Proposing a New Framework and an Innovative Approach to Teaching Reengineering and ERP Implementation Concepts

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ABSTRACT

Recognizing the need to teach ERP implementation and business process reengineering (BPR) concepts simultaneously, as well as the pedagogical limitations of the case teaching method and simulation tools, the objective of this study is to propose a new framework and an innovative teaching approach to improve the ERP training experience for IS students. The proposed framework, derived from Kettinger et al.'s (1997) BPR framework and the AcceleratedSAP® ERP implementation methodology, was developed to center the organization transformation process on business process redesign and not on the ERP solution. The new framework was then tested with post-graduate students completing their MIS program in partnership with a multinational firm that manufactures residential furniture,. Analyzing and reengineering one of our partner's processes and configuring SAP R/3 in our laboratory to support one of the firm's newly reengineered sub-processes demonstrated that the framework offers a very structured, rigorous methodology for teaching BPR and ERP implementation concepts. More generally, the proposed framework and teaching approach helped students to learn "more" by doing and to understand the various skills required when conducting ERP and process improvement projects.

Keywords: Enterprise Resource Planning, Reengineering, Business Processes, Education, SAP.

1. INTRODUCTION

Over the last decade, numerous organizations have significantly changed their business processes in order to remain competitive in the global market. Such process improvements were obtained mainly by combining business process reengineering (BPR) efforts with the adoption of Enterprise Resource Planning (ERP) systems. While the objective of BPR is to eliminate non- value-added activities and administrative barriers, ERP implementation projects seek to streamline an organization's processes by integrating the information flow into a single system. Benefits related to both BPR and ERP implementation projects result from the capability to efficiently combine organizational changes with information technology (Davenport 1993; Esteves et al. 2002; Hammer and Champy 1993).

There has always been a strong relationship between these two business transformation mechanisms, as ERP implementation projects also involve the examination and adaptation of business processes (Boudreau and Robey 1999; Taylor 2000). In fact, BPR is one of the most cited critical success factors in ERP implementation projects (Al-Mashari et al. 2003; Bancroft et al. 1998; Bingi et al. 1999; Holland et al. 1999; Nah et al. 2001). However, it is still not clear which of these transformation mechanisms comes first, as some organizations use ERP systems to promote BPR programs (Martin and Cheung 2000), while others conduct BPR initiatives as part of an ERP implementation project (Kraemmergaard and Moller 2000; Pellerin and Léger 2005). Nonetheless, ERP implementations and BPR need to be closely connected (Al-Mashari and Zairi 1999).

From an academic standpoint, Boyle and Strong (2006) recognized that focusing on business processes rather than on specific ERP functions can give students a better understanding of the complex relationships between the various business functions and the business decision-making

process. However, teaching BPR and ERP implementation concepts simultaneously is a complex task as it requires the development of a wide spectrum of competencies, ranging from technical and business functional knowledge to team development and interpersonal skills.

To date, numerous research initiatives have been undertaken to better understand the skill requirements of ERP graduates (Becerra-Fernandez et al. 2000; Boyle and Strong 2006; Watson and Schneider 1999) and further integrate ERP concepts into business and engineering school curricula (Boykin and Martz 2004; Hawkins et al. 2004; Haynen et al. 2000; Johnson et al. 2004; Peslak 2005). However, most universities still limit the scope of their ERP curriculum to technical implementation and configuration issues, rather than addressing more strategic issues tied to the adoption and use of such systems (Bendoly 2005). This limited focus can be explained by the fact that ERP concepts are still taught mainly in information system (IS) programs, which continue to attract IS analysts and engineers looking for tools and methods to help them deal with complex ERP implementation projects. Also, as we discovered after an informal review of ERP education programs, most universities still favor separate courses to teach BPR and system implementation concepts. This content separation reinforces the student's perception that ERP projects revolve around technology issues.

To maximize the quality and relevance of ERP training, it must integrate BPR concepts and take into consideration the various disciplines involved and the different types of competencies needed to effectively transform an organization. Therefore, rather than focusing solely on configuration activities, universities should make a stronger effort to set up training activities that reflect the complex reality of ERP implementations. Some universities have partly responded to these challenges by using the case teaching method or simulation tools to try to re-create the organizational context in which ERP systems are implemented and used (Davis and Comeau 2004; Draijer and Schenk 2004; Léger 2006; Stewart and Rosemann 2001). The case study approach usually results in more process-oriented thinking than do more traditional or functional area educational approaches. It also allows students to develop high-order reasoning and decision-making skills by "learning by doing" (Hackney et al. 2003), which in turn increases their motivation and interest in the subject (Mustoe and Croft 1999). Unfortunately, teaching cases are inevitably somewhat artificial. They rarely allow students to experience all the challenges of changing a process, as they do not give students the opportunity to interact with real employees and face managers' real-life concerns (Morrell et al. 1993).

Recognizing the need to teach ERP implementation and BPR concepts simultaneously, as well as the pedagogical limitations of the case teaching method and simulation tools, the objective of this study is to propose a new framework and an innovative teaching approach to improve the ERP training experience for IS students. The new framework was tested by conducting all class activities in collaboration with a real company and re-creating a demanding ERP project environment in which process improvement, change management, risk-taking, and the consideration of intangible and human aspects are essential. The result is a teaching experience that shifts the emphasis from system implementation to business process transformation.

The remainder of the paper is organized as follows. First, the proposed framework and the steps undertaken to develop it are presented. A summary of our experience testing the proposed framework is then provided. Next, the lessons learned from the teaching experience are discussed. Finally, our contributions and research limitations are examined.

2. A PROPOSED FRAMEWORK FOR TEACHING BPR AND ERP CONCEPTS

The proposed framework was developed to center the organization transformation process on business process redesign and not on the ERP solution itself. However, the ERP solution still plays an important role in our framework as it is used as a business transformation enabler.

The framework was developed in three steps. First, a literature review on BPR methodologies led us to adopt Kettinger et al.'s (1997) work as the foundation for our new framework (section 2.1). The AcceleratedSAP® methodology was then selected (section 2.2) so we could compare BPR activities to those conducted during an ERP implementation project. Finally, the similarities, redundancies and disparities between the two methodologies were identified, resulting in the development of an integrated framework for conducting business process redesign during ERP implementation projects (section 2.3).

2.1 BPR methodologies: A synthesis

BPR has long been recognized as a powerful tool to transform organizations and improve their performance. Originating in the 1950s (Esteves et al. 2002), the dissemination of BPR practices increased significantly after the publication of Hammer and Champy's (1993) groundbreaking book in the early 1990s. After more than a decade of intense practice, BPR practices continue to evolve as the emphasis shifts to strategic linkage, bottom-up participation, and incremental transformation.

The increasing popularity of BPR has resulted in a growing number of methodologies, techniques, and tools for practitioners in the field (Harmon 2003; Kettinger et al. 1997; Tenner and DeToro 1997). They differ according to the magnitude of the change and the change effort involved. According to Valiris and Glykas (1999), these tools can be classified into three main categories depending on which perspective their developers take with regard to BPR. In the management accounting perspective, analysts attempt to reorganize business processes and use IT as an enabler of their efforts (e.g., Harrington 1991; Kettinger et al. 1997). In the IS development perspective, IS developers attempt to understand and reorganize business processes so that the introduction of IT has the greatest possible impact on them (e.g., Davidson 1993; Olle et al. 1986). The more recent organizational theoretic perspective concentrates more on understanding and analyzing the organization based on principles such as accountability and the roles of the individuals who take part in business processes (e.g., Scherr 1993; Yu and Mylopoulos 1994). Finally, Valiris and Glykas (1999) proposed a methodology that takes a holistic view of

the organization by combining concepts from all three perspectives identified above.

As a starting point for the development of our new framework, we adopted Kettinger et al.'s (1997) methodology, which proposes a generic stage-activity framework for conducting BPR projects. We selected this methodology for four reasons. First, it takes the management accounting perspective by attempting to reorganize business processes while using information as an enabler. Second, it was empirically derived from the methodologies practiced by 25 leading reengineering consulting firms. Third, it provides a set of tools and techniques to facilitate the reengineering effort. Fourth, unlike most BPR studies, in which the unit of analysis is the organization, Kettinger et al.'s (1997) work is centered on the BPR project, which is more relevant to IS professionals.

As described in Figure 1, Kettinger et al.'s (1997) framework comprises six stages, each subdivided into major activities. The initial stage (Envision) encompasses the establishment of management commitment and vision, a review of the firm's business strategy, and the identification of key business processes. The second stage (Initiate) sets performance goals and organizes the BPR project. The existing processes are documented and analyzed in the third stage (Diagnose), which leads to the development of the new processes in the fourth stage (Redesign). The fourth stage requires an evaluation of the different alternative processes and may require changes to organizational structures, management practices, people and information technology. The fifth stage (Reconstruct) ensures smooth migration to the new processes. The sixth and last stage of the methodology (Evaluate) requires the evaluation of the performance of the new processes to determine whether the project goals were achieved.

2.2 The AcceleratedSAP® ERP implementation methodology

Besides requiring process and organization change activities, an ERP implementation requires the transformation of a larger number of business processes than in a BPR project. This wider scope justifies firms' decisions to choose a more rigorous, structured planning methodology when implementing ERP systems.

Business software companies and integration partners have proposed a number of structured ERP implementation methodologies. These methodologies differ mostly in terms of the tools used while conducting solution-specific activities. AcceleratedSAP® is one of the most popular and well-documented methodologies (Brand 1998). It has proven to be effective when implementing the SAP R/3 ERP solution across industries and in different customer environments (Bancroft et al. 1998). This approach provides a detailed description of work packages, activities and tasks associated with each phase of ERP implementation. From an academic point of view, the use of this methodology has significant value as it is aligned with industry standards and procedures, such as the project management handbook (PMBOK®) published by the Project Management Institute. It is also associated with the implementation of SAP R/3, for which the underlying concepts are already taught in numerous university curricula.

The AcceleratedSAP® ERP implementation methodology is composed of five phases, each subdivided into major activities. Figure 2 provides a simplified view of this methodology, presenting the main functional activities and ignoring recurring project management activities and technical tasks (i.e., hardware and software acquisition, installation and testing) required in a typical ERP project. During the first phase (Project Preparation), initial project

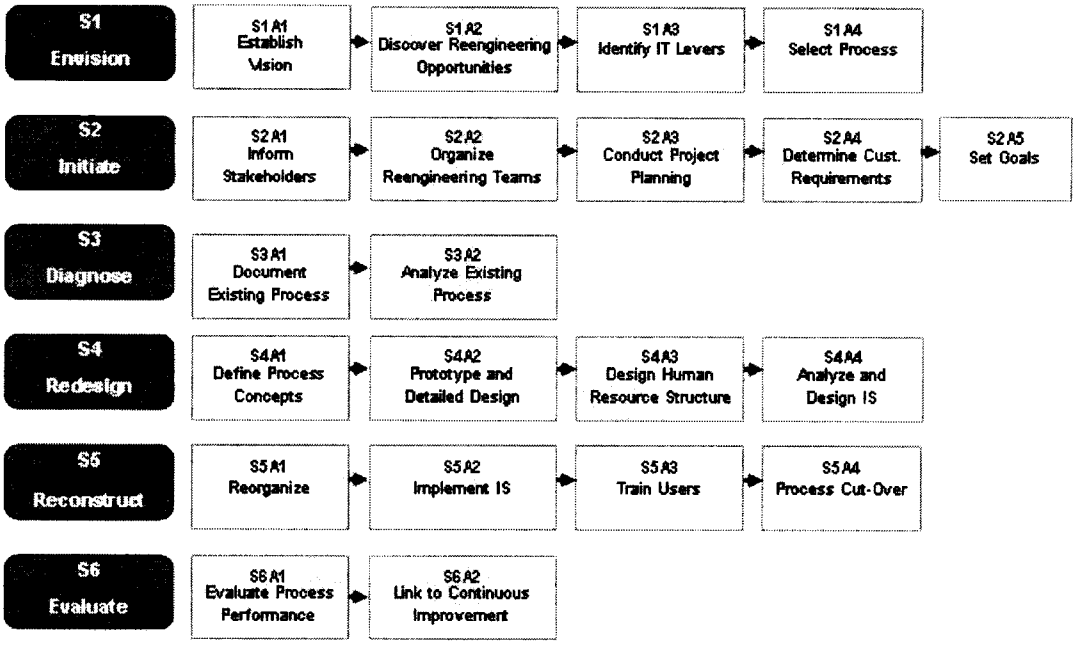

Figure 1. Kettinger et al.'s (1997) stage-activity framework for BPR

planning and preparation are conducted to define the project goals and objectives, the implementation strategy and the project organization. In the second phase (Business Blueprint), the company's business process requirements are documented and the original project goals, objectives, scope, and overall schedule are refined. The third phase (Realization) is when the new processes are developed through system configuration. During the fourth phase (Final Preparation), system preparation, including testing, end user training, system management and cut-over activities, is finalized prior to going live. Finally, the fifth phase (Go Live and Support) moves the project from a pre-production environment to live operation. This phase is also used to monitor system transactions and optimize overall system performance.

3. THE PROPOSED FRAMEWORK

The AcceleratedSAP® methodology clearly shows some similarities with Kettinger et al.'s (1997) framework, as both approaches initiate the transformation process with a strategic positioning exercise followed by the examination of current business processes. Similarly, both approaches end with ongoing support and performance monitoring activities. On the other hand, the AcceleratedSAP® methodology does not include, prior to configuration, specific activities to evaluate future processes.

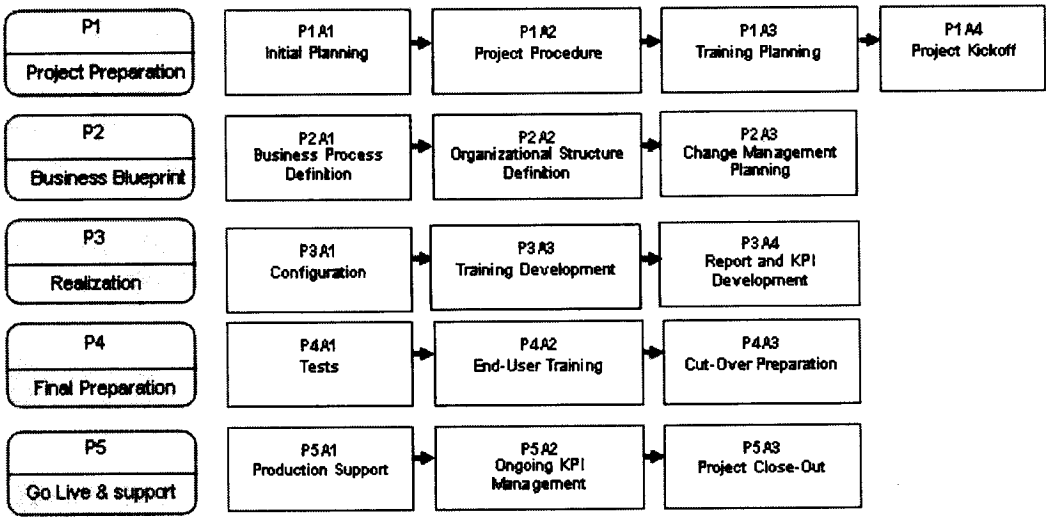

Figure 2. AcceleratedSAP functional phase-activity framework

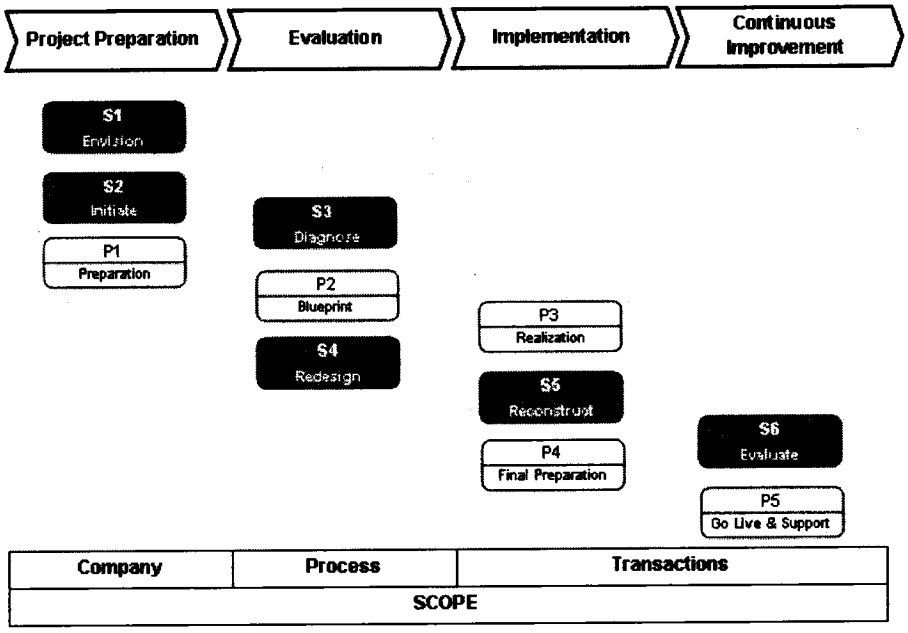

Figure 3. Proposed teaching framework

Consequently, it is not surprising to note that the strict use of the AcceleratedSAP® methodology in a classroom environment often results in a realization phase that focuses primarily on selecting transactions and configuring SAP R/3 to replicate former processes. This indicates the need to complement AcceleratedSAP® with more formal reengineering activities and to adopt a different approach when teaching ERP implementation processes.

The proposed framework presented in Figure 3 was constructed by aligning the AcceleratedSAP® methodology with Kettinger et al.'s (1997) framework. This alignment was made possible by grouping similar activities in the two methodologies into four main phases: Project Preparation, Evaluation, Implementation, and Continuous Improvement. The concurrent execution of BPR and ERP implementation activities within this framework ensures that students remain focused on the organization transformation process and not on making the ERP solution work.

At the activity level, similarities between the BPR and ERP approach needed to be addressed in order to prevent redundant work. At the same time, the IS-centric activities in Kettinger et al.'s (1997) framework needed to be either canceled or revised since only one system, the ERP, is considered here as a potential enabler for process improvement. Figure 4 presents a more detailed view of the sequence of the activities within the proposed framework.

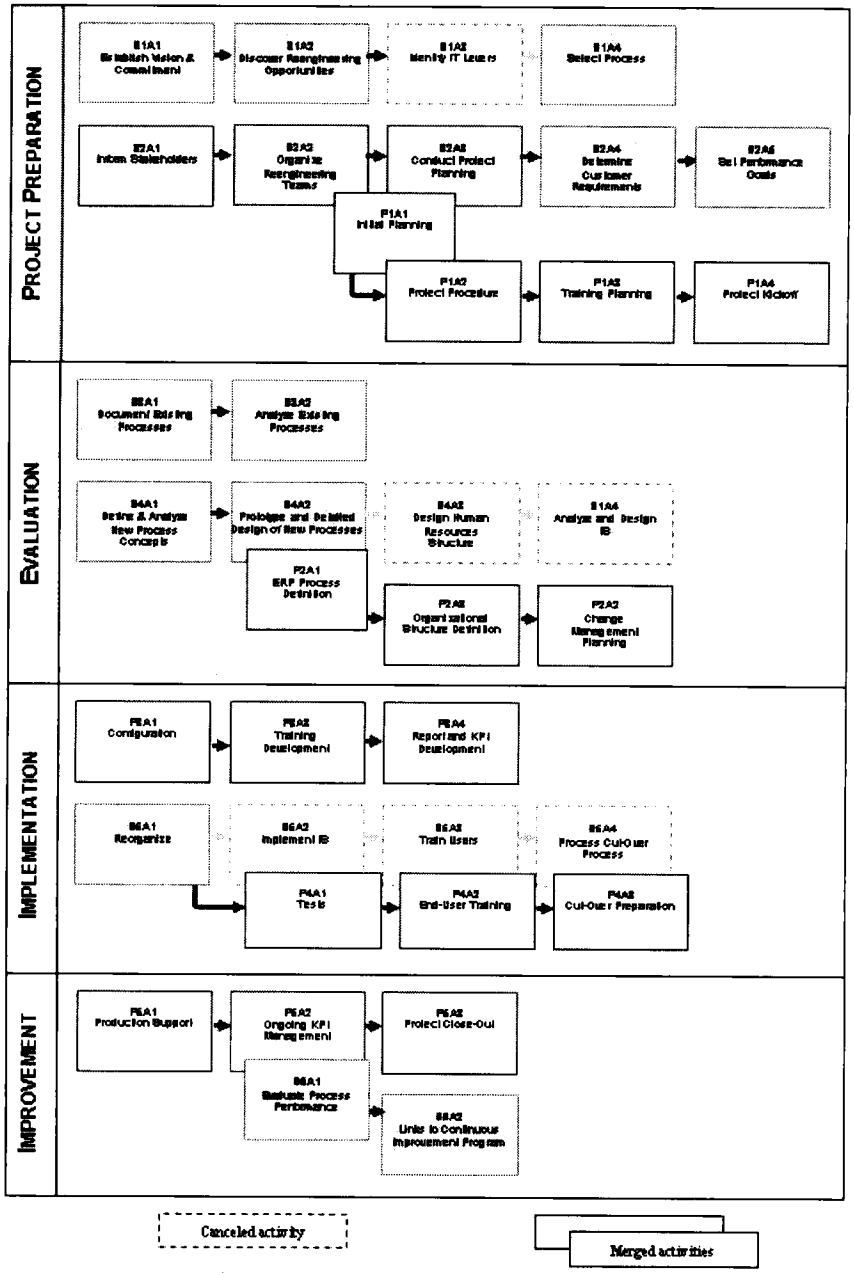

Figure 4. Proposed framework in detail

Canceled activities (each represented by a dashed box) are shown in Figure 4 to indicate BPR and ERP activity conflicts. For the sake of clarity, the names of the activities presented in our framework are identical to those adopted in Kettinger et al.'s (1997) and the AcceleratedSAP® original methodologies. Activities starting with an "S" are those included in Kettinger et al.'s (1997) methodology, while activities starting with a "P" originated in the AcceleratedSAP® methodology.

4. TESTING THE FRAMEWORK

An innovative approach was used to test the framework. In partnership with a multinational firm that manufactures residential furniture, we tested the new framework with post-graduate students who were completing their MIS program. This team project replaced the traditional individual MIS final project where each student works with an MIS faculty advisor to deepen his/her understanding of some aspect of MIS. The manufacturing firm selected to collaborate in this pedagogical experience was very interested in participating in this teaching initiative since the potential process improvement recommendations would be very valuable to their top management. Evidently, senior executives were also very proactive in helping us (the two instructors orchestrating the project) to select the "customer order" process for analysis and reengineering. The organization's involvement was limited to the first two phases of the framework, as the ERP configuration activities during the third phase (Implementation) were performed in a university lab environment with the SAP R/3 ERP system. Due to time constraints, the activities related to the last phase of the framework (Continuous Improvement) were not carried out.

We were fully aware that a detailed, complete ERP implementation to improve the manufacturing firm's "customer order" process would be an unrealistic task within a time-constrained classroom environment, so we decided to reduce the scope of students' activities and the partnering company's involvement at each step of the project (see Figure 3). This scope reduction was made possible by initially analyzing the business transformation process at the company level, then limiting the reengineering efforts to a single business process, the "customer order process" and finally by confining the ERP configuration and preparation activities to the steps of a single sub-process, production planning.

Table 1 presents, for each of the three phases of the framework tested, the activities (roles) undertaken by instructors, the partner company and students, the theoretical concepts taught to students by instructors at the beginning of the phase so they could properly complete their tasks, some of the tools and techniques used by the professors and students to complete their assigned activities, and the deliverables/output required before beginning the next phase.

Analyzing and reengineering the partner firm's "customer order" process and configuring SAP R/3 in our laboratory to support the firm's newly reengineered production planning sub-process demonstrated that the framework offers a very structured and rigorous methodology for teaching BPR and ERP implementation concepts. The combination of BPR and ERP activities into a single teaching experience also offered a unique opportunity to expose students to a number of tools and techniques. By participating in every phase of a real project and by preparing and justifying project deliverables to employees and managers, students were encouraged to evaluate and select the most appropriate methods to complete their project assignments. The framework also allowed us to assess team performance throughout the project as well as taking the necessary corrective actions, through the use of various tools and techniques such as performance measurement and variance analysis, replanning (including reverse analysis), issue logs, status review meetings and the use of a project management information system.

At the end of each phase of the project, students were asked to summarize their learning experience. Here are some of the quotes highlighted during those discussions:

1. Project Preparation Phase:
   "Now, I finally understand the importance and the resources required to properly launch a IS implementation project".
2. Evaluation Phase:
   "Now I understand the critical role of BPR in ERP implementation projects".
3. Implementation Phase:
   "Before doing this project, I could not really grasp the importance of setting clear and measurable performance goals. Now I'm astonished that so many firms do not really have KPIs";
   "I don't think I would have ever really understood the importance and the difficulty tied to process mapping and analysis without a real hands-on experience with real people in a real company and if we did not use those mappings to eventually configure an IS system";
   "Finally, we got a real hands-on experience in BPR and ERP configuration. The best way to remember and get really involved in what we learn";
   "Now I understand why you (professors) put so much emphasis on the fact that ERP implementation projects are very different than development project and why they should be orchestrated by business people and not the IT staff".

To properly grasp to what extent the students really learned during this teaching initiative, we also decided to give students a final recapitulative exam at the end of the project. Results clearly showed that our students learned and remembered a lot more of the managerial and technical concepts taught than in more traditional IS courses where lectures and case analysis are the norm.

More generally, the proposed framework and teaching approach helped students to learn "more" by doing and to understand that negotiation, team management, communication, change management, BPR and ERP configuration are all critical skills when conducting ERP and process improvement projects (see Table 2). In practice, managerial skills were critical at the beginning of the project while the needs for technical skills were growing in the latter phases of the project.

5. LESSONS LEARNED

We learned six important lessons during this pedagogical experience.

	Project preparation	Evaluation	Implementation
Timeline	December 2005 – February 2006	March 2006 – June 2006	July 2006 – August 2006
Activities (roles)	Partner selection and commitment (instructors) Discover reengineering opportunities (instructors) Select process to reengineer (instructors and partner) Establish working procedures and communication channels (instructors and partner) Acquire/organize project team (instructors and students) Develop project plan (instructors) Kick-off meeting (instructors, partner and students)	Document and analyze (in detail) the customer order process (students) Define ideal process (instructors and students) Conduct gap analysis between ideal process and SAP R/3 business blueprints (instructors and students)	Configure SAP R/3 to support the reengineered production planning sub-process (instructors and students)
Theoretical concepts	Project management	Business process reengineering (BPR) Project management ERP implementation and configuration	ERP implementation and configuration Project management
Tools and techniques	Partner selection method Expert judgment and analogous estimating Stakeholder analysis Decomposition Activity resource requirements Templates, forms, standards	EPC process modeling Training Visio Reengineering techniques (gap analysis, benchmarking) Implementation guide for R/3 customizing Templates, forms, standards	Standard SAP R/3 Business Process Procedures SAP R/3 customizing guide Testing techniques
Deliverables - Outputs	Memorandum of understanding (MOU) with the partner Project charter Project management plan Performance goals Work breakdown structure (WBS) Risk register	Requirement engineering/Business blueprints (Levels 1 and 2) SAP R/3 configuration documentation Key Performance Indicators (KPIs)	Updated SAP R/3 configuration documentation Complete project management documentation Final report to the partner presenting a detailed analysis of the customer order process, the various reengineering opportunities and a set of KPIs to better monitor the performance of each sub-process

Table 1. Project Summary

1. First, the teaching initiative must represent a win-win situation for both the university and business partner involved, because the partner company will be willing to properly support the initiative and disclose all the necessary information so that students can properly conduct their activities only if it sees direct benefits from participating in the project. Thus, the process to reengineer must satisfy both the instructors' teaching objectives and the partner's performance targets.
2. Tight project scope management is imperative. Indeed, testing our proposed framework and teaching approach required students to carry out numerous tasks while the number of problems to solve grew rapidly as the project developed. Project success would not have been possible if we had not reduced the scope and constantly juggled with the prioritization of activities as the project unfolded.

Phases	Managerial skills	Technical skills
Preparation	Team management Negotiation	Project planning
Evaluation	Communication Persuasion	Data collection Process modeling Benchmarking
Implementation	Change management	Configuration

Table 2. Skills development during the teaching experience

3. Rolling wave planning and time buffers are essential as: (a) it is impossible to know in advance all the tasks and activities necessary to complete each phase of the project as well as the theoretical concepts, tools and techniques required to properly support them; and (b) proper time management requires buffers to deal with the unforeseen events that will inevitably come up during the project's lifetime.
4. Team training is a must as the realization of the project required the development of multidisciplinary skills; team motivation is also imperative to maintain momentum during such a long (9 months) and complex project.
5. Continuous monitoring and control are crucial so instructors can rapidly respond to the numerous issues and problems that arise and that could have a negative impact on project success.
6. Finally, proper documentation is essential to facilitate information transfer from one activity to the next. It will also make it significantly easier to grade students' work as the project unfolds.

6. CONCLUSIONS

Our research makes an important theoretical contribution as it proposes a new framework to teach reengineering and ERP implementation concepts simultaneously. Besides integrating BPR and ERP concepts, the proposed framework also takes into consideration the various disciplines involved as well as the different types of competencies, tools and techniques needed to effectively transform a process. Three more practical contributions also stem from our results. First, our innovative teaching approach focused students' attention on the organization transformation process and not on ERP technical issues. Second, our pedagogical experience encouraged students to learn "more" by doing. Finally, students' satisfaction with the experience was very high, as our practical, multidisciplinary approach to teaching BPR and ERP implementation concepts allowed them to learn more about themselves, how to manage people and deal with conflicts, and how to properly tackle technical issues.

There are four main limitations on our proposed framework and teaching approach. First, only one business process was investigated and reengineered and SAP R/3 was configured to support a single reengineered sub-process. Nonetheless, improving the partner's customer order process and using SAP R/3 to configure the upgraded production planning sub-process allowed us to adequately test our research framework and teaching approach. Second, SAP R/3 was the chosen ERP system from the outset, and thus we did not evaluate the various ERP systems to select the most appropriate one based on the partner's process and its present IS infrastructure. However, SAP R/3 was deemed the most appropriate ERP system to test our framework and teaching approach as the two instructors had prior knowledge of this system and the university where the course was taught was a member of the SAP University Alliance. Third, the design, implementation and testing of SAP R/3 was conducted in a laboratory environment. Nonetheless, most of the project activities were conducted in partnership with the manufacturing firm to reflect the complex reality of an ERP implementation as well as possible. Finally, we recognize that a 9 month project may not be feasible in all academic programs. For instance, it may be possible to conduct this project in a shorter time period by limiting the scope of the project from the beginning. However, we recommend carrying the project in two consecutive sessions in order to ensure students spend enough time in the partnered company and build a credible relationship with the employees.

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