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Perceptions of MBA Students on Business Process Modeling as a Learning Tool: An Empirical Investigation

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ABSTRACT

Based upon a survey of 95 MBA students in a Business Process Management (BPM) course at a university in New England, this study reports the perceptions of students concerning the efficacy of process modeling as a learning tool. Depending on their majors, students were classified as (a) Information Technology (IT) majors and (b) Business majors. The fifteen variables explored in the survey were classified into three categories: (a) Process Analysis issues, (b) Course related issues, and (c) Organizational issues. Statistically significant differences are found on the value of simulation exercises as perceived by MBA students on five dimensions: (1) Analyzing Business Process Performance, (2) Modeling Business Processes, (3) High-level Process Mapping, (4) Understanding BPM Concepts, and (5) Grasping Process Control Issues. Implications of these differences for designing graduate level BPM courses in colleges of business administration are discussed in the paper.

Keywords

Business Process Modeling, Business Process Analysis, Teaching Business Process Management

INTRODUCTION

In order to meet the challenge of intensified competition and regulatory pressures in the global economic environment, businesses are viewing process reengineering and innovation with advanced information and communication technology (ICT) as a strategic priority (Davenport and Short, 1999; Lewis et. al., 2007). To improve business processes with precise measurements and statistical quality control, business organizations are increasingly adopting the techniques of simulation based modeling to compete with business process outsourcing (BPO) countries such as India, Ireland, Hong Kong, Philippines, and Vietnam (Alonso, 1997; Cleveland, 2002; Profozich, 1998; Saltzman and Malhotra, 2001). Simulation modeling is becoming a powerful instrument for analyzing complex business processes to improve their performance (Eisenhart and Bingham, 2007; Hubbard and Bacoski, 2006; Kiziltas, et. al., 2006; Koide, et. al., 2005; Marrs and Mundt, 2001; vanderAlast and vahHee, 2004; White and Miers, 2008). Simulation based modeling tools are also being used by academic institutions to enhance the effectiveness of teaching in their business process management and reengineering courses (Roussev and Rousseva, 2004).

Criticality of process modeling for organizations has been widely recognized and the factors for its success identified in numerous academic studies (Bandara, 2005; Davies, 2006, Law, 2000; Ray, 2004; Warren, 1995). It is also established that a large number of AACSB accredited universities are now offering courses in business process management due to the increasing demand in industry for BPM trained professionals (Lee, 2008; Peslak, 2005). However, the innovation in the content and pedagogy of these courses has been lagging behind the demand for them. Published work on this subject has also compared process modeling tools and techniques with methodologies ranging from ontological analysis to representational analysis and their combinations (Gregoriades and Sutcliffe, 2008; Recker, 2009; Siau, 2004). In some recent studies of the effectiveness of teaching BPM, process modeling has been found by students to be valuable in understanding business process mapping, information gathering, data modeling and migration strategies (Jairaj, 2010; Tomislav et. al., 2008). Similarly, innovative teaching approaches such as ERP-enabled process simulation have been recommended and their effectiveness argued in other academic studies (Pellerin and Hadaya, 2008; Pope and Reeves, 2005). However, as far as we are aware, research studies to investigate the differences in the perceptions of students on the effectiveness of these innovative pedagogies are absent from the academic literature, although the differences among the students coming into MBA programs with varied backgrounds, career objectives and other motivations are very real. The primary motivation for our exploratory research is to address this glaring gap in the academic literature by examining how IT-oriented and Business-oriented MBA students perceive the usefulness of business process simulation modeling as a pedagogical tool.

Perceptions of students taking a required Business Process Management (BPM) course in the MBA program at Bentley University, an AACSB and EQUIS accredited business university, were investigated in this research to determine the effectiveness of process modeling exercises completed by students. This semester long course consists of three distinct parts: (a) General Process Management concepts, (b) Process Modeling, and (c) Enterprise Resource Planning (ERP) systems. In the first part of the course, the importance of BPM is established and students are introduced to process analysis methodologies such as Six Sigma and SIPOC (Supplier-Input-Process-Output-Customer) or high-level process mapping. In the second part, lasting four weeks, students complete three modeling exercises of gradually increasing complexity. A representative exercise completed by students individually is provided in the following section of this paper. In the last section of the course, students complete two exercises with SAP, studying the details of Sales and Distribution (S&D) and Material Management (MM) processes in organizations. Our investigation centered on the second part of the course, involving business process modeling with the student version of a commercially available simulation tool. **Our empirical investigation reported in this paper is not about the advantages, mechanics, characteristics or comparability of simulations tools and approaches but their utility as a teaching and learning tool in the classroom environment.**

The tools currently available to process analysts and designers fall into three categories – comprehensive systems, graphics tools, and simulation tools. Systems such as Advanced Planning and Scheduling (APS), Manufacturing Resource Planning (MRP II), Enterprise Resource Planning (ERP) Systems, and Computer Integrated Manufacturing (CIM) are often used by strategic analysts in organizations. These comprehensive systems require numerous supplemental tools and techniques to enhance their effectiveness. Process analysts and designers often use "visualization" or "graphic" tools such as Gantt Charts, Queuing Network Models, Colored Petri Nets, Event-Condition-Action (ECA) Rules, State-charts, and Activity Diagrams in Unified Modeling Language (UML). Until recently, most of these techniques have been used by engineers, mathematicians, and computer systems professionals with highly technical notations for solving problems utilizing queuing theory, stochastic events, integer programming, and resource optimization (Harrison and Lopez, 1999). However, since 2004, a standard business modeling approach known as Business Process Modeling Notation (BPMN), managed under the Business Process Management Initiative of the Object Management Group (OMG), has been available for modeling processes from a business perspective. This approach, however, is predominantly used as a standard modeling tool often without any inherent simulation capabilities. BPMN, however, recommends the use of simulation in the modeling process since simulation can imitate the operations of a business by compressing time and displaying the animation of the process flow. Simulation software can gather statistics about various elements of the model and analyze its output to improve process efficiency from management's perspective. The capabilities of simulation modeling are being discussed with increasing frequency in the academic literature on business process management and ERP systems (Greasley and Barlow, 1998). Organizations such as General Electric, Honeywell, American Express, Motorola, 3M, Nationwide Insurance, and NASA have now started using process modeling and simulation to improve their business and manufacturing processes.

Simulation tools treat business processes as dynamically coordinated sets of collaborative activities that deliver value to customers and provide analysts extensive capabilities to model the dynamic behavior of processes. Simulation based process modeling tools help process improvement by (a) incorporating control features that ensure integrity of processes and compensate for human or system failure, (b) increasing the speed of response and reducing the lag time, (c) providing real-time feedback about the status of processes, and (d) measuring the time and cost of processes so they can be optimized.

Two important components of BPM are (a) Workflow Automation, and (b) Enterprise Application Integration. Workflow Automation deals with automating business or industrial processes that primarily involve people and desktop applications used by them. This type of automation is often identified as human-centric business processes. Enterprise Application Integration (EAI), on the other hand, deals with automating business processes involving enterprise or back-office applications. In our experiment, the model building exercise integrates these two components of BPM in a computer based simulation model, analyzes the output from the model, and isolates the problems with the existing process by objectively measuring operational delays, queue build up, resource utilization inefficiencies, and non-value added time.

THE SIMULATION EXERCISE

This simple exercise models a customer service center and is designed not only to demonstrate the modeling process but also expose students to the global dimensions of business process management with extensive discussion in the classroom setting.

Effective operation of customer service centers to maintain competitiveness has become an integral part of organizational strategy with business process reengineering since the 1990's (Caro and Guevara, 2003; Dooman and Jungum, 2008; Gunasekaran and Kobu, 2002; Muehlen, 2004). This exercise models a small-scale customer contact center (CCC) facility located in country such as India, providing customer support to its clients as an off-shore BPO organization for credit card processing operations of two client banks. One of these clients is located in the United States and the other in the United Kingdom. The primary objective of the modeling exercise was to help the management of the BPO center with hiring, training, and allocating to various activities call assistants and customer service representatives with different specializations. This organization initially employed three call center assistants whose responsibility was to receive calls, log them, and direct them towards appropriate CSRs. The modeling software used for this purpose was a commercially available system with simulation capabilities, licensed at the University for use by students and faculty in both graduate and undergraduate courses. It must be reiterated that the purpose of this research is not to demonstrate the advantage of simulation, capabilities of simulation software, or the complexities of the simulation exercise. The objectives is to utilize the simple exercise as medium of studying how differently students perceive the utility of process modeling as a learning tool.

Calls from each client country are separated at the arrival and routed to a CSR who logs the call and determines whether it is a simple call or complex call. While simple calls are answered by the CSR for simple inquiries, complex inquiries are forwarded by this CSR to specialized representatives who address complex queries in detail. This CCC handles predominantly inbound calls that are commonly associated with customer support centers, help desk services, airline reservation systems, order taking, and hotel reservations. To keep the complexity of the modeling process manageable, outbound calls traditionally associated with telemarketing and surveys are not included in the model. The trunk lines of the customer contact center are connected to the public switched telephone network (PSTN) and the calls coming into the center are distributed to one of the three designated "call assistants" through an automatic call distribution (ACD) unit shown in the model.

Initially, among the 16 customer service representatives employed by the organization, 8 respond to the US clients and 8 to UK clients. Three of these 8 CSRs in each group have specialized training to solve more complex problems of clients requiring longer interaction. A middleware is used by this customer contact center to closely integrate the telephone and computer based information system so that a CSR can speak with the customer while displaying information about the customer from the organizations database through a customer resource management (CRM) system on a monitor.

The model analyzed by students is depicted in Diagram 1 below and the results of the two simulation runs are summarized in Table 1. The legend in the diagram explains the meaning of various constructs of the model. After examining the results of the first run which shows a rather inefficient process with large number of incoming calls being abandoned due to inadequate human resources capacity, students adjust these capacities by employing additional human resources or cross-training the existing resources. With these adjustments, the process definitely improves in the second simulation run as demonstrated by a very small number of abandoned calls, among other improvements.

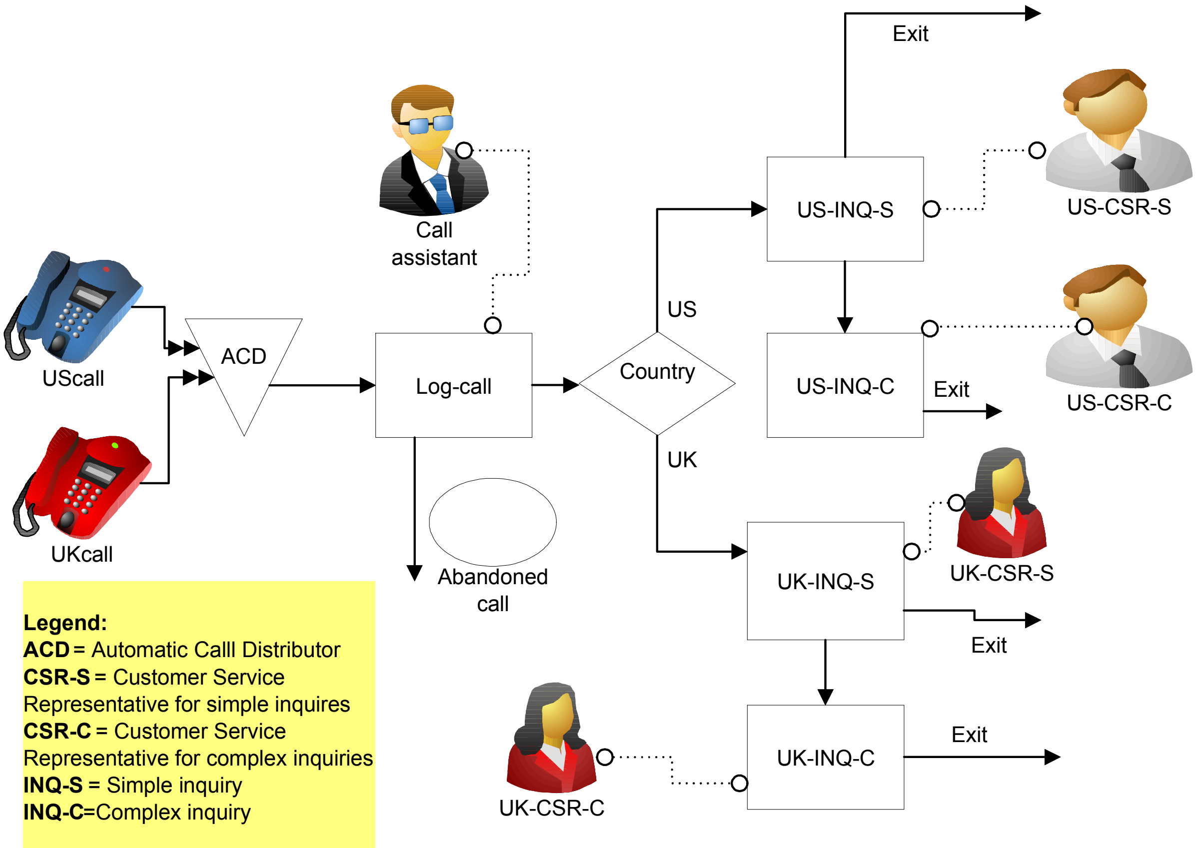

Figure 1: BPMO Customer Contact Center Model

Summary of simulation results

The primary objective of this exercise was to assist the organization with human resources planning for the BPMO operations. Table 1 below summarizes the output from two representative simulation runs to demonstrate to students that employing additional resources to perform activities causing bottlenecks in the system does improve the efficiency of the process.

In the entity summary, we noticed that the average cycle time increased for both US and UK calls with the modified parameters but there was no significant change in the average value-added and non-value added times. However, the new scenario shows a drastic drop in the number of abandoned calls, from 121 to 19. The conclusion drawn from these observations is that the number or ratio of customer service representatives for simple versus complex inquiries for both countries is not a bottleneck in the system. Employing three additional call center assistants, the lowest cost human resource in the organization, significantly reduced the number of abandoned calls and increased process efficiency with respect to the UK calls without significantly affecting the US calls.

	Resource Utilization		**Entity Summary**				
RUN	Resource Name	% Utilization	Entity name	Quantity processed	Cycle time	Value Added Time	Process Efficiency
First	Call Assistant	74.4	US CALL	99	23.3	14.03	62.2%
First	US-CSR-S	35.3	UK CALL	85	26.0	16.05	61.7%
First	US-CSR-C	43.6	ABANDONED CALL	**121**			
First	UK-CSR-C	29.6	**Conclusion from the first run**: Inefficient process with large number of calls abandoned by customers				
First	UK-CSR-C	59.7					
Second	Call Assistant	56.2	US CALL	158	22.3	13.2	59.2%
Second	US-CSR-S	54.2	UK CALL	126	24.0	16.0	66.7%
Second	US-CSR-C	24.4	ABANDONED CALL	**19**			
Second	UK-CSR-C	43.8	**Conclusion from the second run**: Efficient process with very few called abandoned by customers				
Second	UK-CSR-C	45.0					

TABLE 1: Summary of results from two simulation runs

HOW MBA STUDENTS PERCEIVE THE VALUE OF BUSINESS PROCESS MODELING:

While teaching the BPM course, the faulty observed from anecdotal evidence that the reaction of some MBA students with IT background to the difficulties experienced with the modeling exercises was different from the students with business background. These difficulties included installing the software, creating and debugging models, and interpreting the output of the models. These differences in perceptions provided a motive for this study to empirically determine whether the differences were real and how the course can be improved to provide both groups of students a challenging experience. At the completion of the process model exercises, students were asked to complete a questionnaire survey containing 15 questions. These questions, synthesized through a brainstorming session of the faculty involved in teaching or coordination of the course, were classified into three categories: (a) Process Analysis Issues, (b) Course Related Issues, and (c) Organization Related Issues. Each category contains five questions on which students were asked to indicate, on a Likert type psychometric scale, how helpful or unhelpful they found the simulation exercises by indicating one of the choices: (5) Very helpful (4) Somewhat helpful (3) Neutral (2) Somewhat-unhelpful, and (1) Very-unhelpful. Table 1 on the following page lists these categories and dimensions with their means, standard deviations, t-statistic, and the level of significance in the difference between the IT-majors and Business-majors. These surveys were administered to four sections of the course over three semesters and 95 responses obtained from the students were analyzed for relevant statistics.

The five process analysis issues examined in the study are (a) analyzing business processes performance (efficiency and cycle time), (b) describing the structure of business processes (process elements and relationships), (c) defining the process performance parameters (VA, NVA, delays and queues) more clearly, (d) exploring the root causes of process inefficiencies, and (e) verifying the results of manual process analysis. The course related issues are (a) Modeling Business Processes (Creating, executing, and debugging process models), (b) illustrating the process management concepts discussed in class, (c) understanding the purpose of the course, (d) high- level process mapping (SIPOC elements of business processes), and (e) understanding fundamental BPM Concepts. Similarly, the the five organization related issues investigated are (a) improving organizational communication regarding business process improvement, (b) developing a holistic BPM vision in the organization, (c) implementing innovative processes and organizational structures, (d)improving management of BPM projects, and (e) grasping business process control issues.

No.	Variable (dimension)	Group	Mean	Standard Deviation	T-Statistic	Significance
	(a) Process Analysis Issues					
a.1	***Analyzing business processes performance (efficiency and cycle time)***	***IT-majors***	***3.74***	***.966***	***-2.554***	***.012***
		Business-majors	4.19	.702		
a.2	Describing the structure of business processes (process elements and relationships)	IT-majors	3.88	.822	1.374	.173
		Business-majors	3.62	.953		
a.3	Defining the process performance parameters (VA, NVA, delays and queues) more clearly	IT-majors	3.64	.873	-1.156	.251
		Business-majors	3.87	.991		
a.4	Exploring the root causes of process inefficiencies	IT-majors	3.11	.993	-.809	.421
		Business-majors	3.28	1.046		
a.5	Verifying the results of manual process analysis	IT-majors	3.62	.982	-.127	.899
		Business-majors-	3.65	.974		
	(b) Course related Issues					
b.1	***Modeling Business Processes (Creating, executing, and debugging process models)***	***IT-majors***	***3.83***	***.813***	***2.197***	***.031***
		Business-majors	***3.35***	***1.168***		
b.2	Illustrating the process management concepts discussed in class	IT-majors	3.46	.884	-.885	.378
		Business-majors	3.63	.917		
b.3	Understanding the purpose of the course	IT-majors	3.50	.980	-1.254	.213
		Business-majors	3.93	.749		
b.4	***High- level Process Mapping (SIPOC elements of business processes)***	***IT-majors***	***3.15***	***1.027***	***-2.446***	***.016***
		Business-majors	***3.70***	***1.127***		
b.5	***Understanding fundamental BPM Concepts***	***IT-majors***	***3.56***	***.968***	***-2.065***	***.042***
		Business-majors	***3.93***	***.723***		
	(c) Organization related Issues					
c.1	Improving organizational communication regarding business process improvement	IT-majors	3.38	1.170	-.423	.674
		Business-majors	3.47	1.030		
c.2	Developing a holistic BPM vision in the organization	IT-majors	3.43	.874	-.201	.841
		Business-majors	3.46	.926		
c.3	Implementing innovative processes and organizational structures	IT-majors	3.79	1.080	1.424	.158
		Business-	3.48	1.023		

		majors				
c.4	Improving management of BPM Projects	IT-majors	3.77	1.012	.228	.820
		Business-majors	3.72	.960		
c.5	***Grasping Business Process Control Issues***	***IT-majors***	***3.28***	***0.847***	***-2.212***	***.029***
		Business-majors	***3.89***	***0.820***		

Table 2: Difference in the Means for IT-majors and Business-majors
(The rows containing differences that are statistically significant at α<.05 are *bold and italicized*.)

INTERPRETATION OF RESULTS

The mean of student perceptions is the highest (4.19) on "Analyzing Business Process Performance" for Business majors, and the lowest average score (3.15) is on "High-Level Process Mapping" for IT-majors. Since all the averages are above the median of 3.0, it can be concluded that most students found the simulation exercises helpful to a degree in understanding the process-related, course-related, and organization-related issues in BPM. The lowest means of 3.11 for IT majors and 3.28 for Business majors on the question of the "root cause" analysis of process inefficiencies reinforces the notion that process modeling is not very effective in finding these causes. Despite the rapid advances of the technology of stochastic modeling, finding root causes of process difficulties remains a problem that does not yield to mechanistic approaches and the experience of the analysts remains crucial to finding the underlying causes of problems. This observation is in conformity with what the students learned from class discussion and readings on BPM.

Statistically significant differences have been observed on individual questions between IT-oriented and Business-oriented students on five dimensions. These dimensions are highlighted in the appropriate rows in Table 2. Means of 3.74 for IT majors and 4.19 for Business majors are statistically significant on dimension a.1 in the table. The business students, who are generally from accountancy, finance, and marketing backgrounds and, consequently, more familiar with business processes, find the modeling exercises more "fun" for analyzing business processes. IT students, on the other hand, were somewhat disadvantaged in this respect with their lack of formal business training. A statistically significant higher mean of 3.83 on dimension b.1 in the table indicates that IT oriented students find the procedural aspects of the modeling exercises more appealing due to their superior technical training and abilities. This result is not unexpected but its implication to the design and delivery of the course are important. There are two other dimensions, b.4 and b.5 on which the means of the two groups are statistically significant. The SIPOC analysis of b.4, originating with the Six-sigma methodology, has become widely accepted tool for creating high-level process map of the process. Before creating a simulation model of the process, students were asked to identify the SIPOC elements of the processes as a standard approach to process analysis. With a mean of 3.70, the business-oriented students appear to find the delineation of the SIPOC elements of business processes more interesting than IT-oriented students. Again, this can be attributed to the systematic preparation of business students in identifying and describing the business elements of processes while the IT-oriented students are more prone to unstructured and abstract thinking of the process elements. Statistically significant means of 3.93 and 3.56 respectively for Business and IT majors respectively on dimension b.5 in the table confirm the findings of the previous differences. Business oriented students are more convinced about the efficacy of simulation-based process modeling for understanding the underlying process control issues in BPM with simulation exercises. The importance of business process controls resulting from the requirements of the Sarbanes-Oxley Act in the United States and Basel-II accord in Europe is frequently discussed in the accountancy and finance classes in the MBA programs. This definitely gives the business students an advantage over the IT students in understanding and appreciating the process control issues in BPM. The general conclusion that can be drawn from these significant differences is that IT students are more interested in the technical and theoretical dimension of process simulation while business oriented students are more concerned about practical application of the tools and exercises in the business environment.

IMPLICATIONS OF FINDINGS AND SUGGESTIONS FOR FUTURE RESEARCH

The average of all means in the third column of Table 2 is 3.6, with the maximum possible of 5. This leads to the conclusion that students in both categories have sufficient appreciation of the value of the simulation exercises for improving their understanding of the subject. However, the perceived utility of simulation modeling was not extremely high implying that offering a complete graduate level course in business process simulation in MBA programs may not be desirable at this stage in the evolution of the discipline of business process management. We have also learned that by virtue of their undergraduate education, career objectives, and natural proclivities towards the discipline, IT and business majors have different perspectives on learning BPM with simulation modeling exercises. This indicates that at a university with sufficiently large body of students, consideration should be given to designing separate and different courses in BPM for IT and business majors. The course for IT majors can include greater emphasis on the technical issues of process modeling such as optimization and advanced constructs of UML while the course for Business majors can be centered on the organizational, process control, and process management issues. In fact, the course we analyzed in this study has three distinct components each constituting approximately one third of the course. In the first five weeks of the fifteen-week semester, general concepts of business process analysis are introduced to students. These components include the need for process management, characteristics of process enterprises, importance of business processes in organizations, manual process analysis, and techniques of process analysis and design such as Six-sigma. In the second part of the course, a modeling tool is introduced and exercises of gradually increasing complexity are assigned to students to be completed on an individual basis. The third component of the course includes Enterprise Resource Planning (ERP) and inter-organization Systems. This component requires students to complete two major exercises with SAP, one involving the Sales and Distribution process, and the other Materials Management process. The design of the course based on the balance between the theoretical BPM concepts, process modeling, and process implementation with ERP systems provides students a broader exposure to the subject of BPM.

CONCLUSION

Learning business process management, innovation, and reengineering requires students to assimilate a variety of hard and soft skills. Soft skills are inherently difficult to teach with technology-oriented approaches such as process modeling and simulation. Designing appropriate classroom exercises for business processes, therefore, becomes a complex task. Appreciation of the differences between IT and business oriented students is essential to create learner centered simulation environments and exercises which can satisfy the needs of different groups of students. Instead of individual exercises, group exercises can be created and the groups of students can be formed by pairing IT oriented and business oriented students. Alternatively, altogether different exercises can be created for IT oriented and business oriented students. Another approach could be to teach the course by a team of instructors who have expertise in soft and hard skills needed for business process management.

More research is certainly needed to reach any definitive conclusions about the design of these courses because students differ not only on their business versus IT training but their cognitive preferences, gender, age, and many other attributes. A multidisciplinary approach, including the considerations of competencies, tools, techniques, and frameworks, is essential to teach a subject like BPM, which is inherently multidisciplinary and lacks widely accepted paradigms and theoretical frameworks. The essential contribution of our exploratory research is to provide some empirical evidence to create an awareness of these pedagogical issues among the faculty teaching BPM courses in colleges of business administration.

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