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A FOUNDATION COURSE IN ERP AND BUSINESS PROCESSES: RATIONALE, DESIGN, AND EDUCATIONAL OUTCOMES

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Abstract

This paper provides the rationale, educational objectives, and content design for a foundation course in ERP and Business Processes. It also describes educational outcomes as measured by changes in students' self-reported levels of knowledge before and after the course. Using SAP technology, we introduced the course as a business elective into our curriculum in the spring semester of 2001. We believe this elective offers an ideal educational foundation for students and faculty pursuing Business, MIS, and ERP education.

Keywords: IS curriculum, ERP, SAP, curriculum integration

Introduction

Recent years have seen reports about the integration of ERP software into graduate and undergraduate business curricula and about the potential value of such initiatives in promoting cross-functional understanding of business processes (Becerra-Fernandez, et al., 2000; Calitz and Marais, 2001; Closs and Stank, 1999; Lau, et al., 2000). However, with few exceptions (Wagner, et al., 2000), these reports stop short of measuring educational outcomes.

The first part of this paper provides the rationale, educational objectives, and content design for an ERP and Business Processes course we have introduced into our business curriculum in the spring semester of 2001. The second part of the paper describes how we attempted to measure the educational outcomes from the course.

The intention is to share our experience in teaching this course, encourage similar curricular initiatives, and promote further measurements of educational outcomes.

Course Rationale and Objectives

The primary reasons for introducing the course to our business curriculum could be classified as both 'technology push' and 'technology pull'. On the 'pull' side, we hoped that by using ERP technology we would be able to provide our students with a concrete and better understanding of business processes. On the 'push' side, once we committed ourselves to integrating SAP into our business curriculum, we looked for a course design that would provide a foundation for future ERP-related courses while requiring a reasonable amount of preparation effort from our faculty.

This 15-weeks course combines conceptual and technical, hands-on content. Accordingly, class time in this course is divided into two major parts. In the first part, two hours of lecture time each week are used to introduce conceptual material, which is then reinforced by case studies, discussions and guest speakers. In the second part, two hours of computer lab time each week are used to expose students to concrete aspects and user-skills related to business processes and ERP software.

Main Topics

The following table uses the IS'90 Levels of Knowledge (Anonymous, 1991) to suggest prerequisite and exit competency levels for each of the main topics covered by this course. We elected to use the older IS'90 version of the DPMA model curriculum since it provides for zero entry level of knowledge.

Table 1. Educational Objectives and Competency Levels in the ERP & Business Processes Course

Topic	Competency (0 - 5)	
	Entry	Exit
Supply Chain Management	0	3
Customer-Oriented Organization and Cross-Functional Integration	0	3
Business Functionality of ERP Software (SAP)	0	3
SAP Navigation Skills	0	3
ERP Technology Overview	1	3
Sales logistics business processes	1	4
Procurement business processes	1	4
Production logistics business processes	1	4
Human Resource Management processes	1	4
Cost/Benefit in ERP Implementations	0	3
Critical Success Factors in ERP Implementations	0	3

Measuring Educational Outcomes

Several reports about the integration of ERP software into graduate and undergraduate business curricula have already been published (Becerra-Fernandez, et al., 2000; Calitz and Marais, 2001; Closs and Stank, 1999; Lau, et al., 2000). However, with few exceptions (Wagner, et al., 2000), these reports stop short of measuring educational outcomes. Since ERP-related courses require significant resource investment from teachers and administration alike, it is imperative that we collect evidence about the educational outcomes of such courses.

The main mechanism we are using to evaluate the achievement of educational objectives is a comparison of self-reported knowledge levels at the beginning of the semester to self-reported knowledge levels reported at the end of the semester. We also collected general comments from mid-term evaluations and we will use our standard course and teacher evaluation instrument as a way to compare evaluations to existing courses.

The use of students' self-reported knowledge and learning outcomes begs the question of accuracy. However, there are no standard ERP and Business Processes knowledge instruments and the use of self-reported performance measures, such as GPA and SAT scores, is common practice in educational research. Several studies show that such self-reported measures tend to be accurate (Benton, 1980; Cassady, 2001). Furthermore, the problem of inflated self-reported data for reasons such as social desirability (Dobbins, et al., 1993; Shepperd, 1993) may be alleviated by the focus on measuring change, rather than absolute level, in self-reported knowledge before and after the course. Still, self-reporting is a problematic approach to measurement (Collopy, 1996; Straub, et al., 1995) and we should strive to develop more direct instruments for measuring attainment of educational objectives in our courses.

Start of Semester Evaluation

The start-of-semester questionnaire consisted of student classification by semester standing and major and eleven knowledge assessment questions. The questions required students to respond to a Likert-type scale ranging from '1' to '7' with '1' designated as "Strongly Disagree" to '7' indicating "Strongly Agree".

The entire class was composed of MIS students, though the course was open to all majors. Most students were seniors, reflecting their ability to register earlier and the fact that this first-time course offering was extremely popular.

Table 2 represents summary information compiled from the questionnaires.

As expected, the questionnaire results indicate low entry-level knowledge in the targeted areas. The majority of students do not understand the limitations, risks and the implementation challenges of ERP systems. Data also indicated the majority of students could not explain business processes from both a general and a detailed perspective. Student responses were mixed from "neutral" to "strongly agree" when asked if they would like to be involved with implementing technology solutions to support business processes.

Table 2. Entry-Level Knowledge in the ERP Course

	Knowledge Area	Strongly Disagree		Neutral			Strongly Agree		Mean
		1	2	3	4	5	6	7	
1	I can explain what Enterprise Resource Planning (ERP) systems are.	13	6	2	4	3	0	1	2.4
2	I can explain the benefits of ERP Systems	12	10	2	2	1	2	0	2.2
3	I can explain the limitations and risks of ERP systems.	14	13	1	0	0	1	0	1.7
4	I can explain the implementation challenges of ERP systems.	16	10	2	0	1	0	0	1.6
5	I can explain how major business processes such as Human Resources, Sales, Production and Procurement work.	11	5	3	6	3	1	0	2.6
6	I can explain terms in Sales Logistics processing such as picking, consignment goods or a request for quotation.	13	9	3	3	0	1	0	2.0
7	I can explain terms in Production Logistics processing such as MRP, Bill of Material or capacity planning.	10	9	4	2	3	0	1	2.4
8	I can explain terms in Procurement Logistics processing such as service purchase order, subcontracting or a raw material part.	12	9	2	3	2	1	0	2.2
9	I can explain terms in Human Resource Management processing such as performance appraisal, event management and career planning.	10	7	3	4	4	1	0	2.6
10	I can explain how major business processes such as Human Resources, Sales, Logistics, Production and Procurement are supported by information systems.	9	7	2	6	4	1	0	2.7
11	I would like to be involved in processes of implementing information technology solutions to support business processes.	1	4	2	7	4	1	10	4.8

Table 3. Knowledge Comparison in the ERP Course

Knowledge Area		Start of Semester Mean	End of Semester Mean	Paired t-test Significance (α)
1	I can explain what Enterprise Resource Planning (ERP) systems are.	2.4	5.97	0%
2	I can explain the benefits of ERP Systems	2.2	5.79	0%
3	I can explain the limitations and risks of ERP systems.	1.7	5.97	0%
4	I can explain the implementation challenges of ERP systems.	1.6	6.00	0%
5	I can explain how major business processes such as Human Resources, Sales, Production and Procurement work.	2.6	5.59	0%
6	I can explain terms in Sales Logistics processing such as picking, consignment goods or a request for quotation.	2.0	5.59	0%
7	I can explain terms in Production Logistics processing such as MRP, Bill of Material or capacity planning.	2.4	5.83	0%
8	I can explain terms in Procurement Logistics processing such as service purchase order, subcontracting or a raw material part.	2.2	5.76	0%
9	I can explain terms in Human Resource Management processing such as performance appraisal, event management and career planning.	2.6	5.72	0%
10	I can explain how major business processes such as Human Resources, Sales, Logistics, Production and Procurement are supported by information systems.	2.7	5.86	0%
11	I would like to be involved in processes of implementing information technology solutions to support business processes.	4.8	5.38	2.1%

End of Semester Evaluation

By repeating the same questionnaire at the end of the semester we were able to contrast entry and exit-levels of knowledge as self-reported by the students. Table 3 summarizes our findings.

All areas of knowledge showed statistically significant increases in self-reported knowledge. The findings for all 10 questions related to knowledge levels were quite similar, showing an increase from an average of 2.2 to an average of 5.8 on a scale of 1 to 7. Question 11 showed a small but statistically significant increase in students interest in the domain.

We were surprised by the exit level response for the Sales Logistics question (#6). We expected higher levels of self-reported knowledge for the Sales Logistics area since it seems more understandable. This may have been caused by the wording of the question and the reference “consignment goods,” which were only briefly discussed in the course.

Student Comments

As part of the midterm examinations, we requested students to provide written comments and observations about the course. The following list provides a typical sample of comments:

- Integration of the business functions is the real benefit of ERP.
- I have learned a lot about how manufacturing processes work and all steps that are followed for a product to be made.
- There is a lot to ERP. Businesses don't just order product and sell.
- SAP can be best utilized in a company if their business processes are both understood and streamlined.
- SAP is not always successful when implemented because it takes skilled people to implement it. Without a skilled consultant, a company may run into many unforeseen problems.
- ERP can help and hinder an organization. A poor implementation can do more harm than good.
- I have learned all of the steps required to process a sale to a customer, from pre-sales all the way to billing, as well as the importance of process chains.

These comments seem to reflect positive but realistic views about the course and ERP software.

Written end-of-semester comments indicate students would like more hands-on navigation exercises using SAP and more guest speakers. Some students believed an operations management course should be a prerequisite to the course. These students believed their operations management background helped them understand business processes. Some students felt that lab time should be shortened from 2½ hours to 1½ hours and classes should meet three times per week rather than just two.

Student Performance on Assignments and Tests

In general, the overall performance of the class on individual assignments and tests was good. In particular, students did well on case study assignments, business process projects and navigation exercises. We believe the reason for their high performance in case study assignments was that students could relate to studies of how ERP was approached in well-known companies. Another reason for high student performance in the class was that individual and team projects were designed to actively involve students in learning and teaching other students.

Surprisingly, sophomores performed significantly better than juniors or seniors on the two mid-semester exams though their scores were slightly lower than average on the final exam. Questions for the mid-semester exams were taken directly from the textbook while for the final exam students had to answer essay questions on business process situations. This may explain why juniors and seniors performed better on the final exam.

Teaching the Course

Course Preparation and Design

Since the course objective was to combine ERP software knowledge with business process understanding we decided to select key business processes that are significant in various types of businesses. Sales, Production, Procurement and Human Resources were chosen because they represent primary or supporting activities of the value chain.

The selection of a textbook was time consuming because the content not only had to support the course objective of understanding and describing business processes but also contain pertinent material related to SAP. Curran and Ladd's textbook (Curran and Ladd, 2000) entitled "SAP R/3 Business Blueprint" satisfied the requirement by providing an explanation of SAP's business processes in common business terms.

Attendance at three SAP training courses provided baseline knowledge of SAP's business solutions and is highly recommended as preparation for teaching this course. We are aware of several cases where attempts to teach similar courses were frustrated by lack of similar preparation. The first entry-level training course, SAP50 – Basis Technology, presented an overview of SAP's basic technology and business framework architecture. A second entry-level training course, SAP20 – SAP R/3 Overview, identified examples of business integration scenarios in Logistics, Accounting, Human Resources and Procurement. A third course, LO150 – Processes in Sales and Distribution, provided a 5-day, in-depth understanding of the business processes involved in Sales and Distribution. In addition to these training seminars, preparation for teaching the course included reading of various SAP reference manuals and completion of SAP navigation and application tutorials.

Course time was divided into lectures and computer labs. Lectures primarily focused on ERP concepts and business processes while computer labs were used to provide hands-on exposure to the SAP software and demonstrate concepts explained in the lectures.

Course assignments included individual readings, case study analysis, navigation exercises and group projects. Readings and case study assignments stressed information gathering on how companies select and implement ERP solutions. Students were given hands-on assignments, utilizing SAP enterprise software, to demonstrate their understanding of business processes. Group projects required student teams to study, present, and demonstrate process overviews to other students in the class. The teams also administered class exercises and answered student questions on the exercises.

Students earned individual grades for take-home and class quizzes, exams and class participation. Take-home and class quizzes required students to demonstrate they had read and understood the material in assigned chapters and class notes. Two mid-semester exams and one final exam were given in the course. The final exam was divided into two parts: 1) Hands-on lab exam focused on SAP navigation skills and 2) Comprehensive essay exam requiring students to discuss and reason about specific business process situations.

Insights from Teaching the Course

Once a week, the students report to a computer lab where they access the SAP system to complete lab exercises. During the first four weeks of the course, the students experienced response time delays of 5-10 minutes to retrieve screens in the SAP system.

After some investigation, it was decided to upgrade and tune the SAP's Internet Transaction Software (ITS) software using the second and current 4.6D release. The initial release of ITS did not allow for tuning and actually allowed too many students concurrent access to the system causing queuing problems. After upgrading the software and taking advantage of the tuning capabilities built into the software, response time was significantly improved to an acceptable level.

A new problem surfaced in the final lab of the course. While working with the SAP software, students were frequently disconnected and had to restart their session. The problem was traced back to an undocumented error in the Internet Transaction Server. The short-term fix was to bring down and restart the server. The long-term solution is still outstanding and hopefully would be addressed prior to next semester.

It was evident from the first lab exercise that students enjoy hands-on assignments and projects using the SAP software. By completing exercises within each business process, they were able to gain an understanding of how business processes interface with other business processes.

Students found that mastering the navigation and operational skills of using the SAP software is very rewarding but also frustrating. They appreciate the power provided by this type of software and the effect it has on converting vague concepts into concrete operational aspects such as data entry screens, data elements, and reports. While the acquisition of these skills is rewarding and rapid, there are a few trouble spots. In particular, students frequently are at a loss when SAP branches from known screens to unknown ones due to complex business logic.

We highly recommend the use of guest speakers in such a course. Students enjoy listening to professionals who have been involved directly with implementing ERP systems. The speakers have shared real-life experiences and insights related to ERP implementations and their impact on business processes.

A very rewarding aspect of the course is observing how students eventually realize the importance of business processes and how the processes relate to one another. We can see a “light bulb” turn on when students realize how each process within the business relates to other functions in an organization.

In comparing seniors to juniors and sophomores in the class, seniors tend to grasp business processes better than the juniors and sophomores. This is understandable because many of the senior students have taken courses such as Operations Management, which explain cross-functional integration issues (e.g., link between Sales and Production Logistics).

Another rewarding aspect of teaching the course is the high level of student attendance, participation, and motivation. Because the majority of students in the class are seniors, many have completed their internships or have worked in business. As a result, they are willing to express their opinions and offer insights and relate personal experiences. Students seem to realize the value and relevance of the material covered by the course.

In future semesters, we plan to provide more SAP exercises. These lab exercises not only improved the students’ navigation skills but also promoted teamwork and active learning.

Even though many students had previous business experience, we realized they did not understand basic business terms or process flow. Students had difficulty grasping how business processes interfaced between functional units in an organization. We discovered that commonly used terms in business (e.g. Bill of Material structures) were unfamiliar to most students and class time was needed to explain and review basic terminology used in a business environment.

Conclusions

The ERP and Business Processes course offers an efficient and effective foundation for MIS and business students. It is also an ideal entry point for preparing faculty members to teach other ERP-related courses. We hope this article prompts other universities to introduce and evaluate the educational outcomes of similar electives in their business education programs.

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