

Bridging the Gap between Business and Information Systems ERP-based Curricula to Achieve Improved Business Process Learning Outcomes

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Abstract

University administrators and faculty continue to struggle to respond to dynamic structural changes in business environments. Global marketplaces and supply chains extend management of internal cross-functional interactions and relationships to their external equivalents. Critical throughout is the flow of accurate, reliable, and timely data. Concurrently, the evolution of Enterprise System software has challenged university faculty: to what degree should such software be integrated into their curricula? In the world of information systems, information management, knowledge management, etc., the answer is to a significant degree. The conclusion is not as clear when the frame of reference is a business discipline: accounting, finance, human resources, management, marketing, or operations. We explore these two primary issues by reviewing the factors that drive curriculum integration, ERP integration work to date, and the challenges to faculty and ERP developers. Inherent in using ERP to *facilitate* curriculum integration are accreditation and assessment requirements, organizational structural issues, technical support, faculty needs and rewards, business demands, and employment market realities. Achieving success demands challenging the status quo, stimulating inquiry, collaborating with software developers, and accepting disruptive change in higher education.

INTRODUCTION

For at least the past decade, university administrators and faculty have struggled to respond to hyper-dynamic structural changes in business environments. Organizational structures have evolved from the classical hierarchy of independent functional components that frequently led to dysfunctional internal competition to flattened horizontal structures that facilitate interaction and cooperation. Global marketplaces have led to the evolution of supply chain management, a truly integrative paradigm that extends management of internal cross-functional interactions and relationships to their external equivalents. Critical throughout is the flow of accurate, reliable, and timely data and application platforms that facilitate their transformation to function-, environment-, business-, and opportunity-specific information to support best-practice decision processes. Unfortunately, higher education, in particular colleges of business, has been slow to respond, bound instead to half-century-old organizational models of functional structures that continue to “package” business education into functional segments, frequently with little management for consistency, reinforcement, and assessment of market-ready learning outcomes. AACSB, the primary accrediting body for business schools, emphasized the need for change in its report, *Management Education at Risk* (AACSB, 2002):

“Boundary-spanning content, alternative pedagogical approaches, diversity of participants and deliverers, and, ultimately, *business school structures* would evolve from closer discourse between schools and their business and local market constituencies.” (p. 27, italics added)

Concurrently, the evolution of Enterprise System software (generically referred to as ERP), in response to the organizational and environmental changes and their derivative needs, has challenged university faculty: to what degree should such software be integrated into their curricula? The response depends on frame of reference. Clearly, in the world of information systems, information management, knowledge management, etc., the answer is to a significant degree. Whether addressing development, structural, and integrative issues or application and deployment issues, these disciplines require their students to have significant knowledge about how ERP *works*. The conclusion is not as clear, however, when the frame of reference is a business discipline: accounting, finance, human resources, management, marketing, or operations. Faculty in these functional specialties tend to focus on concepts and applications restricted to their expertise. Accounting faculty emphasize financial transactions and record keeping; marketing faculty focus on customer relationships and channels of distribution; operations faculty stress process orientation and resource allocation optimization. Supported (and rewarded) by the standardized functional structure, there may be little value, at least from the professional perspective, to champion the challenge of incorporating ERP software into existing course plans or initiating overtures to align/integrate existing courses to better mirror real business environments.

This paper explores these two primary issues – the need to integrate the business curriculum across functional disciplines and the approach to incorporating ERP to achieve such integration. After reviewing the factors that drive the former, evidence of administrative perspectives, and resource issues and constraints, we proceed with brief description of the ERP integration work to date, its limitations, and the challenges to faculty and ERP developers alike. The single most important question is not whether business curricula should be integrated (it's already been answered in the affirmative); nor is it whether ERP should be taught in information systems curricula (again, the answer is yes). The question is how to take advantage of ERP to *facilitate* curriculum integration while addressing accreditation and assessment requirements, organizational structural issues, technical support, faculty needs and rewards, business demands, and employment market realities. To answer this question responsibly demands challenging the status quo, stimulating inquiry and curiosity, collaborating with software developers, and accepting disruptive change in higher education. Can it be done? Yes. Will it be done? The answer is up to faculty.

LITERATURE REVIEW

Our review of the literature is organized into three principal domains: business curriculum integration, ERP in curriculum, and role-based applications. Each has relevance; most have been explored thoroughly; each can contribute to developing a single conceptual approach to the dilemma at hand. The first, business curriculum integration, spans business processes and how they drive the need for changes in business school approaches. Stakeholders in the education process – from students who desire better career opportunities to employers who desire work-ready graduates – significantly influence this movement as internal and external *customers* of higher education (Athavale, Davis, & Myring, 2008).

Integrating Business Curriculum

The drive to integrate business curricula across functional disciplines is not new. Classic studies sponsored by the Ford and Carnegie foundations (Gordon & Howell, 1959; Pierson, 1959) in the 1950's already recognized the tendency for business schools to lag environmental development. The imperative was reinforced by AACSB-sponsored studies in 1988 (Porter & McKibben, 1988) and then again in 1996 (AACSB, 1996). Its 2002 Management at Risk: Report of the Management Education Task Force to the AACSB-International Board of Directors highlighted the current driving factors including competition from non-accredited and for-profit schools, preparation of students for global operations, and the transformational role of technology. The report noted that even naturally integrative courses, such as supply chain management and entrepreneurship, are still often “force-fed into vertical structures” (p. 20). This need to integrate the business curriculum was confirmed in the academic community based on a survey of deans of AACSB-accredited schools (Athavale, Davis, & Myring, 2008). Defining the integrated curriculum as “an integrated method of business education with a broad-based, multidisciplinary, organization-centric approach” (p. 295), Athavale et al. explored whether deans recognized a need to integrate, the extent to which they succeeded, and the ways they attempted to do so. Notably, while 81% reported the need to integrate, only 23% had implemented a plan to do so. Preferred approaches included the business core (73%), business policy and strategy course (64%), a capstone case course (61%), and an introductory business course (48%). These results suggest that despite over fifty years of “importance” and attention, schools have yet to discover (and confirm) a best practice for achieving curriculum integration. The survey also addressed assessment; the average number of *indirect* assessments (3.15) was higher than the average number of *direct* (preferred) assessments (2.18).

The AACSB perspective described above, and confirmed by Athavale et al., may have unintended consequences. Mullin (2006) addresses de facto weaknesses from a Baldrige-type quality perspective claiming that while schools may have “installed” a course in strategic planning (policy) and utilize the case method, there is little true integration throughout the curriculum. He challenges the existing course-credit completion model as one designed for efficiency rather than learning and argues that AACSB’s assumption that learning is primarily attributable to faculty ignores the basic quality tenets of system processes and interdependencies. His conclusion is that AACSB accreditation and the rewards of the traditional functional structure preserve the status quo leaving little opportunity for the disruptive change necessary for true curriculum redesign. Benson (2004), in his review of the evolution of the business school, had earlier cited yet another consequence of increased research requirements related to accreditation that led to “narrower and deeper knowledge bases resulting in disjointed disciplines and silo-like academic departments” (p. 19).

While business schools have remained “bastions” of functional structures, curricula, and teaching methods, business enterprises have responded to technological innovation and uncertain business environments using flexible manufacturing, outsourcing, just-in-time inventory, and supply chain management (Cannon, Klein, Koste, & Magal, 2004). Why is this the case? Cannon et al. suggest several barriers: faculty resistance, reward systems, teaching loads, resource issues, faculty effort and understanding of other disciplines, and individual discipline influences. These (and others) are consistently identified throughout the relevant literature (Bradford, Chandra, & Vijayaraman, 2002; Bradford, Vijayaraman, & Chandra, 2003; Corbitt & Mensching, 2000; Johnson, Lorents, Morgan, & Ozmun, 2004; Seethamraju, 2007; Selen, 2001).

ERP in Curriculum

The second domain for our review, ERP in curriculum, is rich with attempts to teach enterprise software as well as to utilize such software to demonstrate how functions interact and how data flows through business processes. This domain also includes advanced simulation applications (Cannon, Klein, Koste, & Magal, 2004; Mandal, Saputro, & Gunasekaran, 2008; Seethamraju, 2007). Beccara-Fernandez, Murphy, and Simon (2000) suggested ERP as “a vehicle that will enable change in educational delivery from functionally oriented to business process oriented” (p. 39). Emphasizing an incremental approach focused on business processes, the authors described a sequence of courses building from the basics of business processes through systems, technology infrastructure, project management, and strategy. Boykin and Martz (2004) suggested that ERP systems facilitate understanding of process fundamentals; there is a correspondence between the interactions within an ERP system and the interactions among business disciplines. Their supply chain management approach, team-developed with representatives from accounting, management information systems, and operations management, utilized cases and assignments that illustrated the cross-functional nature of most operational decisions.

Another early advocate for ERP-driven curriculum integration is California State University, Chico (Corbitt & Mensching, 2000). Recognizing the importance of cross-function interactions, value chains, workflow management, and supply chains to modern business environments, faculty dedicated to enhancing students’ knowledge of how businesses actually work committed to integrating enterprise software (in this case, SAP) throughout their curriculum. Considered one of the few documented successful cases, it emphasizes the critical need to redesign courses by collaboration among faculty from different disciplines rather than simply “plug in” ERP in existing courses. Fedorowicz, Gelinaz, Usoff, and Hachey (2004) reinforce this approach, claiming that “true integration of ES in a course will alter course content *as well as pedagogy*” (p. 236, italics added). They suggest developing course exercises internally, noting that software vendor training is designed for corporate users seeking to navigate the system for role-specific purposes (authors note: we come back to this issue later) and advocate for sharing exercises and assignments, collaborating with industry experts, and software workshops and a business process integration course designed for faculty to ensure focus on system interactions rather than navigation and keystrokes. Hawking, McCarthy, and Stein (2004) also discuss issues related to software training materials: version dependent, based on preconfigured data not available in campus systems, and snapshot (rather than full process) exercises.

Successful integration of ERP requires both horizontal (cross-discipline) and vertical (over time) deployment (Hejazi, Halpin, & Biggs, 2003). Proceeding from an overview of the integrated nature of enterprise systems through their development from business process requirements helps students recognize the importance of all business functions. Hejazi et al. described this approach involving four courses: Operations Management, Principles of Finance, Principles of Marketing, and Human Resources Administration. Johnson, Lorents, Morgan, and Ozman (2004) considered an alternative scheduling approach – block scheduling – that used a single professional staff member to develop an integrating set of tutorials and cases for application across all participating courses. A functioning hypothetical company was created; students procured materials, scheduled production, sold products, and completed accounting reports. Leger (2006) took this concept a step further, developing a simulation software program and computer-automated script to automate the sales process (maintaining “real time” sales events and data flow are among the severe constraints to a “living” data set). This approach enabled students to carry out the entire cash-to-cash cycle (procurement/production process and sales process) and focus on the analytical processes, for example, extract data and analyze profitability, update strategy, understand customer behavior, target customer segments, and uncover trends.

Continuing with emphasis on the horizontal aspects of introducing ERP in the curriculum, Mandal, Saputro, and Gunasekaran (2008) suggested the importance of industry-responsive courses that improve job prospects. Clearly, links to business communities are pre-requisite and co-requisite to achieving the integrative prospects of ERP. Mandal et al. recognized the limitations of capstone courses as the principal (and perhaps exclusive) attempt at curriculum integration within a business degree program, especially the lack of focus on operational decisions and the inattention to the importance of information flows to decision making. They suggest incremental introduction of ERP, perhaps in 1-credit courses, based on business processes, e.g., sales process followed by the purchasing process, production process, materials management process, etc., as a useful way to build understanding of multi-disciplinary interactions. Peslak's (2005) initial experiences with introducing ERP into the curriculum were disappointing as students lacked knowledge of business concepts, functions, or processes, leading to failure to achieve course objectives about learning ERP systems. The point here is that introducing ERP exclusively as an information systems tool, without sufficient process knowledge to understand the how and why, may not support desired learning outcomes. Of his "Twelve Step Program," the first three have no explicit link to enterprise systems: 1. Understand concepts of business and management; 2. Understand business functions; and 3. Process management.

By now it should be evident that introductions of ERP into curriculum vary dramatically. Objectives, perhaps other than "understand relationships and transactions among disciplines" are not consistent. Academic environments, too, vary among Information Systems-focused and business discipline-focused; hybrid multi-function course arrangements have also been attempted. Strong, Fedorowicz, Sager, Stewart, and Watson (2006) discussed their respective schools' programs for ERP implementation. California State University, Chico emphasized academic elements including frameworks, conceptual models, and theories. Louisiana State University actually dropped an original objective of ERP facilitating curriculum integration due to the overwhelming organizational obstacles. Queensland University of Technology realized positive outcomes based on the development of robust, "industry-strength" materials. Bentley College focuses its efforts primarily in the accounting and finance courses; in fact, no CIS courses even covered ERP configuration. Worcester Polytechnic Institute utilized modules appropriate for lab exercises rather than modify existing courses or require extensive knowledge of ERP systems by faculty. Again, variation in perspective and approach leads to no clear cut, definitive "best practice" in higher education despite the assumption of "best practices" in business processes being incorporated within enterprise system development.

More recently, attempts at incorporating ERP technology in human resource courses and/or programs have been reported by Bedell, Floyd, McGlashan Nicols, and Rebecca (2007). The authors describe two applications, one at California State University at Bakersfield; the other at California State Polytechnic. The former chose to include a Human Resource Information Systems (HRIS) component in each course, while the latter created a single course focusing on HRIS. Regardless of approach, the significant challenge each school faced was the size and complexity of the ERP software (in this case, PeopleSoft).

Bradford, Vijayaraman, and Chandra (2003) surveyed information systems faculty concerning adoption of ERP to facilitate the transformation from functional orientation to business process orientation. One interesting result was the correlation of ERP adoption and AACSB accreditation that suggests at least a recognition by business schools that the status quo is not acceptable. Based on the responses from 94 universities, applications were primarily restricted to Accounting (69%) and Information Systems (58%) departments, with only one-third of respondents indicating integration in Management courses, 14% in Marketing, and 3% in Finance. Most telling is this result: only 5 of 94 respondents reported more than two departments participating.

Role-based Application

Role-based application is an area primarily emphasized by software developers based on extensive research about how people actually perform their functions (Pruitt & Grudin, 2003; Webber, Manning, & McInnes, 2007; Roles-based Business Productivity, 2006). Identifying realistic scenarios can assist with software design by depicting work practices the software is designed to support. Ideally, this research leads to roles, or *personas*, that "utilize our mind's powerful ability to extrapolate from partial knowledge of people to create coherent wholes and project them into new settings and situations" (Grudin & Pruitt, 2002, p. 149). Personas can be designed to go well beyond routine transactional processing to improve performance in expanded decision making contexts; they can engage team members effectively; and they can provide a shared basis for communication (Grudin & Pruitt, 2002).

Microsoft (2006) has invested heavily in its development of personas (or roles). Its 43 usability labs have conducted over 1100 usability and research studies per year involving over 10,000 participants. Its researchers have also conducted over 1700 annual site visits seeking to gather comprehensive data about people, the departments they are organized into, and the work they perform. This research has led to the Microsoft Dynamics Customer Model consisting of 61 personas (or user profiles), operations, finance, human resources, sales & marketing, and IT departments organized into 15 typical organization structures, 33 process groups, and 155 sub-processes and tasks. There is little activity, at least based on the literature reports, that suggests academics have explored this

knowledge base for application beyond security and access considerations. Given the breadth and depth of the data that serve as the foundation for these personas, including workflows, knowledge-skills-abilities required, typical education levels, psychometrics, etc., it appears the opportunity to map course content to actual business process performance may well reside in this database. Unfortunately, it has not been made available to faculty.

MEASUREMENT OF LEARNING OUTCOMES

Despite all of the efforts at integrating business curriculum and introducing ERP into it (and perhaps utilizing it as a means to achieve the former) discussed already, the literature is sparse when it comes to consensus on specific objectives and learning outcomes and even more so about reports of relevant empirical studies. Briefly, Noguera and Watson (2004) reported results of their study aimed at assessing student performance, self-efficacy, and satisfaction after deployment of a “real” enterprise system in the curriculum. Note, however, that this does not directly measure learning of “business processes.” A sample of 284 students enrolled in five sections of an operations management course were segmented into groups having different levels of engagement with an ERP system. One group completed assignments consisting of reading and exercises only, another experienced simulated hands-on activities (ScreenCams), while the third had actual hands-on experience. Results suggested very little, if any, differences in learning based on a written test. Unfortunately, the study was based on only two 50-minute sessions on ERP systems and one on manufacturing planning; hence, the results cannot be generalized. Results concerning self-efficacy and satisfaction were likewise not significant. Perhaps most valuable were the two questions posed by the authors for “future research” (questions we suggest have still not been answered):

- Does using an ERP system lead to higher levels of learning or knowledge than some other instructional methods?
- What practices within the use of an ERP system lead to the highest learning levels?

Seethamraju (2007) conducted a self-assessment based on expected learning outcomes including generic business processes, business terminology, enterprise system implementation, managerial and interface issues, and technical software skills. In this study, developing understanding of business process concepts was a specific course objective. The measurement instrument consisted of seven constructs, two of which are relevant to our interest: business knowledge (basic terminology that relates to functions and cross-functional relationships) and process knowledge (core business processes, their significance, and their relationship with information systems). Teaching methods included case studies, class discussions, presentations, and guest lectures. ERP modules covered were sales and distribution, procurement, accounts receivable, accounts payable, and general ledger. Assignments included examinations, group project, case study analysis, and software exercises. Based on student self-assessments, no significant differences in learning outcomes for these two constructs were observed.

Davis and Comeau (2004) used simulated ERP screen shots in lab settings and studied whether students improved their understanding of business processes or simply enhanced their ability to follow instructions in system configuration exercises. Despite a substantial comprehensive management learning stream within the course, students did not achieve expected improved understanding and remained focused on simply following instructions.

IDEAL CURRICULA

Despite nearly ten years of discussion, hypotheses, and best intentions about integration of ERP, little has emerged in terms of consensus about curriculum design, learning objectives, and legitimate measurement. One key issue revolves around the primary objective of ERP integration. Is it primarily an Information Systems curriculum issue? If this is the case, development has, in fact, proceeded. Boyle (2007), for example, offers a complete knowledge framework for IT curriculum that includes course sequences and complete mapping of courses to knowledge. This is a useful framework that can provide a legitimate environment for empirical studies. Stratman and Roth (2002) developed a questionnaire to measure ERP competence, “a portfolio of management, technical, and organizational skills and expertise” (p. 601). They suggested this competence includes eight latent constructs: strategic IT planning, executive commitment, project management, IT skills, business process skills, ERP training, learning, and change readiness, with the expected outcome of improved business performance. Whether this can serve as a framework for curriculum development is still an unanswered question. The literature does not offer any applications of this measurement instrument.

What if ERP integration is intended principally as the tool to drive change in the way business curriculum is designed and delivered? This, of course, gets to the underlying issue articulated early on: what is the best way to integrate the business disciplines? To date we have not established that ERP can, in fact, drive such change nor that it is the best way to accomplish it. Hershey (2002)

developed an approach seeking to emphasize learning about functional integration and business processes by increasing specific examples of interrelationships among functions based on information systems curriculum, claiming IS faculty are uniquely positioned to facilitate curriculum integration. He suggested learning goals that included clear understanding of business functions and their relationships to business processes, how processes differ and their inherent management difficulties, how to analyze them and how to improve them. This is one of the few, detailed suggestions that could, in fact, serve as a consensus position for further implementation and research.

Walker and Black (2000) proposed a process-centered model of business education focused on typical high-level processes found in most organizations: acquisition of resources and payment, conversion/service provision, and acquisition of customers and the collection of revenue. These processes align well with the business disciplines typically listed as minimally required to conduct business: finance (capital and cash flow), operations (transformation processes), and marketing (customers). They present a comprehensive mapping of course content to five “process” courses entitled acquisition of capital resources, human resources acquisition, conversion/service, sales/collection/customer service, and organizational performance measurement and management. This model, perhaps more than any other, represents true business curriculum integration. Now ten years old, the literature offered no reports of implementation of this model or its application as a basis for ERP integration. Such lack of information suggests, again, the significant obstacles to changing the status quo in business education.

CHALLENGES TO FACULTY

One of the difficulties facing faculty is their position in this debate; i.e. reactive rather than proactive. Enterprise systems have evolved; they have “trickled down” the chain from only the largest enterprises to small businesses; their marketplace continues to expand; their utilization is becoming commonplace. Faculty must choose whether to respond but have the complicating factor of software training versus process education – what Davis and Comeau (2004) distinguish as know-how versus know-why. They emphasize the challenge to bridge micro-level skills acquisition and management theory and practices. How can this be balanced? A useful analogy is the evolution of quality management paradigms that are now inherent in management education. Initially, total quality management (TQM) was practiced by a very few companies but evolved throughout the 1980’s to the point where it became prerequisite to marketplace success. Only after-the-fact did academia seek to identify key elements, issues, programs, initiatives, etc., through rigorous empirical investigation. Businesses don’t necessarily wait; they take risks to maximize profits. We suggest the ERP integration issue is at a similar threshold. Businesses are using it. If students don’t have knowledge of it (or at least some understanding of it) they suffer disadvantage in employment relative to those who do. We, as faculty, can organize and collaborate, develop innovative curricula and pedagogies, and establish a stream of research to identify best practices. The question is how. Isolated and individual ideas and applications, discussed above and prevalent in the literature as descriptive case studies, do little to move the issue forward. Academic alliances supported by software vendors, to date, have not developed a comprehensive approach that not only recognizes but *resolves* the consistent obstacles and limitations identified in virtually every published report of curriculum ERP integration. Lack of collaboration among such alliances likewise stifles communication of successful practices and facilitates non-value-adding redundant investment by faculty and universities.

CONCLUSION

An ERP-based integrative framework *seems* a natural tool to facilitate full integration of business curricula. Numerous reports have suggested alternatives, needs, and opportunities that faculty, administrators, ERP developers, software partners, and ERP vendors may consider as the business environment continues to evolve. The objective now is to agree on the foundation for a “best model” that takes advantage of enterprise systems as a vehicle to curriculum integration. This requires acceptance, at all levels, of the fifty-year-old mantra that business curriculum integration is desirable and some empirical evidence that enterprise systems are, indeed, better than capstone courses, threaded case studies, and all the other approaches that have already been tried and for the most part, failed. We suggest partners in a research consortium – schools, faculty, students, ERP vendors, industry users – that systematically develop and implement a long-term research study to resolve the evidence issue. Otherwise, enterprise systems will remain (based on affiliation of the authorship of the reported studies) predominantly an Information Systems curriculum issue with little cross-business-discipline development.

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