Solution \_\_\_\_\_ Installed on local servers \_\_\_\_\_
  
16. Rank order the costs related to the following installation components, with being the most expense to your school regarding ERP, 2 being the next most expensive and so forth.  
 Training \_\_\_\_\_ Hardware \_\_\_\_\_ Software/License Fees \_\_\_\_\_  
 Consulting \_\_\_\_\_
  
17. How much **difficulty** do you feel your school experienced with regard to installing the ERP system? (Use a scale of 1 to 5, with 5 being *most difficulty* and 1 being *least amount of difficulty* in relation to other major software packages your school has installed).  
 Difficulty with installation                      1            2            3            4            5

18. Regarding pedagogy for integrating enterprise systems into your school curriculum, which of the following methods below most describes current classroom use? Please number the main use as (1), next use as (2) and so forth.

- Execute only selected transactions (e.g., enter PO etc) \_\_\_\_\_  
 Teach processes in sub-modules (e.g., Accts Payable) \_\_\_\_\_  
 Teach entire modules (e.g., Financials) \_\_\_\_\_  
 Teach entire processes across modules (e.g., Purchase to Pay; Order to Cash) \_\_\_\_\_  
 Teach extended Enterprise Systems (e.g., CRM, Knowledge Management) \_\_\_\_\_  
 Other \_\_\_\_\_ (Please explain)
- 

19. Regarding pedagogy for integrating enterprise systems into your school curriculum, which of the following methods below describes how your school would like to integrate enterprise systems in the future? Please number the main use as (1), next use as (2) and so forth.

- Execute only selected transactions (e.g., enter PO etc) \_\_\_\_\_  
 Teach majority of processes in sub-modules (e.g., Accts Payable) \_\_\_\_\_  
 Teach entire modules (e.g., Financials) \_\_\_\_\_  
 Teach entire processes across modules (e.g., Purchase to Pay; Order to Cash) \_\_\_\_\_  
 Teach extended Enterprise Systems (e.g., CRM, Knowledge Management) \_\_\_\_\_  
 Other \_\_\_\_\_ (Please explain)
- 

20. How **satisfied** is your school with the ERP software/vendor (use a scale of 1 to 5, with 1 being least satisfied and 5 being most satisfied)

Vendor support	1	2	3	4	5
Training	1	2	3	4	5
Course material	1	2	3	4	5
Ease of use	1	2	3	4	5

21. Does your school teach a course **specifically** devoted to Enterprise Resource Planning (ERP) systems?

- Undergraduate Program: Yes \_\_\_\_\_ No \_\_\_\_\_  
 Graduate Program: Yes \_\_\_\_\_ No \_\_\_\_\_

## APPENDIX II. SCHOOLS IN SAMPLE

Abilene Christian University	Dakota State University
Anderson University	East Tennessee State University
Appalachian State University	Eastern Carolina University
Arizona State University	Eastern Illinois University
Ben Gurion University	Eastern Michigan State University
Bentley College	Emporia State University
Bond University	Florida Southern University
Brigham Young University	Florida State University
Bryant College	Georgia State University
California Polytechnic State University- San Luis Obispo	Gonzaga University
California State- San Bernardino	Grand Valley State University
California State University- Chico	Hunter College
California State University- Fullerton	Idaho State University
California State University- Los Angeles	Illinois Wesleyan University
California State University-Poly Pomona	Indiana University Northwest
Chapman University	Indiana University of Pennsylvania
	John Carroll University

Kansas State University  
Kennesaw State University  
LaSalle University  
Lehigh University  
Manhattan College  
Marietta College  
Marist College  
Mississippi State University  
Montana State University- Bozeman  
Morgan State University  
North Carolina Agricultural and Technical  
State University  
North Carolina State University  
North Dakota State University  
Northeastern University  
Northern Michigan University  
Oakland University  
Oklahoma Panhandle State University  
Pennsylvania State Great Valley  
Saginaw Valley State University  
Sanford University  
Seattle University  
Southern Illinois University  
Southern Illinois University- Edwardsville  
Southern Methodist University  
St. Edwards University  
St. Joseph's University  
State University of New York- Binghamton  
State University of New York- Geneseo  
Stephen F. Austin University  
Suffolk University  
Temple University  
Texas Christian University  
The Citadel  
The Metropolitan State College of Denver  
Truman State University  
University of Arkansas  
University of Houston  
University of Houston- Clear Lake  
University of Illinois- Chicago  
University of Illinois- Springfield  
University of Maribor  
University of Michigan- Dearborn  
University of Missouri- Columbia  
University of Nevada  
University of Nevada- Reno  
University of New Albany  
University of North Carolina- Charlotte  
University of North Carolina- Greensboro  
University of North Carolina- Wilmington  
University of North Colorado  
University of Northern Texas  
University of South Alabama  
University of Southern Florida  
University of Tennessee  
University of Wisconsin  
University of Wisconsin- Eau Claire  
University of Wisconsin- Whitewater  
University of Wyoming  
Western Illinois University  
Western State College  
Widener University

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