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INCORPORATING BUSINESS PROCESSES AND FUNCTIONS: ADDRESSING THE MISSING ELEMENT IN INFORMATION SYSTEMS EDUCATION

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ABSTRACT

This paper reviews a gap in information systems education today, the lack of education and training in business functions and processes. A number of researchers published in both the popular press and the peer-reviewed journals have noted the need for understanding of business processes by information technology professionals. But little work has been done on the incorporation of these needed skills into the curriculum. Specifically, the IS 2002 model curriculum makes little mention of the skills. The author describes a tested approach to imparting these needed skills into a portion of a general Information and Organization course. Included are detailed examples of frameworks and exercises to incorporate business process education into an information technology course.

Key words: business process, information systems education, business functions

INTRODUCTION

Information systems exist to serve business or other organizational objectives. In information systems education, significant amounts of time are spent on a variety of topics including systems analysis and design, project management, databases, networking, and programming. But little time is spent on one of the major areas of information systems work, business problem solving and in particular, business functions and processes. The author has recognized through teaching a variety of courses from systems analysis and design through enterprise resource planning that students do not gain an understanding of underlying business functions and processes anywhere in a typical information science or systems curriculum. Without this understanding, today's students cannot become effective and productive information technology workers. Without this knowledge, graduates cannot solve business problems and become more vulnerable to commoditization of their skills and subsequent off-shoring of their work. Understanding business processes and functions is the missing element in information systems (IS) education today. With increased outsourcing of difficult and labor-intensive programming efforts, the role of the US information technologist has changed. No longer is it sufficient to have strong technical skills. These technical skills have been mastered by foreign nationals in countries such as India, the Philippines, and Singapore and these new technical professionals work for less money often with higher quality. Technical jobs that will return after the dot com bust will be different from prior periods (11). Technical skills remain important. But these skills must be coupled with strong business understanding and problem-solving abilities. For the most part education in these business fundamentals has been left outside the information systems department. These skills were not viewed as an essential part of the curriculum. These views must change for the development of future information technology professionals. Only with knowledge of business skills can our graduates survive and flourish in the "new" new economy.

This paper presents a literature review of the importance of business functions, processes, and acumen for information technology graduates. The importance of these skills is summarized and a tested and effective approach to addressing this missing element is presented. Specific business function and processes exercises and approaches are reviewed resulting in a comprehensive approach to business process education for the information systems/technology student.

LITERATURE REVIEW

The importance of business skills for an information technology professional has long been recognized as important. Weston (24) reports on the importance of "business savvy." He recaps a survey of 150 CIOs from Fortune 1000 companies that notes 85% of the CIOs are looking for business acumen. Wagner (22) notes that narrow programming skills are insufficient in the job market. Business rules and the use of the Internet as a business tool are necessary for successful job placement. Employers are looking for technologists who can "use" tools and "create content." He notes that at one company "an understanding of business processes is already considered vital."

The 1999 InfoWorld compensation survey (1) examines the advantages to information technology professionals in combining both business and technology skills. The survey notes that "business skills pay off." For all categories of IT professional - senior management, middle management, and staff - salaries are higher for those who focus on both business and technology, compared to technology alone. Improved earnings ranged from 1.3 percent to 8.8 percent. The dual-focused professionals also received higher salary increases, supervised more employees, had higher budget responsibility, and had higher job satisfaction.

Tobias (20) interviewed CIOs and recorded their thoughts on IT education and current skills. They suggested that IT schools were teaching how to code but not "how to use technology to affect the bottom line." Graduates do not understand business processes and outcomes. Even hard core programmers such as game designers need the ability to work

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within an organizational structure and collaborate with marketing groups (16). Betts (3) suggests that the focus for electronic commerce applications needs to be on "basic business principles." Usability and marketing, and soft business skills, will differentiate the successful from the unsuccessful firm.

Competition for information technology jobs remains intense. King (14) notes that in 2001 2.1 million IT workers were hired but 2.6 million were fired resulting in a net loss of 500,000 workers. The most important factor in interviewing IT workers is "specific industry and technical experience," not technical certifications. King (15) also suggests that in developing your resume, you should "describe your skills in business terms." Melymuka (17) writes that three-fourths of US firms will face shortages of qualified IT workers but notes the need for business process skills. "IT workers well-versed in how applications uphold business processes possess skills that cannot be outsourced." Currently the California Employment Development Department is suggesting that the IT industry in California will have a rebirth by the end of the decade but will require integration of IT into business operations. Future employees must understand business, the particular industry, working within an organization, and business needs analysis. Outsourcing of labor-intensive programming jobs will require new IT workers to understand business and the use of IT tools to solve business problems (11). The need for business skills even was prominent in the popular press as far back as 1994. Garner (7) urges IT professionals to emphasize their soft skills including team-building, communication, decision-making, and understanding business functions.

One of the major efforts regarding business expectation of information technology graduates was performed by Trauth, Farwell, and Lee (21). The authors surveyed Information Systems managers and IS professors and found that the largest gap between academic emphasis and expectations of IS managers was in integration and management. The authors define integration as "the ability to link BUSINESS PROCESSES through integrating technology, data and applications" (emphasis mine). The authors also conclude that "IS professionals must have a solid understanding of the business areas."

Some of the significant educational research on incorporating business processes into curricula has been in the business and accounting areas. Walker and Ainsworth (23) suggest that business schools are not teaching the proper skills and graduates are "inadequately prepared for a cross-functional world." The authors suggest a cross-functional approach to business education. David, Maccracken, and Reckers (5) developed an approach to teaching accounting that involves "fundamental understanding of how businesses operate within new and traditional business models." Wong (25) reviewed the education of IS professionals in Hong Kong and found that although there is a strong overall need for IS skills, "to be really useful, these people need to realize the importance of business functions and understand how IT can be applied to enhance business objectives." Currently most IS students do not have any training in business objectives.

Although professing the need for business knowledge, the IS model curriculum jointly developed by the three major information systems organizations - Association for Computing Machinery (ACM), Association for Information Systems (AIS), Association of Information Technology Professionals (AITP) - does not specifically fit business functions or processes into the coursework. Business process is only mentioned three times in the IS 2002 model curriculum (8)

1. New electronic business strategy course scope
2. In the scope definition of information systems
3. In Table 2. Representative Capabilities and Knowledge Expected for IS Program Graduates

There is no other specific mention of business process in the 60 page document. Likewise business function is mentioned 3 times but all in the overview section. A need is noted but the teaching of business fundamentals is left to business departments.

The inclusion of business process and business functional processes in information technology programs has had limited discussion in the literature. One of the few articles discussing the issue is Ramiller (18), "Animating the Concept of Business Process in the Core Course in Information Systems." The author reviews the current state of information systems textbooks and courses and suggests that nearly all courses deal with a hodgepodge of topics which have no cohesive theme. The courses have no "binding ingredient" and end up disjointed and unorganized. The author proposes binding together these diverse topics through the concept of business processes. The author proposes the use of Alter's WCA (Work Centered Analysis) framework to coordinate all the elements of business processes including not just technology, participants, and information. The processes are discussed utilizing the architecture (technology, participants, and information) as well as the infrastructure and context.

Most of the other pedagogical articles dealing with business process deal with the issue as part of an overall discussion of enterprise resource planning systems, due to the central nature that business process plays in their design and implementation. An example of the role of business processes in ERP is illustrated in Hawking and McCarthy (9). The authors review three different factors in ERP education:

- Emphasis on instruction and training in a specific ERP system.
- Review of overall business processes using an ERP system to illustrate and develop skills.
- Selection, implementation, and benefits of ERP systems.

Chrysler (4) suggests that the role appropriate for systems analysts is other-directed involving the user more in systems design. The analyst would need to understand business processes since the analyst assists the user in making business decisions. Kim (12) discusses the importance and challenges of business process reengineering (BPR). He suggests that most BPR projects have been based on heuristics instead of a comprehensive methodology. The stages proposed by Kim included

- Envision
- Definition
- Diagnosis
- Design
- Implementation

The author provides tasks, deliverables, critical success factors, and modeling tools for each of the stages. The information systems group is prominently displayed in the solution, yet few information systems provide knowledge or skills necessary to perform these functions. Kim and Peterson (13) do not list any topics resembling business processes in their "Five Subject Areas for An Introductory MIS Course" table.

The concept of understanding business processes does seem to be supported in an upper-level course by Adelkoya and Rowe (2). Their study suggests that the number one learning objective of an upper-level MIS course is to "understand the application of Information Technology to various functional Business Systems." Hingorani and Sankar (10) note that the

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number three skill (out of twenty) that industry requires is business knowledge and skills. Russo (19) found that the number four and number one tasks noted by educators for systems analysis and design courses are analyzing existing systems and defining new systems requirements, respectively. But nowhere in the list is mention made of the backbone behind these tasks, business functions and processes.

AN APPROACH TO TEACHING BUSINESS FUNCTIONS AND PROCESSES

When the author first taught an enterprise resource planning (ERP), specifically SAP R/3, an attempt was made to work directly through modules and exercises. Surprisingly the efforts were nearly a complete failure. After exploring the issue with the students, it was determined that the number one reason for their failure to understand ERP was their total unfamiliarity with business functions and processes. Many students had no understanding of what an invoice was or accounts payable or purchase orders. Most had vague understanding of marketing and production and almost no understanding of accounting or finance. It was clear that before a topic such as ERP could be started a major effort would be necessary to increase students' knowledge of business fundamentals. The result of this recognition was the design and development of the content for IST 301, a fall junior year course for all Information Science and Technology students that would include as a major component, an overview and application of business functions and processes relevant and accessible to information technology students.

In partial recognition of the need for business skills, this new course was added to the Information Sciences and Technology curriculum at Penn State University. Officially the course is IST 301, a junior level course titled, Information and Organizations. The course is a three credit course and has as its description "Overview of organizational structures and functions. Includes information processing and analytic perspectives of organizations." The prerequisites for the course are: IST 210, a basic database course, and IST 220, a networking and telecommunications course.

The course was first offered in the fall of 2003. I taught two sections of the course and I used the business process deficiency as my main motivation for content development. I realized that most students would never take any management, business, or marketing course and yet when they graduated they were expected to not only successfully function in a business, but also to design and develop effective information systems to handle all business problems. I brought my 25 years of practical experience as well as my MBA and tried to develop a course that would include teaching the students the basics of business and organizations with an information technology perspective.

I have found that Information Technology students primarily learn best by the "learn by doing" approach. In addition, analyzing problems are what attracts most students to information technology in the first place. The main components of my course were thus going to be

- Limited lecture
- Hands-on problem solving
- Real world case studies

In addition, I searched for a business simulation game that would require students to make common business functional and process decisions such as advertising expenditures, production planning, and employee hiring. A good simple yet competitive game was found with Mike's Bikes.

The first part of developing this course content was to develop overall course objectives. These related objectives included that the student upon completion of the course would be able to successfully:

- Describe modern business processes through systems and software.
- Evaluate business process and functional paradigms and select and implement the appropriate one for your organization.
- Evaluate various business tools and techniques and implement the specific techniques in your organization.
- Coordinate and manage a management team in practice.
- Examine corporate structure and key indicators and determine current status of the business relative to its competitors.
- Describe an organizational structure for a business and describe HR systems and software.
- Detail functional business areas including marketing, finance, and production to devise systems solutions.

The textbook chosen was Ferrell, O. and Hirt, G. (2003) Business: A Changing World 4th edition. McGraw-Hill Irwin bundled with Mike's Bikes Advanced software, ISBN 0-07-4189115. The book combined simple and accessible business and business function education with ample text and video case studies. One of the cases extensively used was Starbuck's (6). A video case study presents all the major issues associated with Starbuck's and served as an introduction for many class exercises and assignments. The required software for the course was only Microsoft Office including Microsoft Access as well as MS Visio for charting.

ASSIGNMENTS

There were many specific assignments that reinforced the lecture and textbook knowledge of business functions and processes. Some of the general directions provided included the following.

> During the semester, students will work individually and in teams on specific projects. Students will be required to research topics beyond those covered in their course texts to complete many project requirements. Significant time may be required outside of formal class to meet assignment and project requirements. Students will be required to evaluate themselves and fellow team members in team projects. Grades for projects will be based on the successful completion of stated project criteria, student evaluation feedback, and instructor evaluation. At the end of a project, students will be required to make a formal presentation about results of their work, problems encountered, and their approach to solving the problem. In IST 301 there will be 2 projects. The first will be a business simulation term project requiring the use of Mike's Bikes Advanced software. The second project will be the study of a specific Management and Information concept and include development of a written report of at least 5 pages double spaced, font 12 Times New Roman, standard margins as well as a 15 minute PowerPoint presentation of the results. This project will be based on complexity, creativity, organization and proper writing and presentation. The written report must be in APA format.

There was a significant number of writing assignments in the course. The general grading rubric for these assignments included evaluation of

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- Mechanics of writing, APA style, grammar, punctuation
- Organization and structure
- Creativity and/or insight
- Demonstrates knowledge.

The full course syllabus is highlighted in Figure 1. As can be seen, the course progressed through the major business functional areas, combined these into processes and flows and finally demonstrated these functions and processes in a hands-on overview of SAP R/3, the Enterprise Resource Planning (ERP) package. In order to understand business analysis and problems, tests included critical components of business and business process knowledge and assignments were geared to practical application areas.

FIGURE 1
Course Syllabus

Week	Topic	Readings	Cases	Mikes
Week 1 Sep 3	Intro to mgmt	F1	Starbucks	
Week 2 Sep 8, 10	Intro, Intro to Mikes Bikes		Hershey Foods	Strategy
Week 3 Sep 15, 17	Human resources	F11	Von Maur, e-Quality	Org. Behavior
Week 4, Sep 22, 24	Accounting	F14	Many Purposes of Accounting Statements	Accounting
Week 5 Sep 29, Oct 1	Accounting, Test 1		Dana Fashions	
Week 6 Oct 6, 8	Marketing	F12	E-Commerce	Marketing
Week 7 Oct 13, 15	Team Project Workday, Marketing	F13	Red River	
Week 8 Oct 20, 22	Production	F9	Alton Bridge, McDougal	
Week 9 Oct 27, 29	Production, Test 2			Operations
Week 10 Nov 3, 5	Teamwork, Motivation	F8		
Week 11 Nov 10, 12	Motivation, Processes and Flows	F10, 7	Bagel and Bread	Product Development
Week 12 Nov 17, 19	Processes and Flows, Test 3	Appendix C	Southwest	Finance
Week 13 Nov 24	E-business	F4	Metamor	
Week 14 Dec 1, 3	International Business, SAP	F4, 3	APL	
Week 15 Dec 8, 10	Presentations	Readings		
Final				

In order to reinforce understanding of financial terminology, an assignment required students to analyze the content of Starbuck's financial statements. The specific assignment was:

> Please prepare a minimum 3 page analysis of Starbuck's financial statements, posted in ANGEL. The report will be graded based on the syllabus rubric and should emphasize balance sheet and income statement. The report is due October 20, prior to class. Please place an electronic copy in ANGEL and bring a paper copy to class and be prepared to discuss.

In a later assignment business process functional and process knowledge was put to the test as the students were exposed to SAP R/3 and then asked to explore the system and map the business functions and processes to the SAP modules. The assignment was:

> Please prepare a Visio diagram of major business functions as presented in the SAP hierarchy. You should have a minimum of 10 functions and three organizational levels.

One of the most interesting and fun experiences for the students was the Mike's Bikes business simulation. Mike's Bikes is a single or multi-player business simulation where the user assumes the role of a bicycle manufacturer. In the single player mode, the user competes against the computer and participates in two market segments (Leisure and Adventurer) and competes against one other competitor. In the multi-player version the game is online and students compete against each other with up to five competitors and five market segments. In my first experience, the online version of the simulation was used with five market segments and five competitors. There were two sections of the class and each competed in their own world. The manufacturer of this simulation is SmartSims and they did the hosting of the multi-player simulation. Rollovers were scheduled weekly and reflected a year in the life of the firm. The teams made their decisions during the week, entered their actions and when the system rolled over, and were able to see the results of their decisions as reflected against their competitors.

The decisions that had to be made involved all phases of business activities including

- Marketing – pricing, advertising, media selection and promotion
- Production – production levels, shifts, training, batch size, maintenance, and inspection
- Logistics – inventory levels, distribution channel support
- Finance – cash flow, debt and equity decisions, investor relations
- Development – new product design and development,

The overall goal of the game was the same as any publicly traded company, to maximize shareholder value. The final assignment required:

> Please place full report on Mike's Bikes here. Include

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an appendix that has one page for each team member and their participation and activities. The body of the report should generally include initial strategy, decisions made, reactions to competition, understanding and reaction to reports, lessons learned, what you would have done differently, and overall assessment of your performance.

Another project that required students to apply their organizational knowledge is presented below.

> Prepare a three page report with references that reviews various organizational structures used to manage information technology departments in organizations. Organizational charts are encouraged.

One of the projects that highlighted Starbuck's was to analyze the company based on Porter's five competitive forces of bargaining power of buyers, bargaining power of suppliers, threat of new entries, threat of substitute products, and competitive rivalry.

> Prepare an analysis of Starbuck's based on Porter's 5 competitive forces. Please include thoughts on IT.

A project that focused on the organizational process aspects of information technology was also included.

> Prepare a list of at least 10 processes in the human resources function where information technology would play a significant role. Describe that role. I would expect this to be at least 2 pages of double space, font 12, Times New Roman length.

FEEDBACK AND LESSONS LEARNED

Overall the course was successful particularly for its first offering. The course was rated a 5.1 on a scale of 1 to 7 and many positive comments were generated from the students. Most provided feedback that they found it to be worthwhile and useful. There were many lessons learned from the process as well that will be incorporated into future versions of the course. These lessons follow.

Both basic business knowledge and business function and process knowledge are essential.

The popular and scholarly literature as noted is full of the plea from practitioners for IT workers to understand business and its processes. Without this knowledge, IT workers cannot understand user needs nor create successful systems. It is little wonder then that 50-70% of all IT projects still fail.

Basic business knowledge is missing in IT education.

Most IT programs have no room in their curricula to focus significant efforts on business functions and processes. The author discovered an abysmal lack of general business knowledge when he first attempted to teach ERP to senior level students. Unfortunately, most students had no knowledge of business process and most did not even know simple business artifacts such as invoices and accounts payable. Most IT programs assume that the student will pick up this knowledge and skills elsewhere either through a cognate type course or through on the job training. This is unwise and unreliable. IT students as the literature has suggested need business knowledge and are not receiving it now.

IT students learn business best by doing.

IT students understand and are used to learning through the process of actually performing activities. They learn networking, programming, and design all by actually performing the IT activities. In order to understand business, IT students performed best when they were actually performing exercises and activities that reinforced business concepts and knowledge. The author incorporated financial analysis, hands-on SAP, organizational analysis, as well as business simulation to provide these hands-on opportunities.

Business simulation is useful.

Students needed to obtain some way of understanding all the issues and input that are necessary to comprehend in a real business situation. It is one thing to understand general business concepts. It is entirely another to understand why these concepts are actually important in a live business setting. The simulation, though still somewhat artificial, provided an environment where IT students can understand all the issues that make up business decisions. In addition, the software used allowed dynamic real competition that fostered competitive strategy as well as a high interest level in the process. The business simulation was far and away the most engaging of all the activities that the author has incorporated in his classes.

Case study analysis fosters understanding.

Video and text case studies were extensively used to provide a grounding of concepts and simulations in actual real world businesses. The case studies were a bridge between the text and the simulation and the real world the students must soon face.

IT students learn business best with businesses they know.

A great deal of work was performed on two companies, Starbuck's and McDonald's. Everyone is familiar with the basic businesses of these companies so more time could be spent exploring the business functions and processes that these businesses deal with.

CONCLUSION

This report is a review of the literature and a discovery of the need for business process education and development. The author has outlined his approach for dealing with the shortfall in IT education. Further work is necessary to expand on this discovery. Detailed survey work and case study analysis can provide a more comprehensive template for the exact skills that are needed in industry. The author is preparing a comprehensive study to document the specific skills that are lacking in IT education today. Once more fully identified, work can begin on how best to incorporate these specifics into an IS/IT education program. This study is underway and will be reported when completed.

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