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Going From Data to Decisions: Preparing Students to Use Enterprise Systems

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Abstract: In the last decade one of the largest IT investments has unarguably been Enterprise Systems (ES). Evidence suggests that this trend will likely continue. In 2006 for example, the ES market had a revenue growth of over 14%–more than $28 billion. Despite the continued interest from organizations with regards to ES, many are still reluctant to adopt it. On top of the list reasons is the fact that many companies who implemented ES systems have not gained strategic competitive advantages and have only seen partial integration of transactional data. Research has attempted to explain the limited benefits achieved by some companies and one explanation is a gap between users' skills and achieving ES benefits. ES users need to be properly trained in both technical aspects of ES and integrated business processes. To close this gap, some business schools have undergone curriculum changes to include skills critical for ESs: technical skills, statistical and analytic skills, knowledge of data, knowledge of the business, and communication/partnering skills. This paper describes the efforts of a business school located in the southwest of the US to develop a five-year plan for integrating ES content into courses to help students build the five key skills for today's businesses using ES. This paper presents the five-year plan, gives detailed information about a new course, outlines the content of an ES minor, and suggests possible future curricula development.

Keywords: enterprise systems, enterprise resource planning, business curriculum, information systems curriculum

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Going from Data to Decisions: Preparing Students to use Enterprise Systems

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Abstract

In the last decade one of the largest IT investments has unarguably been Enterprise Systems (ES). Evidence suggests that this trend will likely continue. In 2006 for example, the ES market had a revenue growth of over 14%--more than $28 billion. Despite the continued interest from organizations with regards to ES, many are still reluctant to adopt it. On top of the list reasons is the fact that many companies who implemented ES systems have not gained strategic competitive advantages and have only seen partial integration of transactional data. Research has attempted to explain the limited benefits achieved by some companies and one explanation is a gap between users' skills and achieving ES benefits. ES users need to be properly trained in both technical aspects of ES as well as integrated business processes. To close this gap, some business schools have undergone curriculum changes to include skills critical for ESs: technical skills, statistical and analytic skills, knowledge of data, knowledge of the business, and communication/partnering skills. This paper describes the efforts of a business school located in the southwest of the US to develop a five-year plan for integrating ES content into courses to help students build the five key skills previously mentioned. This paper describes the five-year plan, gives detailed information about a new course, outlines the content of an ES minor, and suggests possible future curricula development.

Keywords: enterprise systems, enterprise resource planning, business curriculum, information systems curriculum

1. INTRODUCTION

Businesses have invested billions of dollars in implementing enterprise systems (ES), also referred to as enterprise resource planning (ERP). Many companies continue to invest in add-ons and tools to take advantage of ES data, such as data warehousing, data mining, and customer relationship management (Davenport, Harris, De Long, & Jacobson, 2001). ERP vendors saw a revenue growth of 14% in 2006 (Jacobson, Shepherd, D'Aquila, & Carter, 2007). Large companies nowadays consider that having an ES simply a requirement for doing business in the world today (Kumar & Van Hillegersberg, 2000). Similarly, many medium-size and small companies are also investing in ES because this software has become more affordable and is becoming compulsory in a highly networked business environment.

Despite the fact that more organizations have implemented ES, many have not

reaped the benefits, indicating that technology and data alone do not necessarily lead to better decision-making and financial benefits. Enterprise systems users not only need technical software training but other important skills (Chian-Son, 2005; Robey, Ross, & Boudreau, 2002; Willcocks & Sykes, 2000.). Davenport et al (2001) identified five key competencies organizations need to cultivate in their employees if they want managers to make data-based decisions—decisions based on the result of transforming data into information. These competencies are: technical skills, statistical and analytic skills, knowledge of data, knowledge of the business, and communication/partnering skills. *Technical skills* include knowledge of the software and the tools for extracting and manipulating data. *Statistical modeling and analytic skills* enable analysts to understand modeling and analysis constraints and make valid interpretations of results. *Knowledge of the data* is needed to understand what data is available and where within the enterprise system. *Knowledge of the business* provides the context within which people analyze and interpret data that is pertinent to decision-makers and their business. *Communication and partnering skills* enable people to combine their skills in addressing problems and questions and to communicate information effectively to various people in the organization.

These core competencies must be embedded within the organizational culture of a company; thus, they must develop these competencies in their personnel in order to get the most out of their ES. This does not mean that every employee will now have significant knowledge in all these areas but, rather, an organizational culture should be in place that supports and rewards employees who develop their skills and who also partner with others to support decision-making in the business' data-rich environment.

To close the gap between potential ES payoffs and employee skills, some universities have also shifted their focus from teaching software implementation and configuration to teaching skills that help people maximize the benefits of enterprise systems once they are already in place (Strong, Fedorowicz, Sager, Stewart, & Watson, 2006). One such case is presented here involving faculty in the department of accounting and information systems in the college of business of a university located in the southwest of the US. The university has 18,000 students on the main campus and 2,500 students in the college of business. The business college has actively worked to provide a cross-functional view of business to its students in a couple of courses. For instance, one junior-level, required course was developed and team-taught by faculty from different departments for a few years. It was dropped eventually due to scheduling problems for both the faculty team and students due to the 6-credit hour time slot.

Several faculty members believed an integrated perspective of business could be part of the curricula without the scheduling issues for a non-traditional class structure. Students could experience an integrated, process-oriented business perspective using enterprise systems (Cannon, Klein, Koste, & Magal, 2004; Strong et al., 2006) This course could also enhance the key competencies identified by Davenport et al (2001). This curricula change would better prepare students for the business world and improve their job opportunities upon graduation (Bradford, Vijayaraman, & Chandra, 2003). In fact, the faculty has received positive feedback from companies that recruit in the university on a regular basis.

This paper describes a five-year plan to integrate enterprise systems coursework into several courses and the development of an enterprise systems minor. This plan included the development of two new courses, the modification of some existing courses, and the development of an enterprise systems minor for business students. This article also describes in detail one course in terms of teaching methods used to develop key competencies for knowledge workers, regardless of their major. The implementation of this curricula plan is ongoing and in the fourth year. A few future developments are presented. The remainder of the paper is structured as follows. First, a description of the 5 year plan is presented. Second, an overview of the contents of an ERP course is outlined as means to demonstrate how ERP content is being integrated into the course work and how the key competencies are being integrated into this course. Third, the course of study for an ES minor is presented. Finally, future curriculum development and conclusions are presented.

2. ENTERPRISE SYSTEMS INTEGRATION PLAN

Initially, several of the faculty in the accounting and information systems (IS) department spent a year conducting research and collecting information about the best practices for teaching with ES. They considered the availability of software, associated costs, hosting issues, reviewed the literature, attended conferences, and invited speakers to campus to learn the best practices from peer institutions. Though a large number of universities have not adopted the use of ERP software (Bradford et al., 2003), the majority of the ones that have done so since 2000 have chosen SAP (*https://www.sdn.sap.com/irj/scn/uac*) both because of its widespread use in industry and its academic alliance program that provides software hosting and support to schools. (In the last couple of years Oracle began offering a similar program (*https://academy.oracle.com*).

A five-year plan was developed for integrating ES concepts into the curricula (*http://business.nmsu.edu/erp/*). In the first year, faculty introduced enterprise systems concepts and SAP software to existing courses: introduction to computer information systems, business information systems, business information systems for managers (graduate level), and accounting information systems. IS and Accounting faculty taught these courses. In the second year, an instructor in the management department incorporated ERP into two additional courses (operations management and electronic commerce) and new undergraduate and graduate enterprise systems courses were developed and taught. In the third year, another new course was developed called enterprise information portals and this will be taught in the fourth year. The ES minor was approved and will be an option for students starting in the fall of 2009. Also, one teacher added Oracle's E-Applications in the graduate course business information systems for managers.

The five-year plan is reviewed and revised each year. Faculty members using SAP or Oracle meet at least once a semester to discuss potential changes in their courses to improve the learning experience. Over the first three years, faculty have attended training and conferences and collected information and teaching materials they might use in their courses. At the start of the fourth year of the integration plan, faculty have plans for more changes in some courses already using enterprise systems and the addition of enterprise systems coverage in at least one other business course.

3. INTEGRATING KEY COMPETENCIES INTO AN ES COURSE

During the first year of the curriculum integration plan, a number of existing courses were modified to include or expand the coverage of enterprise systems. This process was greatly facilitated by SAP's Academic Alliance community. SAP provides training tailored to educators, hosts an annual conference, and has supported efforts by faculty at several universities to develop teaching material which is then made available to other alliance members. In the second year of the five-year plan a new course was offered that focused on enterprise resource planning and enterprise systems. At the time when this course was first offered, a business simulation using SAP called ERPsim (*http://erpsim.hec.ca*) was released to members of the SAP University Alliance. Faculty received training for the simulation prior to teaching the new course and planned for its use from the outset of the course. ERPsim was developed by professors at HEC in Quebec, Canada, and the simulation allows students to manage a business using SAP.

The content for the ERP course is:

1. Introduction to enterprise systems concepts and hands-on practice using SAP.
2. In-depth coverage of business processes with concomitant exercises using SAP.
3. Formation of teams and introduction to the business environment for the simulation.
    a. Learn about master data with exercises in SAP.
    b. Review business processes of the cash-to-cash business cycle within the context of the simulation with exercises in SAP.

4. Manage a business using SAP (execution of the simulation for five to eight quarters).

5. Presentation of business performance over the simulated quarters.

During the first weeks of the course instructors cover ES concepts and students complete detailed exercises in SAP. Most students in the ERP course have had brief exposure to SAP in the business information systems course required for all business students but it is important in this ERP course that students become much more familiar with several modules of SAP. Hands-on work is done in conjunction with lecture, discussion and course material that covers the evolution of enterprise systems, the distinction between functional areas and business processes, and the transactional data generated through business processes, (transactional data, for instance, from scheduling production, running material requirements planning and procuring raw materials for production).

Once students gain an understanding of some of the modules of SAP and how they are interrelated, they are introduced to the ERPsim game and they begin working in teams, where each team represents a company in the same market. Each instructor may take a somewhat different approach to forming teams—random, self-selected, or instructor-assigned—but there is a consistent effort to distribute students from the different business majors across the teams. Each team manages a business using SAP and the business competes with other teams. Before the simulation begins students work with additional components of SAP as they learn more about master and transactional data in their business and they review the SAP-enabled processes in their company--planning, procurement, production, and sales-to-cash.

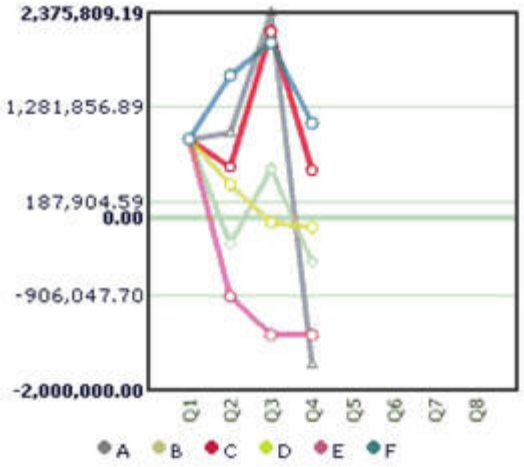
When the simulation begins, one business quarter is simulated during a class period (75 minutes). The simulation can run up to eight quarters (approximately four actual weeks in the course) but, due to time constraints, typically the simulation runs six quarters. At the end of a quarter, the simulation generates a financial summary of the businesses and their performance within the quarter and cumulatively. The teams can see the financial summary for their company and the others, similar to public financial reporting. For example, **Error! Reference source not found.** shows the profit and loss statement for six companies at the end of the 4th quarter.

Table 1. Profit and Loss Statement 4th Quarter (in thousands)

	Team A	**Team B**	**Team C**	**Team D**
Sales Revenues	1,199	2,227	4,203	5,706
Cost of Goods Sold	1,409	1,782	2,416	4,945
Other Costs				
SG & A	510	510	510	510
Prd. Imp.	750	0	471	0
Mktg	15	90	0	0
Int. Exp.	225	361	256	363
Total - Other Costs	1,501	962	1,237	873
Net Inc.	(1,711)	(517)	550	(112)

Figure 1 shows how the simulation charts the net income for each company. Having this information displayed publicly in the course engages students almost immediately in the simulation because they can see how their company compares to others. In addition to the public financial data, each student team has access to extensive transactional data for their company through the SAP software. They can view this data in SAP and export it into a spreadsheet to analyze performance measures, including material management (such as inventory turnover), marketing expenditures (such as trends in product sells in the target markets), and other performance measures.

Figure 1. Quarterly Net Income*



* Companies E and F were used by instructors and were not part of the student teams.

Incorporating the ERPsim simulation game into the ERP class has been particularly beneficial. It provides instructors more opportunities to help students develop their competency using enterprise systems and move beyond learning technical skills with ES software to a deeper knowledge of enterprise data, business processes, analysis and decision-making.

Initially, the simulation was run in consecutive class periods for approximately three weeks. The instructors quickly shifted to include some reflective "breaks" between simulation quarters. This has allowed students additional time to understand the impact of their decisions on the company performance as well as to grasp the effects of changes in the business environment (there are announcements of fluctuations in raw material costs and about world events during each quarter).

Reflective breaks after the second and third simulated quarters have given students an opportunity to discuss the transactional data and the financial data for their company. Students are encouraged to synthesize concepts and skills learned earlier in the course and achieve higher order thinking involving analysis and evaluation (Tribunella & Baroody, 2005). Students, as a team, can then make more intelligent decisions based on what they learned from analyzing the data. They decide about production: what to produce from a 12 possible items, how much to produce, whether to invest in production improvements to reduce setup times, marketing allocation expenses, and product pricing decisions. The students also make financial decisions such as whether to take out a loan and whether to pay down an existing loan (a minimum payment is always required) which will ultimately have an effect on their credit rating and interest rate. Marketing decisions deal with how much to spend and in what target markets.

Table 2. Key competencies and their coverage in the ERP course

Competency	Coverage in Course
Technical skills	• Gain significant knowledge of SAP. • Locate data within SAP. • Export data.
Statistical & analytic skills	• Learn how to glean information from SAP about particular processes • Analyze and interpret financial data. • Forecast and planning.
Knowledge of data	• Learn about master data used in the business processes. • Learn about the transactional data generated in each process.
Knowledge of the business	• Learn common business needs addressed by the enterprise system in general. • Learn specific characteristics of a business and its competitors.
Communication & partnering skills	• Work within a company (team), coordinating responsibilities and actions. • Weigh alternatives and make decisions.

The culmination of the business simulation is when each team makes a formal business presentation. The teams must provide a summary of their company's performance,

the strategy the team had, how they used the ES data, and highlights of "what went wrong" and "what went right." It is interesting to note that executives, not recruiters, from companies that hire graduates from this business college often agree to fly in attend these presentations and ask questions. This presentation is also the main grade students receive for this section of the course.

Table 2 summarizes the coverage of the key competencies in the ERP course.

In the future, instructors are considering adding more reflective time and adding a couple of short reflective writing assignments to help students articulate what they have experienced. Incorporating *reflective writing (Carroll, 2006; Wills & Clerkin, 2009)* has been shown to help students synthesize and retain what they experience. Aside from the team meetings and activities, it is important for each student to reflect and put into his/her own words what they experience managing a company, using ES software and coordinating work with others in a team.

4. ENTERPRISE SYSTEMS MINOR

In the third year of the curricula integration plan, a minor in enterprise systems was proposed and approved. The coursework in this minor gives students a cross-functional perspective of business and provides a distinction on their transcript. It is also cross-functional, with courses from accounting, information systems, management, and finance. The minor also includes two additional new courses and is appropriate for any student in the college of business. Any prerequisites for the courses in this minor, except for the ERP and EIP sequence, are courses every business student takes. Below is the coursework for this minor, which totals 18 credit hours.

- Management: Supply Chain Management or Production and Operations Management
- Accounting: Accounting Information Systems
- Information Systems: Knowledge Management and Decision Support or Management of Information Security
- Information Systems: Enterprise Resource Planning (ERP)
- Information Systems: Enterprise Information Portals (EIP). *The ERP course is the prerequisite.*
- One elective chosen from the following:
    - Management: Quality & Competitiveness: An International Perspective
    - Accounting: Cost Accounting
    - Finance: Financial Information Technology

Ideally, the sequence of coursework would have the ERP and EIP courses taken last. Students who already have the requisite courses in management, information systems, and accounting would likely gain the most when working with the ES software and ERPsim simulation that integrate business processes and cover ES decision-making support features. Many students, however, will not follow a recommended sequence of courses because of their scheduling preferences and issues. Students will still benefit from what they learn in the ERP course even if it's taken before some courses in the business functional areas. For example, the ERP course provides a good basis from which to study supply chain management in greater depth or to study cost accounting.

Approval of this minor was finalized at the end of the third year of the five-plan integration plan and is available to students starting the fall of 2009. At least initially, the greatest number of students interested in this minor is from accounting and information systems majors. It is a goal, though, to attract students from all business majors.

5. PLAN FOR FUTURE CURRICULUM DEVELOPMENT

As faculty's experience with SAP increases they continue to find ways to use the software to teach key business concepts. For example, each semester SAP and the ERPsim simulation provide master, transactional and financial data that offer a great opportunity to develop ES-related learning modules teachers in management, accounting, marketing and finance could use in their courses whether or not they choose to have students work with the software. In finance, for instance, teachers could use the quarterly financial data for each company to have

students do ratio analysis and even compare against real companies in a similar industry. In marketing, teachers could use the sales data to help students investigate what products sell well in each sector and to do price sensitivity analysis. These learning modules could be developed to teach specific objectives and they could be reused each semester but the data students use can change based on the outcome of the previous semester's simulation run.

Another opportunity for curriculum development is to include SAP's database into a module in the database management course. This module would reach students in the IS undergraduate major and the IS graduate minor. Working with SAP would be good practical experience dealing with data in such a complex, real-world database.

6. CONCLUSIONS

In this paper, we have outlined how faculty from the accounting and information systems department and one teacher from management have pursued a plan to integrate ES concepts and software into several courses. Two entirely new courses have been developed—enterprise resource planning and enterprise information portals. The ES integration plan included an ES minor and this minor was approved by the curriculum committee in the spring of 2009. The faculty members involved believe there is much more to this integration project than teaching software. The ultimate goal of this project has been to encourage students to understand the complexities of ES and develop key competencies that include technical skills, an understanding of data, analytical skills, an understanding of business processes and partnering skills that support decision-making.

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