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Abstract:

In response to the growing proliferation of Business Process Management (BPM) in industry and the demand this creates for BPM expertise, universities across the globe are at various stages of incorporating knowledge and skills in their teaching offerings. However, there are still only a handful of institutions that offer specialized education in BPM in a systematic and in-depth manner. This article is based on a global educators' panel discussion held at the 2009 European Conference on Information Systems in Verona, Italy. The article presents the BPM programs of five universities from Australia, Europe, Africa, and North America, describing the BPM content covered, program and course structures, and challenges and lessons learned. The article also provides a comparative content analysis of BPM education programs illustrating a heterogeneous view of BPM. The examples presented demonstrate how different courses and programs can be developed to meet the educational goals of a university department, program, or school. This article contributes insights on how best to continuously sustain and reshape BPM education to ensure it remains dynamic, responsive, and sustainable in light of the evolving and ever-changing marketplace demands for BPM expertise.

Keywords: business process management, scholarship, curriculum design, education, course offerings, issues, assessments

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Editor's note: Authors are listed in alphabetical order of last names. All authors contributed equally to the paper. The article is based on a panel held at the 2009 *European Conference on Information Systems*, Verona, Italy.

I. INTRODUCTION

Business processes are the capability of an organization to execute its strategy; thus a structured approach to manage business processes is essential to achieve strategic goals. In recent years, Business Process Management (BPM), a set of structured methods and technologies for managing business processes, has emerged as a powerful competitive tool for today's organizations [Harmon and Wolf, 2010; Spanyi, 2008; Watson, 2008]. The term *BPM* is today claimed by various parties but seems to have originated sometime in the 1980s. The focus then, as now, is on viewing business processes as a defined and properly managed corporate asset, with all that entails (ownership, objectives, measurement and control, oversight, improvement, strategic fit, and development). This more generic view of business processes and their management is a maturation of the process movements of the 1980s and 1990s that include business reengineering [Hammer and Champy, 1993], business process innovation [Davenport, 1993], Six Sigma and Total Quality Management (TQM) [Laguna and Marklund, 2004], and workflow management approaches [van der Aalst and Hee, 2002]. The technologies associated with BPM include enterprise resource planning (ERP) systems, process modeling and simulation applications, and business process management systems (BPMS). Additional methods, such as work systems [Alter, 2002; Alter, 2009], are also being proposed for bridging the gap between BPM and the socio-technical approach to systems analysis and design and facilitating understanding of processes and systems by business professionals.

As organizations are becoming more process oriented and BPM tools and methods continue to evolve, the need for BPM expertise is increasing. Process owners, process analysts, process architects, and managers of BPM centers of excellence are just some of the job descriptions for which specialized BPM skills are required [Antonucci et al., 2009; Hill, 2006; Melenovsky and Hill, 2006; Olding and Rosser, 2007]. While an increasing number of organizations are interested in adopting or expanding BPM approaches and implementing BPM technologies, most lack sufficient internal competencies needed to undertake these BPM initiatives. For example, there is a general lack of (1) understanding of BPM principles in business organizations, (2) stakeholder commitments to implement and support BPM initiatives, and (3) managers' knowledge of BPM [Bandara et al., 2007]. This situation is exacerbated because BPM scholars, practitioners, and professional bodies lack a common definition of the scope and meaning of BPM.

In addition, there seem to be at least three practitioner BPM camps, with various factions within each. First, the BPM generalists advocate a wide range of methods directed at improving the functioning and management of business processes. Various efforts are underway to develop manifestos for this (such as BPM Nexus group's effort to develop a "BPM Accord"), although most generalist groups are generally centered around the views of one or two leading BPM consultants and speakers. These BPM professionals, especially in Europe, adopt a managerial perspective of BPM as a "*top-down methodology designed to organize, manage, and measure the organization based on the organization's core processes*" [Harmon and Wolf, 2008]. Second, the Lean/Six-Sigma BPI professionals are attempting to extend their previous focus on physical flows and processes to information-based processes and services [George, 2003]. Third, the BPM technologists focus on enablement of core enterprise processes through information technology (IT) using BPM platforms or suites. This group, which includes most software firms, emphasizes the technical aspect of BPM [Oracle, 2008] as "*a set of new software technologies that make it easier for IT to manage and measure the execution of process workflow and process software applications*" [Harmon and Wolf, 2008].

Last, but not least, there is also a growing set of BPM certification standards. Two professional associations already offer business process certifications. The OMG Group offers the "OMG Certified Expert in BPM" certification with five different levels of certification offered or planned, each with a published set of recommended readings related to these certifications. The ABPMP (Association of Business Process Management Professionals) has published its own body of knowledge and offers the "Certified Business Process Professional (CBPP®)" certification. The ABPMP claims that their BPM core body of knowledge is practitioner-developed and attempts to combine these perspectives recognizing BPM as "*both a management discipline and a set of technologies that support managing by process*" [Antonucci et al., 2009]. To this end, the practitioner core book of knowledge borrows, refines, and extends tools, techniques, concepts, and ideas from management, technology, and quality domains.

In response to the growing need for specialized BPM skills, BPM is making strides in academia. Faculty members in Information Systems (IS), Computer Science (CS), Operations Management (OM), and other disciplines are leading the diffusion of BPM teaching and research in academia. Some IS departments are expressing an interest in teaching and developing new courses on BPM in order to attract students to the ailing IS majors [ISAHI, 2008].

European universities, with their emphasis on design science, seem to be ahead in this endeavor [ISAHI, 2008]. In Australia, BPM is proposed as an answer to calls from employer representatives, professional associations, and the federal government to embed employability skills in university curricula [Seethamraju, 2007]. There are indications that a few schools are establishing dedicated academic departments to develop courses and programs to enhance the education of university graduates and prepare tomorrow's BPM professionals and leaders.

Still, the lack of a common vision and definition of BPM among researchers and practitioners is hindering the development of a consistent BPM body of knowledge that can be used for education by both professional certification bodies and universities around the world. There have been few venues that have enabled the academic communities to come together in order to share experiences, shape courses, and engage in a serious dialogue on BPM education initiatives. One of the first attempts to do so was the 2009 BPM education panel at the European Conference on Information Systems (ECIS) in Verona, Italy [Chircu et al., 2009], featuring academics who were facilitators of BPM education initiatives at universities in Australia, Europe, Africa, and North America. The panel participants came from different continents, and they represented diverse universities, academic departments, degree programs, and educational approaches. This article is the result of the discussions generated during and after the panel. It documents what these schools are doing in the area of BPM, around the globe. The article thus builds on and expands the goals of the panel in documenting a sampling of current BPM initiatives in academia in terms of programs, courses, modules, technologies, and cases.

The remainder of the article is organized as follows. The BPM educational initiatives at five universities around the world (Bentley University, Georgia State University, Queensland University of Technology, University of Pretoria, and University of Vienna) are described in separate sections. Each section includes a brief description of the featured university, a summary of the BPM initiatives at the university, and a summary of challenges and lessons learned. Next, the article presents a comparative content analysis of these BPM education programs. The article concludes with a review of main contributions and a discussion of implications for higher education institutions to leverage the experiences described here in their own BPM curriculum design.

II. BPM EDUCATION: FIVE EXAMPLES OF THE STATE OF THE ART

BPM @ Bentley University

Bentley University was founded in 1917 as a school for accounting and finance in Waltham, Massachusetts, approximately twenty minutes west of Boston. Bentley is a business university with both AACSB (Association to Advance Collegiate Schools of Business) and EQUIS (European Quality Improvement System) accreditation. As of 2010, Bentley University enrolls about 4,000 full-time undergraduate students and 1400 graduate students, and is ranked among the top sixty undergraduate business programs in the United States and among the top five regional programs in the Northern United States. The McCallum Graduate School at Bentley University offers a full-time cohort-based MBA (Master of Business Administration) program, a more flexible part-time MBA program, seven MS (Master of Science) programs in business disciplines, and two Ph.D. degrees blending business, technology, and society.[1]

Although all degree programs at Bentley integrate business, technology, ethics, and global understanding, the IT focus in teaching, research, and supporting infrastructure has been a distinguishing feature of Bentley University. In the Business IT space it has three departments: the traditional CIS department, the Department of Information Design and Corporate Communication (IDCC), and the most recently created Information and Process Management (IPM) department. The development of courses and programs in the Business Process Management area is the responsibility of the IPM department.

Overview of BPM Teaching

Although Bentley does not have a major, minor, MBA concentration, or Master of Science degree that is dedicated to Business Process Management, the university has considered business processes to be an integral component of a broader business education for at least ten years. Bentley's journey of incorporating Business Process Management understanding in business education started when the cohort MBA program was launched in 1999. This inaugural cohort program was designed as a "clean slate" program with significant input from corporate partners. The first incarnation of the business process course was intended to be an integrating mechanism for the first year of the two-year program. After the course was offered for a few years in the new cohort MBA program, it was determined that BPM was important enough for all MBA students that it should be part of the advanced core of the part-time MBA program. A few years after the BPM course was included in the advanced core of the part-time MBA, two MS programs (the MS in Information Technology and the MS in Human Factors in Information Design)

[1] For more details, see http://www.bentley.edu/.

chose to include it as part of their program requirements. This steady increased requirement of the BPM course indicates faculty recognition of the importance of BPM in graduate business education. In any given year, the course is offered for one to two sections[2] of full-time MBA students and eight to ten sections of part-time MBA students, resulting in 350–400 MBA students taking the course. In addition, the cohort full-time MBA program requires a second course in BPM where the students work in directed teams on a large process analysis and improvement project for a leading local organization.

When Bentley University revised its business core for the undergraduate program (effective Fall 2009), the importance of business process management resulted in a three-credit required course called *Business Processes and Systems.* This course is scheduled to be taken each year by about 950 juniors as part of a twenty-seven credit business core that, along with the General Education core (arts and science courses), the student's major, and other electives, comprise the 121 credit undergraduate degree at Bentley. Last, but not least, the Accountancy Department also offers accounting information systems courses that are business-process focused with an emphasis on controls and accounting systems.

Overview of the BPM Curriculum at the Graduate Level

The goal of the graduate BPM course is to provide a clear understanding of how to manage business processes which includes understanding strategy/process linkage, defining processes, analyzing processes, and appraising the role of IT in process design. This goal is supported by the following learning objectives:

- Recognizing different types of processes in an organization and understanding how they relate to the organization's competitive strategy
- Using the firm's value chain to understand cross-functional linkages among business processes
- Describing a process in terms of work process goals, customers, activities, resources, and measures and management processes associated with the work process
- Employing quantitative and qualitative tools for analyzing, measuring, and evaluating business processes
- Understanding how enterprise systems integrate business processes
- Comparing and contrasting BPM approaches with Six Sigma and other quality improvement approaches

The major course goals and topics, as well as the materials, tools, and assignments used are summarized in Table 1. For delivery purposes, the course is organized into three parts. The first part uses the DMAIC (define, measure, analyze, improve, and control) framework from the Six Sigma approach to learn how to define, analyze, and measure business processes. The second part focuses on understanding how enterprise systems integrate the standard business processes. The third part looks at the challenges of integrating inter-organization processes.

From the first offering of the graduate business process course in 1999, its philosophy has been to inculcate a process view of the firm. There is an emphasis on business processes (those that cross functional areas) and their support of the operational strategy of the firm. The DMAIC model is generally followed as the course imparts skills in the definition, measurement, analysis, and improvement of business processes. The course content is consistent with the topics included in the Business Process Management Common Body of Knowledge, published by the Association for Business Process Management Professionals [Antonucci et al., 2009].

The course starts with an introduction to Business Process Management and an explanation of how the broader concept of BPM fits with BPI (Business Process Improvement) and BPR (Business Process Reengineering). The evolution of related management theories and methods, such as TQM and Lean, is briefly reviewed. To distinguish BPM from a more narrow approach to the study of processes, the course starts by making the connection between business processes and the strategy of the firm. Business processes are presented in the context of the value chain to reinforce the notion that an organization is a set of business processes (starting with product design and ending with post-sales service) that cross the organization horizontally to provide customer value, but also that link vertically in a hierarchy of processes. For example, the supply chain management process can be further broken down into production planning, requirements planning, procurement, inbound logistics, production, and outbound logistics.

The first part of the course introduces Six Sigma and the DMAIC framework (Define, Measure, Analyze, Improve, and Control) as one method within the broader BPM discipline that is well-defined and that provides specific tools for process improvement. Each step in the DMAIC framework is covered in detail:

[2] At Bentley University, a section is a particular offering of a course listed in the course catalog during a specific semester.

Table 1: Graduate BPM Courses @ Bentley University	
Business Process Management (full-time program: 2 semesters; part-time program: 1 semester)	
Goals and Course Topics	Master basic BPM skills: • DMAIC: Defining, modeling, and analyzing IT-enabled business processes • Understanding the capabilities of enterprise systems that support business processes • Understanding people and organizational issues involved in BPM Develop strong analysis capability: • Critically read and assimilate BPM literature. • Analyze BPM cases. Become familiar with advanced issues: • Managing the supply chain • Inter-organizational systems in supporting cross-organizational processes
Materials	Reference book [Pande et al., 2001], book chapters [Laguna and Marklund, 2004], various BPM-related articles (research papers and industry whitepapers), internally-developed cases, notes, and exercises on process definition, measurement, analysis, and improvement and on inter-organizational processes and systems.
Tools	ProcessModel (http://www.processmodel.com/), SAP.
Assessments	Process modeling and analysis exercises using ProcessModel, core business process execution and analysis using SAP, exam (mid-term), team project (semester-long, separate, instructor-assigned team consulting project with major companies for full-time MBA course, scaled-down version, ¾ semester, student-proposed project in a real-world organization for part-time MBA course), self-reflection paper.

- Define: The importance of defining the process is emphasized and students learn to explicitly document the starting point, the end point and any interacting processes, as well as the process inputs and outputs and the process stakeholders (including customers and resources that perform the process). The students are also introduced to a modeling tool, ProcessModel. With this tool, they model simple processes along with attributes that can be used to simulate the process (e.g., arrival rates of items being processed, activity times, move times, and resources).
- Measure: In terms of process measurement, the focus is on calculating process capacity, throughput time, value added vs. non-value added time, and demand. In addition to these primary process measurements, issues related to assigning costs to a process and the broader concept of performance measurement are also discussed. Here, the emphasis is on the importance of designing performance measures that are specific (referring to the concept of operational definitions), unbiased, motivating, and supportive of process and strategic objectives.
- Analyze: As a result of "measuring" process performance, specific problems can be identified, and the search for root causes can commence. Six Sigma tools, such as fishbone diagram and cause and effect diagram, are presented as ways to organize thoughts about what the root causes may be. We then discuss various ways that hypothesized root causes may be tested. Students should be able to identify specific data that would be collected to "test" hypotheses and methods that would be used to analyze that data.
- Improve: Ways to improve the process, including the use of information technology to support any process improvements, are presented and discussed in this step.
- Control: The first part of the course ends with a discussion of process controls, intended to enable students to understand the many dimensions and uses of controls. For example, one can think about a process being "in control," one can design controls into the process to achieve better adherence to process objectives and reduced risk, or one can also think about the concept of "controlling" a newly revised process to make sure it is implemented and executed as intended.

Students complete a series of assignments in this first phase of the course that test their ability to "define, measure, and analyze" a process. The first assignment focuses on "define" by requiring that the students specify standard process elements and then model a process in ProcessModel. A second assignment asks the students to analyze a process and to compare the results from their manual calculations to the results reported by ProcessModel. Not only does this show if the students understand the fundamentals of analysis, but it also indicates if they can correctly interpret the results provided by the model simulation. In addition to these assignments, a midterm exam has been implemented recently at the end of the first part of the course to further test the student's understanding of these core BPM concepts.

The second part of the course allows students to spend three weeks studying how enterprise systems support core business processes in organizations today through the use of videos, lectures, and hands-on experience with a

leading enterprise system, SAP. The SAP enterprise system was chosen in order to enable students to experience managing real-world business processes with a system they are likely to encounter in their future jobs [Fedorowicz et al., 2004]. There are three assignments used in the course to allow the students to experience SAP directly. After the SAP architecture is introduced, students navigate through records, documents, and reports that already exist in the system and answer questions to highlight the integrative features of the system. Next, the students are introduced to the sales and distribution process in SAP and then they work on creating customer master, material master, quotation and sales order records. They traverse the sales and distribution process from quotation to payment, viewing a number of intermediate screens. The SAP portion ends with a purchasing process assignment. Throughout the assignments, students are required to answer questions intended to get them to think about and understand the power of the system to support end-to-end business processes, the integrative nature of the system, and the possibility for greater efficiency and effectiveness afforded by such a system.

The third part of the course is devoted to inter-organizational business processes and the concept of BPM maturity. We use a case about a retailer that is implementing CPFR (Collaborative Planning, Forecasting, and Replenishment) with its vendors. The case illustrates the complexities of coordinating processes and systems across business partners. The discussion includes issues of process standardization and process maturity.

The pedagogy adopted in the course requires the students to complete several individual process definition, modeling and analysis assignments, a mid-term exam, several individual SAP assignments, and a team project. The team project is essential to ensure students can apply the lessons learned in the classroom in a real-world situation. Figure 1 shows how the classroom learning concepts are related to the field project requirements.

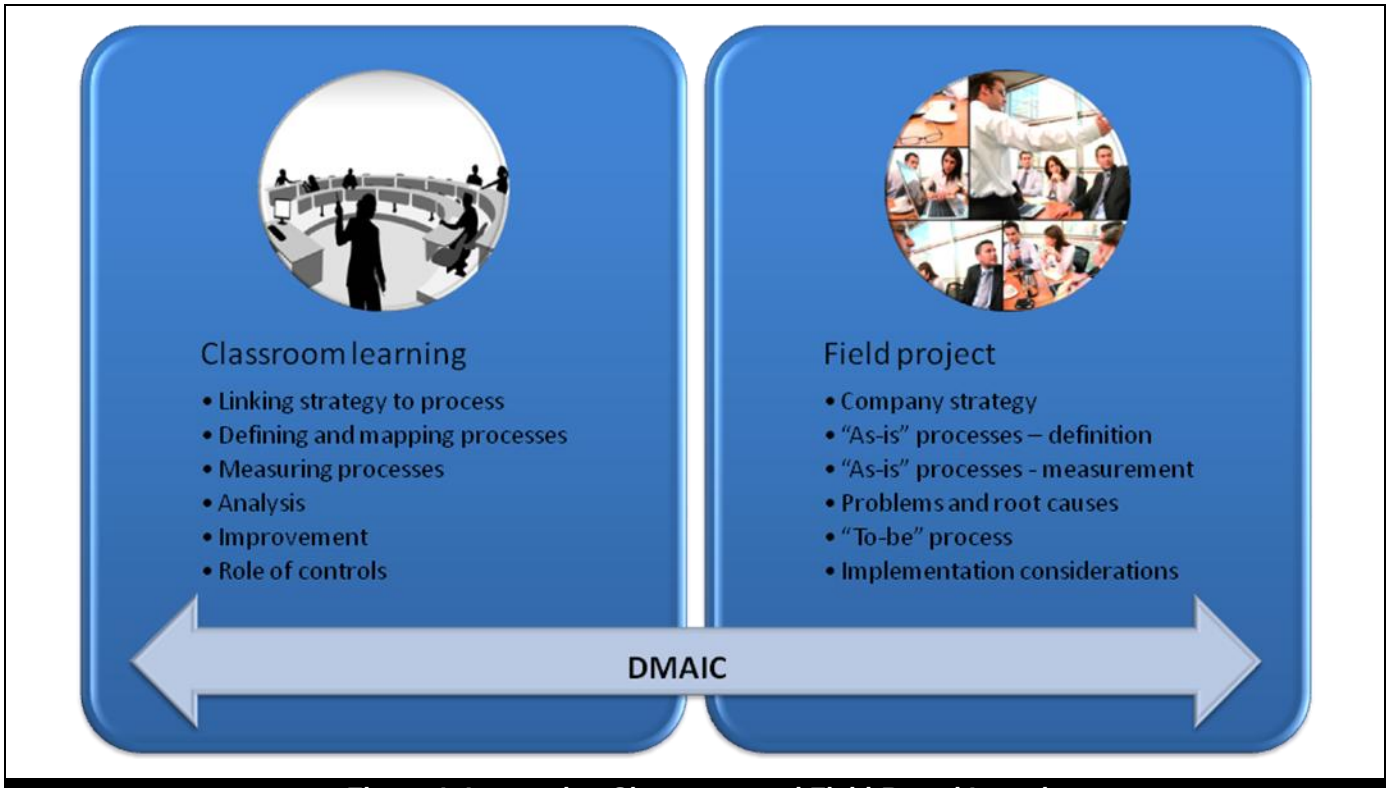

Figure 1. Integrating Classroom and Field-Based Learning in Graduate BPM Courses at Bentley University

Due to the different length of the part-time and full-time MBA courses (one versus two semesters), the team project is structured in the two courses as follows.

The students in the one-semester course do a team project whereby they define and analyze a business process. The teams usually choose a process that exists within a company where one of the team members works. The define, measure, and analyze phases of DMAIC are emphasized in this project as the teams are guided and monitored to collect sufficient data and analyze it appropriately to find the root causes of problems. If the appropriate root causes are identified, the recommended solution is fairly obvious. The instructors deemphasize the solution aspect of the process project, however, since there is a limited time the teams can devote to the project and it is more important to gather data and analyze it appropriately so that a reasonable solution can result. If there is a strong emphasis on the solution in a limited project like this, the teams are motivated to "skip" to the solution without

doing the requisite data collection and analysis. Thus, the approach adopted for this project is to try to reinforce the importance of the early stages of any process improvement project.

The two-semester BPM course follows the same general pattern as the one-semester course. However, it includes a major field-based learning component that takes up a second semester. In teams of five or six students, the full-time MBA students take on a major process improvement project in a leading local organization. The project is one that has been arranged by the faculty in consultation with corporate contacts. The particular process to be studied and the general scope of the project are determined before the specific projects are assigned to specific teams. There is an attempt to match team skills to the requirements of the project. The projects can cover any business process and be in any industry. The exposure that students get, not only to their own assigned process and organization, but to all the projects being undertaken in a particular year is extremely valuable to their MBA education. Throughout the second semester the faculty work with teams individually to guide them and sort out all the myriad issues that come up in a process improvement project. The teams learn how to apply the skills they have learned in the first semester of the course, but they also learn about the importance and challenges of other factors such as culture, information systems, people, industry, and environment. All teams discuss their projects and challenges in class so all students gain greater knowledge and mature quickly in their ability to deal with multi-faceted, complex problems and projects.

Overview of the BPM Curriculum at the Undergraduate Level

The planned undergraduate Business Processes and Systems course is the only organizational-level information systems related course in the business core. Because of this important role, this course includes additional coverage of systems that the graduate level course does not include. According to the curriculum plan (current as of August 2010), the undergraduate course covers basic concepts of business process definition, measurement, analysis, and improvement, but does not cover managerial issues in as much depth as in the graduate course. The plan is to introduce students to both the process modeling software (ProcessModel) and enterprise systems (SAP) in a similar way as at the graduate level. However, any process improvement projects undertaken at the undergraduate level is a scaled-down version of what is done in the one semester BPM course in the graduate school.

This course is intended to give undergraduate business students (from every major) a better understanding of how businesses operate in an integrated fashion by acknowledging business processes and the systems that support them. The same perspective that is provided to the graduate students serves the undergraduate students well as they prepare for their first professional positions as accountants, financial analysts, or marketing associates, among others.

Challenges, Lessons Learned, and Innovations

As the BPM courses at Bentley University have been evolving since their introduction in 1999, a number of innovative solutions have been developed to deal with the various challenges of delivering these courses. These challenges and innovations are briefly discussed below.

The challenges faced by the Bentley University in creating and sustaining the business process curriculum may be unique to the philosophical approach taken during the course proposal, design, and implementation. The course started in the MBA program and did not initially have a departmental home. The very first time the course was delivered in the full-time MBA program, it was taught by a team of faculty. An operations management professor coordinated the content and taught several sessions, while an accounting professor dropped in to cover the measurement issues; one computer information systems (CIS) professor taught the SAP content and another CIS professor taught a modeling tool (iThink). The multi-faculty design was considered appropriate since the course was intended to be a cross-disciplinary course, but this original model was not sustainable. After the first year, the two-semester course was taught by a pair of faculty members, usually one from the management department and one from the accounting department. More recently the teaching has been done by IPM department faculty, two in each section of the two-semester course, and one IPM faculty member per section of the one-semester course. The Information and Process Management department was created after the university had established a presence in the BPM area. The CIS department has not played a role in the BPM curriculum since the first year it was offered.

One of the major challenges of offering BPM courses is the lack of appropriate textbooks. While various reference books can be used to support parts of the course, there is no integrated textbook that covers BPM topics in sufficient depth. As a result, the graduate BPM courses rely on a combination of reference books, book chapters, articles, and internally-developed cases, course notes, and exercises. We have observed for example that one of the hardest parts of process analysis is teaching what data to collect in order to establish the real problems impacting the process. Therefore, the department has been developing internal cases to support the teaching of what specific data to collect and how to successfully collect and analyze it. The lack of a text book increases the uncertainty on the part of new instructors and students about exactly what “Business Process Management” is. Core faculty frequently

update the course, consistently trying to improve the pedagogical techniques and materials to help students become proficient in the skills and attitudes required of a manager with a business process orientation. The updates are managed by a course coordinator and deployed to all course instructors using a faculty knowledge base hosted on the university's online course delivery platform.

Another challenge is related to the interdisciplinary nature of the course. At Bentley, the BPM course is managerially oriented but has two IT applications that are integral to its delivery, ProcessModel and SAP. The concept of performance measurement is also featured in the course. Teaching the course requires the faculty to have a holistic view of business, to understand the role that business processes play in organizations, and to understand the integral relationship between people, processes, and systems. Because many business faculty are PhDs who tend to specialize even within a particular functional discipline, it is not natural or easy for most faculty to quickly grasp the big picture of the course. After going through the whole cycle of the course once or twice it becomes easier and the faculty are better able to help the students understand how all the pieces fit and why it is important to have a process perspective in business.

A major challenge is brought by the significant technology component of the course. Because of the number of students involved, technical issues cannot be handled by instructors alone. Instead, close relationships with the software vendors for software licensing, access and support, and strong involvement from the IT department are key. Enabling student access to the process modeling and analysis software on campus and on personal laptops requires interaction with the software provider every semester and continuous monitoring for errors from the university IT specialists, as well as periodic testing for each vendor software upgrade, operating system change, or planned computer image deployment each academic year. SAP implementation problems are minimized somewhat as the software is accessed through the SAP University Alliance program. In addition to these technology set-up issues, it is burdensome for faculty to get up to speed on ProcessModel and SAP. Bentley does offer training on each of the applications, but it requires an investment of significant time for the faculty to learn both well enough to support the students and to feel comfortable with their integration in the course. It is particularly difficult to have part-time faculty teach the course as the time investment to learn the tools well enough is generally not worth it for the one semester they may teach the course.

Furthermore, it is challenging to maintain consistency across multiple sections, semesters, and programs. With over 350 students taking the course and three or four lead faculty teaching the course—in its various configurations—every year, it is essential to maintain a core set of common topics, cases, exercises, and assessments. To this end, a common syllabus and set of course materials is usually developed each summer for use by all course instructors during the next academic year. Apart from the time commitment required for this advanced planning and coordination, an additional challenge is tailoring the course topics for the needs of a very diverse student body (enrolled in full-time, part-time, or specialized master's programs, with varied levels of work experience) as well as for each instructor's interests and strengths.

Last, but not least, an extra challenge is related to the requirement to work on a real-world team project. In the part-time program, students are required to identify a business process in a real company on their own—and sometimes find it difficult to secure adequate access for appropriate data collection. In the full-time program, the projects (which are much more complex than those for part-time MBA students) are identified by the instructors prior to the beginning of the semester, and assigned to teams based on skills matching. To further ensure successful team dynamics, the full-time MBA students take a separate, two-semester team-building skills course in parallel with the BPM course. The formal set-up of teams and projects before the year-long BPM course sequence starts requires a significant time investment from faculty every summer to find appropriate projects and supportive sponsors that can work within the constraints of the academic calendar for the course. Any last-minute changes in sponsor availability or team composition can create delays and rework. And even if the terms of the projects are agreed upon beforehand, once the MBA student teams start the project there could be scope changes (sometimes significant) and data availability problems. The tight project schedule in the part-time MBA program, and the increased project size and complexity in the full-time program require continuous monitoring of project activities by instructors. In the full-time MBA program, this translates into a much heavier workload for course instructors, especially during the second semester, which requires frequent team meetings and feedback on lengthy project documents.

Based on Bentley's ten years of experience with including BPM in its graduate school curriculum, there are a few lessons that have been learned. It does take time for students to appreciate what they are learning in the BPM class. Because the approach is comprehensive and cross-disciplinary, students do not always see the immediate benefits of what they are learning. This can be problematic for faculty for whom student evaluations of teaching are critical (i.e., tenure track faculty). To help counter less than stellar official student evaluations, informal feedback received (unsolicited) from students after they recognize the benefits of the course is collected and used. It is not unusual to

receive an e-mail from a student several months after the end of the course praising the course for what it contributed to their success in an internship or permanent job.

Although BPM is a cross-disciplinary area, it is not a good idea to have several faculty try to teach the course, each lending their own expertise, as it happened during the first year the course was offered at Bentley, since it is too difficult for the students to make the cross-disciplinary connections themselves. It is best to identify instructors who have a solid understanding of business because he or she has earned an MBA, has extensive business experience, or does field based research in businesses. Someone whose education, interest, and experience are more technically focused may find it difficult to assimilate into Bentley's BPM environment easily. The time it takes for such a faculty member to "come up to speed" can be frustrating for the faculty member, as well as for his or her students.

For any institution seeking to implement a similar BPM curriculum to that in place at Bentley, the following is suggested: (1) have one person act as a coordinator for the curriculum, (2) invest in, and maintain strong support for the IT components of the curriculum, and (3) adopt a continuous improvement approach to sustaining the BPM curriculum. Bentley has found that having one person take on the role of curriculum coordinator has been critical to maintaining consistency and quality in the curriculum. The coordinator should be someone who understands the intent of the BPM course. She or he can coordinate among all the different parties required to set up and maintain the IT components of the course, and can manage the updating of the course each year, making sure that all instructors have access to materials as required.

The technology components of the course need support beyond what the instructors can provide. Bentley has developed a close relationship with ProcessModel over the years which enables us to have easy access to the company and its support staff. ProcessModel has provided its corporate training at Bentley for several years. In exchange for Bentley providing the facilities for the training, ProcessModel allows Bentley's faculty to attend the training for free. For SAP, funding was secured from the university to hire a part-time specialist, someone who knows SAP well, and who can help instructors with learning SAP, developing curriculum and assignments, and grading SAP assignments. The SAP specialist assists in the classroom when required, and helps students outside of class. We also have a graduate student who supports both ProcessModel and SAP. The graduate student tests new assignments, hold hours in the lab to help students, answers students' questions by e-mail, and helps with some of the grading of the ProcessModel and SAP components of assignments. Having both the SAP specialist and the graduate student helps to relieve some of the burden of the faculty.

In addition to the solutions to the various challenges discussed above, another innovation is giving students the opportunity to reflect on their and others' work. Each MBA student team has the opportunity to try out ideas in class and receive feedback during interim project presentations and discussions. Moreover, in addition to the team grade earned on the project, each student must write a graded reflection on his or her project experience. Although not a large percentage of the individual's course grade, the reflection paper can be instrumental in helping the student realize the relevance of what they have learned over the semester and how they could have improved their performance on the execution of the project.

BPM is not a well established discipline and it is difficult for students to fully understand the importance of a business process orientation and how IT supports that. The students can also get frustrated by having to learn two IT applications in a single course. Each application has a unique role to play in the course and both are examples of tools that make significant contributions to BPM in many organizations. Bentley has a strong tradition of incorporating IT applications in many of its business courses so that students learn the theoretical concepts in an environment that will be similar to their future work environment. Therefore, for example, it is important to have that "hands-on" experience with SAP to truly understand how such a system supports a process orientation. Graduate students in particular do not always agree with this tenet and become very frustrated with having to navigate such a complicated enterprise system. But in the struggle, there is learning. Many companies use SAP or systems like it, and knowing first-hand how complex, but also how powerful the systems are, gives the Bentley graduate an advantage in the workplace.

However, faculty must always be on the look-out for new concepts that must be taught, as well as new ways to teach existing concepts so students can better understand them. Bentley's BPM faculty have a good understanding of the skills and concepts future business managers should have, but are constantly working on new ways to motivate the students to appreciate the integrated perspective they are trying to convey.

BPM @ Georgia State University (J. Mack Robinson College of Business)

The J. Mack Robinson College of Business at Georgia State University (GSU) began as an evening school of business in 1913. As of 2010, it enrolls 6,000 undergraduate business majors, 1200 MBAs, 500 specialized master's, sixty doctoral and twenty-five executive doctoral students. Overall the University has about 30,000

students registered at any given time. The College's Flex MBA program has been consistently ranked among the top-ten business schools in the United States since these rankings began.[3]

The Computer Information Systems (CIS) department is one of the oldest IS departments within a business school with its origins dating back to the late 1960s. It has been consistently ranked as one of the top-ten IS departments at both the undergraduate and graduate levels since the early 1990s by the major United States program ranking organizations. In terms of research productivity of its faculty, it has been consistently placed at or near the top based on numbers of research journal articles in various "baskets" of premier research journals in the field of IS. By the mid-1990s it was the largest US-based IS department by student numbers. Various business environment issues related to IT (e.g., Y2K, dot.bomb, offshoring) caused a significant decline in enrollments at the millennial shift that has only recently reversed itself, particularly at the undergraduate level. As of 2010, the CIS department has 470 undergraduate students majoring in Information Systems, ninety-five graduate students and twenty-eight doctoral students, selecting courses from among twenty-two undergraduate, and thirty-five graduate and Ph.D. CIS course offerings to complete their degree specializations in CIS.

The following remarks are made in the context of a business school and a business school curriculum, not that of computer science or informatics where students will likely have far greater technology backgrounds and knowledge.

Overview of BPM Teaching

Business process management as a course theme or topic was first proposed and implemented at the graduate business level as a required course for CIS master's students in the mid-1990s as a business process-reengineering course—CIS 8010. It has continued to this day with various updates in emphasis and theme along the way, and as of 2010 it is entitled *Business Process Innovation & Organizational Change Management*. Table 2 presents an overview of the course. In 2007 an advanced course on BPMS (Business Process Management Systems) implementation was offered as a one-time, special topics course.

Table 2: Graduate BPM Courses @ Georgia State University

CIS 8010: Business Process Innovation	
Goals	Imparting an understanding of how IT can be used to change and improve organizational functioning and the behavioral and political issues associated with bringing about such change.
Materials	Cases such as Eye Need Help—Now!, Apparel Manufacturing in Latin America, Online Learning at Minkuo Hospital, Call Center Design for Lion Financial Services, Pharmacy Service Improvement at CVS, Mann Gulch, Pacific Bell: Centrex Reengineering, Cisco Systems, Inc.: Implementing ERP, Town & Country, iTalk, Carrefour China, Building a Greener Store and Zara: IT for Fast Fashion, and others.
Tools	None
Assessments	Case analysis (one per class session), exams (mid-term and final; case-based), project (analysis of a real organizational setting and a proposed change using appropriate applications of information technology)

In 2003, a four-course master's specialization in BPM was proposed. However, the significant declines in graduate student enrollment caused this proposal to be shelved. Instead, with the revamp of the College's MBA curriculum, a required half-semester course on business process innovation (MBA 8125) was introduced in the fall 2004 semester. This course covered various aspects of process discovery and modeling, process critique and methods for both improvement and process innovation (inside-out and outside-in). In fall 2008, two half-course first-year MBA courses were recombined into full semester courses and the resulting MBA 8220 course combined both process improvement and innovation as well as more traditional topics on information systems management. It should be mentioned that other aspects of process improvement are addressed in courses offered by the College's Managerial Sciences department; mainly six-sigma and lean approaches to primarily analog processes.

In an effort to re-vitalize undergraduate enrollments, an effort began in 2005 to rethink the CIS undergraduate curriculum as a relatively small core set of courses and specializations. One specialization proposed and accepted in 2007 was in BPM. While the full set of BPM-related courses in the specialization consisted of four courses, only two courses beyond the CIS undergraduate core have been offered thus far. The next section focuses on these two courses in more detail.

Overview of the BPM Curriculum at the Undergraduate Level

The first of the two undergraduate BPM courses (see Table 3 for an overview) is CIS 4120, entitled *Define and Innovate IT-enabled Business Processes.* This course has been offered since the spring semester of 2008. It focuses on the following general topics: process-as-service contextualization and metrics, process discovery and

[3] For further details, see http://robinson.gsu.edu/index.html.

modeling (using BPMN), process critique, improvement and innovation, change management and implementation, and selected additional topics including simulation, process monitoring, management and business activity monitoring (BAM), business rules, and business object models. The mode of instruction is that of problem-based learning (PBL). That means that a single class session has the majority of time spent on solving previously assigned (at-home) problems or in-class problems. Approximately one-third of the time is used to introduce the session topic. The course also relies on a student-group defined external project (experiential learning) that involves all the elements of the course. This is delivered as a set of student team presentations and reports at the end of the semester. A commercial (free-to-use) BPMN modeling tool is used (TIBCO BSv3, switching in 2010 to BizAgi Process modeler), and IBM's INNOV8 BPM game. Other related tools associated with business object modeling (Liquid XML for XSDs) and rules specification modelers (iLog) have been tried but found to be too complex to assimilate relative to the value gained and topical coverage. This course is offered once per semester and tends to attract sixteen to twenty-four students per semester.

Table 3: Undergraduate BPM Courses @ Georgia State University

CIS 4120 Define and Innovate IT-enabled Business Processes		CIS 4140 Implementing IT-Enabled Business Processes	
Week	Topic	Week	Topic
1	Course and team project overview; introduction to BPM and BPMS	1	Course overview; introduction to BizAgiXpress
2	Process discovery, client/process metrics; servitization	2	BPMN review
3	BPMN Process modeling—activities and flows	3	From BPMN to BPMS process models (platform peculiarities)
4	Process modeling—gateways	4	BPMS implementation
5	Process modeling—events	5	Implementation lab #1
6	Review, synthesis, process patterns, BPMN tips and tricks	6	Web services and their specification and use
7	BPMN review session	7	Form design and user interface 1
8	Mid-term exam	8	Form design and user interface 2
9	Critiquing the As-is process	9	Master data model management
10	Process/service innovation	10	Implementation lab #2
11	One-on-one with project teams	11	Instantiating business rules
12	Process simulation	12	Portals and portal interaction
13	Defining business rules	13	Implementation lab #3
14	Guest lecturer on BPMS	14	Fine-tuning the implementation
15	Data models (BOM)	15	Continuous improvement
16	Project presentations	16	Project presentations
Materials: BPM for dummies (free) [Garimella et al., 2008], BPMN Modeling and Reference Guide [White and Miers, 2008] **Tools:** Process modeling tools (TIBCO Business Studio v3, moving to BizAgi Process Modeler), IBM's INNOV8 business process simulation/game. **Assessments:** Weekly in-class exercises, at-home exercises (~60% collected for grading), team project (process modeling, analysis and improvement), exams (midterm, final)		**Materials:** Documentation available from the BPMS vendor and optional readings depending upon the topics covered and interest of the students. **Tools:** BPMS platform—BizAgiXpress **Assessments:** Workshops and tutorials, case implementation using the chosen BPMS platform, team project (working BPMS implementation)	

The second of the two current course offerings is CIS 4140, entitled *Implementing IT-Enabled Business Processes.* As the title implies, this course is about how to take the knowledge gained in the preceding CIS 4120 course and actually implement a working system using a modern BPMS platform. As a by-product of this focus, a number of additional topics are naturally surfaced, such as business object models, human interactions and forms design, the role of internal/external business data, external services, organizational roles and task alignment, reasons for and methods of handling business rules, portals, and alerts, reporting, notifications and related concepts, and tools for on-going process management and improvement. "Details" also become more significant, among these: types of sub-processes, event types and handling, forms of iteration, roles and users, and task properties (expected versus actual). The flow of this course is to first acquaint the student with the BPMS platform by having them go through two or three sequential (and increasingly more complex) workshop-guided implementations of "real" business processes. This is done over the first six weeks of a fourteen-week semester. Along the way, the course interjects topics on the handling of data, business rules and forms. Then the student is given an "open-ended" case that he/she is to implement using the BPMS. About three weeks is given for completing this. Additional topics are introduced including sub-process handling, business process management analysis and reporting, and BAM. The remainder of

the time is spent on student-driven topics arising from their encounters with the BPMS (and broader reading) as well as bringing in external BPM experts to speak about real-world deployments. They are also expected to complete the implementation of a "real" BPMS using the platform. This could be the project they began in the preceding course or in a new one.

A critical aspect of the second course is the selection, implementation and use of a BPMS platform. A rather lengthy search and evaluation process for an appropriate BPMS learning platform was undertaken. This included (often difficult to obtain) academic licensing, training, and demo-ing for the following platforms: Cordys, TIBCO, IBM WebSphere, WebMethods, Ascentn, Appian, HandySoft and Intalio. In the end it was finally decided to adopt BizAgiXpress as the BPMS learning platform for CIS 4140. BizAgi has turned out to be a very good teaching platform as it has all the elements one would seek in a modern BPMS with a small enough footprint that it can, if need be, run on individual student's computers (BizAgi provides a free version of its software that is good for up to ten users). Reasonable documentation, workshops, tutorials, and forum support are available at no charge.

The good news in all of this is that the students themselves are beginning to realize the value of BPM-related knowledge and courses. Even though none of the GSU undergraduate BPM courses are part of the required core courses, enrollments have risen from a starting point of fifteen or sixteen students per year to over-capacity sections of twenty-five-plus offered in multiple sections (for the first CIS 4120 course). This is largely due to student "word of mouth." As they take (or are required to take) other process- or modeling-related courses (accounting, CIS, operations management) they are now beginning to appreciate the value-added perspective of BPM (and BPMS). They are telling their friends and fellow-students that they really need to have a better understanding of business processes, how they're identified, modeled, improved, innovated, and supported. We are now seeing increased student interest beyond "just" CIS students as well. And with more students taking the first course, the follow-on course (implementation) can now expect to see a proportionately greater number of students asking for and taking it as well.

Challenges and Lessons Learned

BPM-related topics and courses, as in the real world, challenge the status quo and consequently, present curricular implementation challenges. Within universities and departments, this is true in at least three levels: administrative, faculty, and student. Starting with the students, they want to know where the jobs are and how a BPM course or specialization will give them a competitive advantage in obtaining desirable, persistent, well-paid positions. While the student emphasis on job availability is especially challenging at the time of this writing, it is always there. Unfortunately the marketplace is not particularly clear about where individuals possessing BPM and BPMS skills are being recruited or their associated job titles. As always, HR departments significantly lag technology shifts regarding job titles and qualifications. A particular problem in the United States is the Motorola-GE syndrome where process improvement (of any kind) is equated to the possession of a brown- or black-belt in six sigma. This is partially ameliorated by having guest speakers from vendors, consultancies, industry, and professional research organizations [e.g., Gartner] come in to discuss job prospects, but this is, in some sense, preaching to the converted. Getting the word out that this is a good profession to be in is the primary challenge at the student level.

For faculty, teaching BPM-related courses present problems that also affect students, namely the lack of textbooks, teaching cases, and lecture materials related to BPM. To be clear, there are many books on all aspects of BPM, BPMN, and BPMS, as well as process improvement methods in various stripes and flavors. However, these are usually written for a "professional" audience and are devoid of elements students and faculty seek, such as real cases, clear stand-alone explanations, end- and in-chapter exercises, back-cover CDs with software, or instructor quizzes and exams. The few academic texts available (as of 2010) assume a strong technology background and orientation that is not present among typical business students majoring in information systems. For example, Petri Nets cannot be assumed to be common knowledge among IS majors in the United States.

If any technology is to be used (which is hard to avoid), acquiring and learning how to use this technology (which constantly changes and updates), as well as determining how to support this (servers, campus labs, student workstations), poses an additional burden on teaching preparation and detracts from other activities faculty is expected to engage in (such as research and service). Students also invariably complain about the lack of these learning resources

Finding suitable faculty might present an additional challenge for departments considering the inclusion of a BPM course or track in their curricular offering. BPM spans a broad range of topics, from business strategy, objectives, metrics and KPIs, structure, and roles, through their realization in business process functioning, to methods of process discovery, modeling, improvement, and innovation, and then to more technical issues related to BPM implementation using a BPMS, as well as change management. Finding faculty that can span this range of topics can be challenging for many departments, particularly at the technology end of the spectrum. For example,

converting faculty who would otherwise have the necessary technology backgrounds and traditionally teach courses in systems analysis and design and/or database management systems, means moving from a UML-centric, models beget code, to a model-as-execution way of thinking. Moving faculty (and students) over to "the dark side" of model-driven execution can be difficult.

At the moment, there is no silver bullet for the above challenges. The simplest approach is to demonstrate (or have someone demonstrate) the power of BPM, BPMN, and BPMS to faculty and students willing to listen. If you can attract students to such a course offering, they generally have fewer preconceived notions and can act as catalysts and ambassadors to faculty (and administration).

Regarding administration, this means working at both department and college level. Challenges at the college level largely come in terms of administration's willingness to forgo minimum enrollments while you build student interest. In some cases, faculty may receive challenges from a sister department that believes the term *process* in all its forms and methods of investigation and improvement belongs to them. Faced with this, choose course title prefixes, such as "IT-enabled …" or similar terms that narrow the scope but still allow you to deliver the necessary content. Departmental level challenges have to do with faculty resources capable of teaching such courses, the view of a zero–sum game regarding such a course versus competing courses for the same students, and thus the possibility of reducing the frequency of offering of courses taught, staffed, and "claimed." The general approach here is that someone has to take the initial, full responsibility for any BPM-related courses (content, technology set-up and support, teaching) until such time as recurring student enrollment and "canned" syllabi and resources are in place so that other faculty might be willing to take over. In addition, there is a need to convince resisting forces that it is not a zero sum game, but will result in a net addition of students.

BPM @ Queensland University of Technology

Founded in 1989, Queensland University of Technology (QUT)[4] is a university located in Brisbane, Australia. QUT offers BPM at both the master's and undergraduate levels. The BPM units[5] (a.k.a. subjects) are offered as core and elective units and are also open to students from other faculties. While each unit's student enrollment numbers vary, overall enrollment numbers have continually grown over the years, and the core BPM units hold an average of 120+ students (made up of both undergraduate and postgraduate students) each semester (as of 2010).

Overview of BPM Teaching

While QUT's current BPM offerings are delivered under the Information Systems Discipline within the Faculty of Science and Technology, QUT strives to maintain a clear nexus with the technology and business aspects associated with the phenomena. QUT initially started teaching "process" concepts in 1997—with the introduction of its ERP curricula; mainly as a response to the rising industry demands for these skills in the field. By the mid-1990s, a number of universities internationally started to integrate ERP into their IT and Business curricula [Stewart and Rosemann, 2001]. QUT commenced its ERP and process-oriented curricula at the (then) School of Information Systems in the Faculty of IT. Since then, QUT continuously (re-)designed, extended, and delivered ERP and process-oriented curricula. Over recent years, QUT has further expanded their BPM education offerings, in response to the continuously growing demand for process-related skills in industry [Gartner, 2010].

While QUT has been teaching BPM since the late 1990s, QUT's main BPM offering, the Master's of BPM, commenced in February 2008. BPM is also taught at the undergraduate levels across a number of units, and the following sections describe the overall details of the units and depict how they fit within the overall course structures.

Overview of the BPM Curriculum at the Post-Graduate[6] Level

The Master of Business Process Management (MBPM) at QUT is the only dedicated BPM degree program in the whole of Australia and one of the few BPM Master's degree programs in the world. It provides graduates with the skills and knowledge to create and align information systems to effectively support business processes and ultimately enable business strategy. The program examines business-IT alignment issues through appropriate theory and skill development, and provides career enhancement opportunities into senior management and governance roles.

This course[7] is designed to run across three full-time semesters (eighteen months of full-time study). It is available both in full-time and part-time modes, and runs only as an internal offering. The Master's programs consists of four

[4] For further details , please see www.qut.edu.au.
[5] A "unit" is the same as a subject offered in a semester (in some countries these are also referred to as *sections, courses*, or *papers*).
[6] The postgraduate level in Australia is the equivalent of the graduate or master's level in the US and various other parts of the world.
[7] The term *course* is used to refer to a whole degree program in the Australian context.

blocks of unit types, viz., Basic Units,[8] Gateway Units,[9] Core Units,[10] and Elective Units,[11] from which the candidate has to select and complete twelve units. Figure 2 displays the core structure of the MBPM program and also depicts the most common completion paths for students (which can vary from case to case).

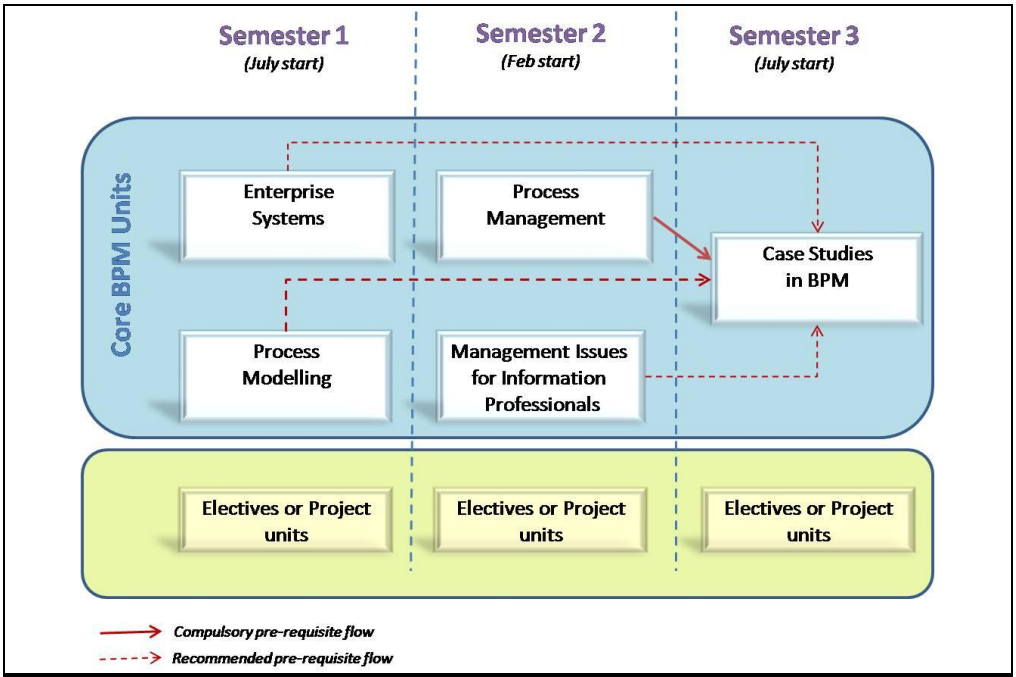

Figure 2. Overall Structure of QUT's BPM Master's Core Units

Process Modeling

The main aim of this unit is to introduce students to modern methodologies of business process modeling. Thus, this unit provides a contemporary introduction to the methods, notations, grammars, tools, and purposes of process modeling. In particular, students get a deep understanding for the most popular process modeling grammars (i.e., BPMN, EPC) and their application on practice. This is complemented by lectures on process modeling governance, process modeling tools (especially ARIS), model-to-execution, and the future of process modeling. Students gain insights into national and international process modeling case studies.

Process Management

The aim of this unit is to introduce students to modern methodologies of Business Process Management. A main objective is to increase their awareness of the close link between business requirements and IT capabilities, and the related fundamental role of business processes. This unit provides a contemporary introduction to process-based management principles and methods. Students get a deep understanding for the importance of Business Process Management (BPM). The unit provides first an overview about the main steps of the business process life cycle, incorporating principles from modern methodologies such as Lean, Six Sigma, Innovation, and Business Process Re-Engineering. The second part is designed around the six factors of strategic alignment, governance, methods, process-aware information systems, people, and culture following the Business Process Management Maturity Model [de Bruin, 2007]. Students also gain insights into national and international BPM case studies.

Enterprise Systems

This unit discusses the key aspects relating to the selection, implementation, adoption, diffusion, and management of Enterprise Systems (also known as Enterprise Resource Planning Systems). This orients the students to the requirements of addressing total cost of ownership, change management requirements, and process modeling

[8] This block of units is designed for non-IT graduates to up-skill their IT skills. Students without an IT background are expected to complete four from a pool of six introductory level IT units, prior to taking any of the mainstream BPM units.

[9] This block of units is designed for IT graduates to top-up their skills. A range of specialised units (seven in total) are offered within this block, where the students are expected to complete four of these seven units.

[10] This block of units is designed as the core of the master of BPM and is further described in depth below. The students are expected to complete a minimum of four of these core units (among a group of five).

[11] A range of project based units are made available to students to enable them to apply BPM concepts in practice, within an academically supported environment. They can be individual- or group-based; research- or applied-focussed, and are closely supervised and managed by an internal BPM teaching staff member.

requirements in order to achieve business benefits. Concepts of Enterprise Systems success and associated enablers and barriers, the technical architecture of complex three-tiered client server environments, are also introduced. The unit seeks to demonstrate how an Enterprise System application meets common core-business needs of an organization and yet is at times insufficient to meet the total Information Systems requirements (Information System Portfolio).

Management Issues for Information Professionals

The overall aim of this unit is to enable the student to identify and resolve selected key management issues within a particular type of organization. Actual topics covered include planning (strategic planning, human resource planning, information planning, technological planning, and financial planning), contemporary leadership theory (and practices, which are analyzed to determine the role of leaders in motivating their employees, encourage entrepreneurial team-building, and institute-effective organizational communication); contemporary marketing approaches; change management; and an introduction to both qualitative and quantitative methods, to evaluate service delivery.

Case Studies in Business Process Management

This unit provides the unique opportunity to experience the challenges of process redesign in a practical setting. Students work in groups of three to five and jointly scope, contextualize, model, analyze, and improve a selected business process. The main aim of this unit is to provide deep insights into the real-life issues of a process redesign project, and as such, this unit complements the models and theories taught in the prior units described above. Selected representative industry partners take the role of the main stakeholders that have to be addressed in a series of reports and presentations. Students develop a deep understanding for the boundaries of BPM methods and techniques. In particular, they gain insights into corresponding challenges such as team management, presentation skills, and project management.

Overview of the BPM Curriculum at the Undergraduate Level

QUT's BPM units are also offered to undergraduate students. All of the core units listed above, except Case Studies in BPM are made available to undergraduate students and are taught concurrently with the postgraduate offering of the same unit. While postgraduate and undergraduate students attend the same lectures, a postgraduate student is required to complete separate assessment tasks that reflect the advanced knowledge and understanding of the subject.

A student can also chose to do a co-major or a minor related to BPM. Essentially, co-majors and minors are forms of discipline specializations. At QUT, such BPM related specializations can be obtained through the Business Analysis co-major and the Business Analysis minor. The term *Business Analysis* was used mainly as a means to relate to a broader audience. This major/minor provides students with the essential skills for being a business or process analyst, and prepares them to face modern organizations that function within complex blends of Business Processes, Information Systems, and Human Resources.

The Business Analysis co-major requires the completion of the three core units of Business Process Management, Business Process Modeling, and Business Analysis, and three others from a list of approved electives (all from the School of IT offerings). The Business Analysis minor has a very similar structure that requires the completion of the same three core units and one other elective.

The Business Process Management and Business Process Modeling units were described above. The Business Analysis unit gives the student an introduction to the role, knowledge, and skills required of a business analyst. Bridging the gap between the business needs and IT solutions effectively have always been a key issue in organizations seeking to improve their business. This is often due to the lack of appreciation and knowledge of IT solutions by business on one hand and a lack of clear understanding of the business domain and needs by the IT professionals on the other hand. It is expected that students undertaking this unit would have covered the necessary understanding of the role of IT in business and have acquired sufficient technical skills. This unit equips students with knowledge and skills necessary for a business analyst who is equipped to identify the areas of business that could be improved through IT solutions and develop business cases and plans for achieving effective solutions. This unit focuses on both the trades-tools and methods used by a business analyst, as well as the soft skills—creativity and communication, both of which are critical to successful business and requirements analysis.

Challenges and Lessons Learned

While QUT has been teaching BPM since 1997, BPM lessons are still being learned and BPM teaching practices are continuously evolving.

Like many others, difficulties include resourcing the teaching, as skilled BPM teachers and supporting resources are very scarce. An internal mentoring scheme, linked with a faculty-based peer partnership scheme, to assist staff develop in the scholarship of BPM teaching, has helped to alleviate this limitation.

Also, the stark diversity of the students in the BPM classes is a challenge. There are undergraduates mixed with postgraduate students; students with no work experience mixed with those who have ten+ years of BPM specific work experiences, international and domestic students, direct school leavers with matured aged students, those who are technical "nerds" with those who have technical phobia—it is a very mixed bag of students, and catering to this diversity is a challenge. Strategies used include assessment choices (various topics provided for different assessments which students can choose from), different assessment types (for example, for postgraduate versus undergraduate students); peer-based learning (where experienced students lead project teams and discussions in class), additional reading resources on a resources net site in the units' pages.

Further challenges in BPM education at QUT stem from the large amount and complexity of the content covered in the units, which can be challenging to some students, especially at the undergraduate level. One way to ease this situation would be to offer two distinct BPM units, one for undergraduate students and the other for postgraduate students. Research-inspired and -inclusive teaching (as described below) is included. Feedback in some units, however, indicates the complexity that research-inspired and -inclusive teaching approaches can bring. While in general students appear to appreciate the currency and relevant focus of the latest BPM technologies, concepts, and methods, the research view can be challenging to some students.

With these challenges in mind, a summary set of reflections about BPM education at QUT and recommendations for institutions contemplating a similar approach to BPM education are provided below.

Case-based Learning

QUT is marketed as "a university for the real world," and our students enter with high expectations for the workplace relevance of learning activities, which emphasizes the need for exemplars that connect learning with real world workplaces. Case-based teaching has become an established pedagogical technique in many higher education disciplines. We use the case study approach in our Business Process Modeling and Business Process Management classes. What makes our case-based learning approach innovative is how we derive our cases. While we do use existing, published case studies, we try to also derive our own cases that are specifically tailored for our syllabus and learning objectives (which is constantly updated to align with industry requirements). We document selected cases that students complete as part of a Case Studies in BPM unit in the form of detailed case narratives or mini case vignettes [e.g., Bandara et al., 2005]. As the students who were the project members are the central actors within these projects and QUT has already got strong links with the industry partners of these project sites, we are then able to bring in the real actors of the case into the classroom, where students are able to interact on a face-to-face basis. Depending on the strength of a university's industry network, we can recommend such an industry project-based case teaching approach to other institutions as well.

Research-inspired Teaching

The BPM teaching offerings at QUT are being designed with a strong focus on recent research. Specifically, the selection of teaching content is heavily influenced by up-to-date critical success factor studies [Bandara, 2007], management theories [de Bruin, 2007], experimental results [Recker and Dreiling, 2007], or global Delphi studies [Indulska et al., 2009a, b] about the execution of BPM in industry practice. This approach allows us to identify content areas (e.g., governance, culture, method knowledge) that have been confirmed through research to be critically important skills in BPM practice. Consequently, students passing through the courses have mastery of skills required in actual industry practice. For other institutions, this recommendation entails a need to overview, and critically review, latest research in BPM, and we hope that this article contributes to this challenge by referencing some of the most prominent work in the BPM space.

Research-inclusive Teaching

To complement the research-inspiration, our aim is also to include latest research in the lectures. Aside from the use of "modern" workshop and assignment topics (see below), this means that the actual content of the lectures draws, wherever possible, from recent or ongoing research. In process modeling, for instance, a large part of the course syllabus considers ongoing research in areas such as workflow technology [van der Aalst and Hee, 2002], risk and compliance management [Sadiq et al., 2007] or context-awareness [Rosemann et al., 2008], to name just a few. Some practical advice on how such research-focused content can be integrated into a BPM curriculum is available elsewhere [Recker and Rosemann, 2009].

Innovative Topics and Assignments

Within the practical parts of the teaching offerings (workshops and tutorials, most notably) as well as in the assessments, we seek to use innovative and stimulating topics with a "modern" touch. For example, in the workshops affiliated with the business process modeling course, students are confronted with real-life process scenarios gathered from an extensive network of industry partners (http://bpm-collaboration.com) or from domains that students have high knowledge of, such as online shopping scenarios (e.g., Amazon, eBay), Voice-over-IP applications or Web 2.0 applications (e.g., Facebook).

The use of familiar case domains popular among students (e.g., Facebook, Amazon) allows us to focus within the assignments on the knowledge transfer of process-related methods and methodologies, rather than domain information. Educational literature suggests that students do not transfer knowledge across domains unless they master the problem-solving methods and techniques they seek to apply [Salomon and Perkins, 1989]. In the context of BPM, this suggests that students should be presented with a learning environment in which they can strengthen and deepen their methodological and technical knowledge so that they can apply this knowledge across the domains they will be confronted with in business practice. The approach used hence eliminates confounding learning problems potentially stemming from a lack of background knowledge in a business case, and allows the students to concentrate their learning and design efforts on the mastery and application of process concepts and methods. Current and relevant Web 2.0 scenarios, as used in some of the assignments, for instance, are well received by the students and give both the course and the assignment tasks a "modern" touch. Some sample scenarios include: organizing payment via PayPal; purchasing a used book on the Amazon Marketplace; purchasing an album on iTunes Shop; setting up an event on Facebook.com; conducting a video conference via Skype; or bidding for a hotel room via Priceline.com. Students are simply better motivated and even excited about the learning experience when they can faithfully reason about process concepts in familiar environments they experience in day-to-day life.

BPM @ University of Pretoria

The University of Pretoria (UP)[12] is situated in South Africa's capital city, Pretoria. The University celebrated its 100th birthday in 2008 with a student base of nearly forty thousand full-time and part-time students. The Department of Industrial Engineering offers degrees in industrial engineering at undergraduate level (bachelor's) and at master's and Ph.D. level. Each year the department graduates an average of sixty to eighty engineers from an industrial engineering corps of six hundred graduate and postgraduate students. The staff consists of six full-time and fifteen part-time lecturers. At the time of writing, it was the largest industrial engineering department in South Africa.

This description relates to the typical offerings in the context of BPM, delivered at the Department of Industrial Engineering, which is part of the Faculty of Engineering, Built and Information Technology (EBIT).[13]

Overview of BPM Teaching

The BPM discussion in this section does not follow a particular module or course orientation, but rather focuses on the industrial engineering curriculum. There are many definitions of the term *industrial engineer,* but the industry has accepted this as a good definition in lay terms: an industrial engineer is "an engineer whose responsibility it is to balance man, machine, and money." The author extends this definition by adding a very important focus: business processes. Thus *an industrial engineer balances people, machines, and money through business processes, in order to ensure an optimal and sustainable business system* [van Rensburg, 2009].

From this perspective, it is understood that BPM is a management theory that views business processes as assets to be managed and adapted in response to constant change [Smith and Fingar, 2007]. So BPM can be defined as the strategy for managing and improving the performance of a business through the continuous optimization of business processes in a closed-loop cycle of modeling, execution, and measurement [Cantara et al., 2007]. Educating and training people in this area requires three core competencies: business engineering, business architecture, and optimization [van Rensburg, 2009].

Business engineering is the framework for engineering a business system through a change management life cycle. This life cycle covers the phases of analysis, design, planning, implementation, operation, management, and maintenance activities—from both a system and a people perspective [van Rensburg, 2009]. The second competency, business architecture, is the framework for developing the blueprint design of the business system

[12] For further details, see http://www.up.ac.za.

[13] For further details, see http://www.up.ac.za/ie.

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[Spewak, 1991]. This provides the capability to create a complete multidimensional business process specification of the organization. The third competency, optimization, is defined according to the discipline of operations research as the scientific approach to determine the best way to design and operate a system [Winston, 1994].

These three competencies support the required capabilities to execute BPM successfully. The details below elaborate on the undergraduate industrial engineering curriculum and on how it supports these core competencies.

Overview of the BPM Curriculum

The curriculum overview is based on information from the Engineering Council of South Africa's (ECSA) accreditation visit to the department in 2007 [van Rensburg, 2007]. The curriculum requires four years of full-time study at the university, as indicated in Table 4, with a total of 2,660 lecture-hours, excluding projects and assignments. To receive the bachelor's degree in Industrial Engineering, the student needs to pass forty-one semester modules.

Credits per semester module are based on the computation of contact periods and contact hours. In general, four contact lectures per week (each fifty minutes long) form an eight-credit module. Five or more contact lectures per week can constitute a sixteen-credit module per semester. The forty-one modules represent a total of 644 credits.

Table 4: Program Content

Contact time	Year of study	Hours/Week	Weeks/Semester
Total time in hours, and percentage of total hours, that students are required to attend classes, tutorials, and laboratory sessions; average of two semesters per year.	First year	28	14
	Second year	25	14
	Third year	25	14
	Fourth year	17	14

The three core competencies for BPM—optimization, business engineering, and business architecture—are not formally used to structure curriculum, except for research and contracting activities in the department. The module credits and competency definitions are used to create Table 5, which shows the percentage competency focus per year in the curriculum. The curriculum strategy focuses on pure mathematical sciences, engineering sciences, and basic sciences in the first two years of study. Table 6 provides a detailed breakdown of the modules per year for these competencies.

Table 5: BPM Competency Composition for Curriculum

Year of study	Optimization	Business engineering	Business architecture
First year	84%	1%	15%
Second year	60%	5%	35%
Third year	30%	40%	30%
Fourth year	10%	80%	10%

Business engineering addresses the BPM themes of BPM strategy, operations, and BPM integration. The aim of this course theme is to ensure that the student has the ability to introduce BPM change into the business environment, and to deal with the project management life cycle of BPM activities and with people change management. Thirteen subjects underpin this: professional ethics, labor relations, environmental management, business engineering, management accounting, final year project, business law, financial management, operations management, industrial logistics, communication, innovation, and community-based projects.[14]

System applications used in this theme vary from the traditional Microsoft Visio application to specialized business architecture applications such as Enterprise Architecture Workbench, ARIS, and ARENA. Open source solutions include Alfresco, Openbravo, and Pentaho. In the final year subject, business engineering students use the free balanced scorecard tool Strategy Map to implement a balanced performance management system. In the critical area of enterprise resource planning (ERP), efforts are being made with Openbravo as an open source ERP suite. Some action has also been started to introduce the Netsuite cloud computing application in the operations management and supply chain management modules.

[14] For further details, see http://web.up.ac.za/modules/index.asp.

Table 6: BPM Competency Structure for Curriculum			
Year	**Optimization**	**Business Engineering**	**Business Architecture**
Year Four	Operations Research	Professional Ethics, Labour Relations, Environmental Management, Business Engineering, Management Accounting, Final Year Project	Systems Engineering
Year Three	Operations Research, Simulation Modeling, Engineering Economics	Business Law, Financial Management, Operations Management, Industrial Logistics	Manufacturing Systems, Facilities Planning Computer-aided Manufacturing, Information Systems Design
Year Two	Calculus, Differential Equations, Dynamics, Engineering Statistics, Numerical Methods, Mathematics, Programming	Communication, Community-based Projects	Manufacturing and Design, Thermodynamics, Productivity
Year One	Calculus, Physics, Linear Algebra, Computer Literacy	Innovation	Electricity, Mechanics, Material Science

The main standards being used and taught are those reference models provided by the Supply Chain Council: the Supply Chain Operations Reference Model (SCOR), the Value Chain Operations Reference Model (VCOR) from the Value Chain Council, as well as examples of the telecommunications industry through TM Forum's eTOM (enhanced telecommunications operations map).

Examples of Innovation in BPM Teaching

For many years the department has followed the approach of testing the student's ability to solve problems. In many courses, and especially in the final year project course (Table 6), students need to go and find industry-related problems and solve them. Here the diverse ways in which BPM can be applied becomes evident, as the students are not limited in their creativity and thinking. At the end of the academic year, the department hosts a special evening where the best six projects are presented (www.up.az.ca/ie). Industry partners provide sponsorships for this event, which include cash prizes for the best presentation, best document, and best poster.

In most third and fourth year courses, students are required to be innovative in solving problems. In the Business Engineering course (Table 6), students need to create a business process model for a global business. The business idea can be their own or it can use innovative ideas from such websites as www.springwise.com. These projects are stored and provided as a repository for the following year's students to expand upon. Although the university has a good content management system that supports information storage and retrieval, social media such as Facebook are used to encourage information-sharing between students on BPM topics.

Where possible, industry experts are brought into the classroom to share their experiences and to expose students to the industry.

Challenges and Lessons Learned

The lessons learned so far in this BPM journey are also the challenges that face one on the road ahead. The first lesson learned is that BPM requires a cross-functional and multi-disciplinary approach; whether in practice or in academia. Pockets of expertise exist—such as BPM Strategy, or Service Oriented Architecture (SOA)—but BPM requires more than these pockets. To structure and focus a curriculum for the purpose of BPM is extremely difficult, as the academic world is focused on functional expertise rather than an integrative multidisciplinary approach. A good example is subjects such as business analysis or enterprise architecture: Do they lie in the domain of computer science, informatics, commerce, or industrial engineering?

In practical terms, BPM requires different functions of the organization to work together. Information technology cannot drive this alone, as BPM must be part of business strategy. Without translating this into an operations strategy, the business people will not support the IT people, and management will be left wondering why nobody supports their strategy. In the same way, the lesson learned from teaching students is that different skills are required for different parts of BPM. It can be argued that business school training should focus on the strategic side of BPM to train managers to understand the business impact, potential organizational change, and a conceptual understanding of BPMS technologies. Industrial engineering and commerce degrees are suited to train business

people to analyze, design, and optimize a BPM-driven business, while the computer science and information technology departments should focus on the BPMS and Information technologies supporting it. The challenge is to bring these schools together and help them realize that every role has a specific purpose in achieving overall BPM success, and that one does not have to be a leader in all the BPM domains.

Very little exposure so far has been given to BPMN, BPEL, or general BPMS applications. As a user and implementer of these standards and technologies, industrial engineering is not concerned about the why and what of the BPM technology, but rather with how it can be used to solve business problems. So we have been delaying the use of BPMS systems purely because commercial BPMS systems are too expensive for our budgets. These budget constraints force us to search the open source community for BPMS infrastructure. Unfortunately, history has taught us that in most cases these systems are difficult to implement and unstable to use—and that always creates disruption in student learning. On the flipside, if a company donates commercial software, it typically requires hardware and software maintenance—and this can seldom be funded from internal funds, rendering the donation quite useless for all concerned.

UP tries to train the students in classic process modeling techniques (e.g., IDEF), knowing that the concepts of BPMN and BPEL can be understood more easily when the student is faced with commercial BPM applications. It is believed that simulation modeling (process optimisation) and process analytics through Business Activity Monitoring (BAM) are still in their infancy in BPMS applications, and hence the need to focus our students on mastering subjects such as simulation modeling, using well-known applications such as ARENA.

In 2010, South Africa still lags behind in the digital revolution because it has one of the most expensive broadband cost structures in the world. This affects teaching: students are capped on their Internet usage, while private broadband use becomes highly expensive for them. The ability to investigate, research, and use online resources is severely limited, thus restricting what one should be able to teach and study in a dynamic discipline such as BPM.

Development of a BPM academic strategy requires good insight into the potential impact of BPM on the world. As digitization becomes more common in business, a company's BPM capabilities will become more critical. This is a golden opportunity for academics to embrace a new, exciting, cross-functional discipline, and to create the curricula that provide appropriate training platforms for building these competencies.

BPM @ University of Vienna

The University of Vienna was founded in 1365 and is the oldest university in the German-speaking area and one of the largest in Central Europe. As of 2010, about 86,000 students are enrolled at the University of Vienna, in close to 180 degree programs The University of Vienna is also the largest teaching and research institution in Austria, with close to 8,900 employees, 6,700 of which are scientists and academics.[15]

Overview of BPM Teaching

At the University of Vienna BPM topics are offered in two graduate curricula: for the School of Computer Science (commonly referred to as the Faculty of Computer Science in Europe) in the study of Business Informatics (for the German term *Wirtschaftsinformatik*) and for the School of Economics (commonly referred to as the Faculty of Economics in Europe) in the study of Business Administration. In both curricula, basics of BPM are offered as part of the more general introductory courses in the undergraduate programs and as a specialization topic in the master's level.

The courses are delivered by the Department of Knowledge and Business Engineering (DKE)[16] of the School of Computer Science. The department has a long history of teaching in BPM, starting in 1996 with the publication of the Business Process Management Systems (BPMS®) paradigm [Karagiannis et al., 1996], as a method independent framework (see Figure 3). Because of its generic approach, the BPMS paradigm still provides the basic concept for the design of the BPM courses.

Out of these research results and in addition to the conceptual work on the BPMS paradigm, the BPM Tool ADONIS® was developed and is offered under the ADO*uni*® cooperation program.[17] The program also includes a tool for strategy and performance management (ADO*score*®) and IT-Management (ADO*it*®). It aims to offer teaching and research institutions IT-supported management tools to be used in the courses for individual student projects or research.

[15] For further details, see http://www.univie.ac.at/university/about-the-university-of-vienna/?L=2.
[16] For further details, please see www.dke.at.
[17] For further reference, please see www.dke.at/adouni.html.

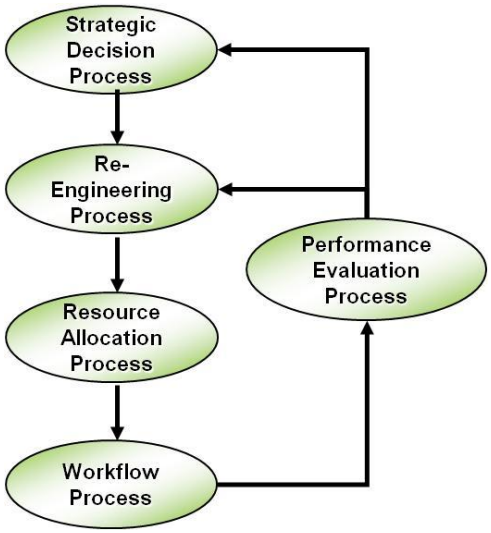

Figure 3. The BPMS® Paradigm [Karagiannis et al., 1996] as a Foundation for BPM Teaching

The Department of Knowledge and Business Engineering has a strong scientific history and background in the concepts of modeling and meta-modeling, hence the lectures in the domain of BPM started more in the context of company-wide modeling approaches and business engineering. The lectures included topics like modeling in general, meta-modeling concepts, and modeling methods, and then went more deeply to the company's elements of design, namely product, processes, IT, and organization. The main focus, therefore, was on process modeling with different methods but not especially on BPM as an holistic management approach. With a new curricula for the master's in Business Informatics that began in 2006, the curriculum got more specialized, and BPM was offered as a separate course to highlight BPM as a management approach that embraces business process modeling but is not merely concerned with the same. Experiences from industry projects and funded projects by the European Commission also highlighted the need for a more practical focused BPM training at universities.

In the curriculum of Business Informatics the BPM course is provided as a mandatory single course within other courses with a focus on BPM covering topics like workflow technology, method integration, and meta-modeling (see Figure 4). The whole BPM focus comprises eighteen credits (according to the ECTS[18]) out of eighty-four credits for the whole master's program. The main BPM course contributes with three credits and is scheduled to be completed in the first term. A total of 559 students are enrolled in the undergraduate program in computer science at the University of Vienna and fifty-seven students are enrolled in the subsequent graduate program of business informatics (as of 2010). The BPM lecture is offered every second term with approximately twenty students attending and is organized as a joint lecture and practical training.

In the curriculum of Business Administration the BPM course is provided as a single course within the elective module Business Informatics (see Figure 5). Besides BPM, the module comprises lectures in the field of Business Intelligence, E-Business, ERP-Systems, and Knowledge Management. The whole elective module is worth forty credits out of 120 credits for the whole master's program. The BPMS course herein is valid eight credits. As of 2010, 409 students are enrolled at the master's program in (international) business administration, and around twenty-five students attend the BPM class every second term. The course is organized in two classes a week, whereas one class is mainly teaching theoretical concepts and experiences from the industry and the second one is focused on practical training.

Besides the two curricula; Business Administration and Business Informatics, the Department is also involved in offering BPM modules for the Virtual Global University, that offers a long-distance learning International Master of Business Informatics (MBI). BPM is also taught in the executive Health Care Management program, a joint MBA program offered by the Medical University of Vienna. The University of Vienna is also initiator of the Business Informatics Network (BinNet) to foster an internationally recognized full master's degree study in the field of Business Informatics to improve the educational quality in this field.

[18] ECTS—European Credit Transfer System (see http://ec.europa.eu/education/lifelong-learning-policy/doc48_en.htm for further details; current April 20, 2010).

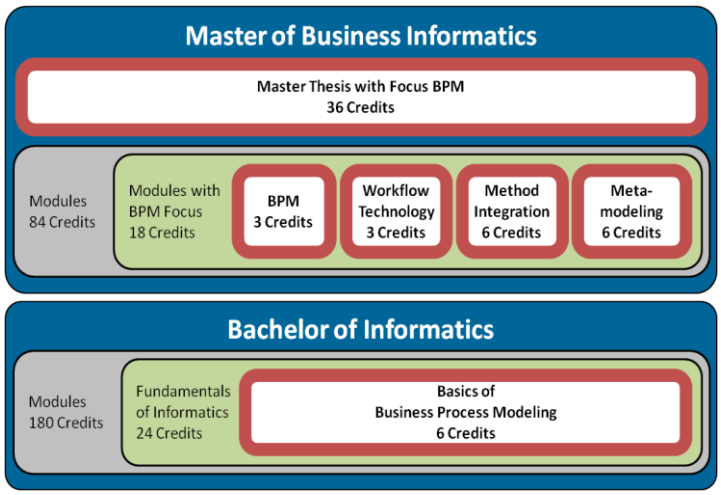

Figure 4. The BPM focus in Business Informatics

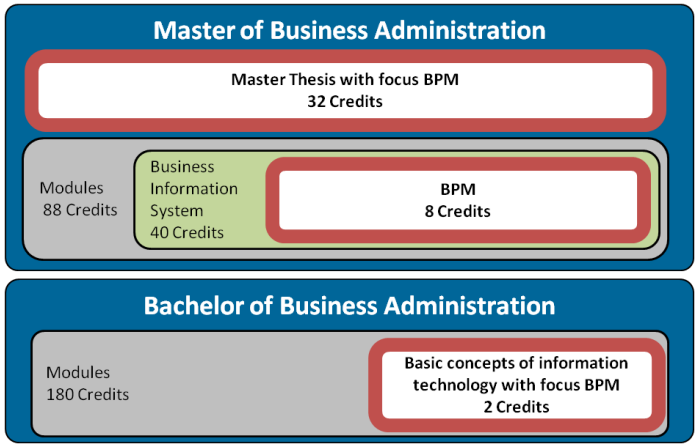

Figure 5. The BPM Focus in Business Administration

Overview of the BPM Curriculum

The BPM offerings at the University of Vienna are single lectures within broader modules for the two master's programs; Business Administration and Business Informatics. Since topics around BPM, like workflow management systems, (meta)–modeling, and large scale information systems are covered in separate lectures, the focus for BPM in Business Informatics curriculum is directed to the managerial concepts of BPM and the organizational transformation of designed/modeled processes. The following description of the lecture design focuses on the course offered in Business Informatics. Figure 6 gives an overview of the themes for the BPM course. The figure is also presented in the lecture material throughout the course to guide the students through the relevant topics. The topics are described briefly in the following paragraphs, for a detailed description of the course design, refer to the general overview in Table 7.

The course themes BPM Foundation and BPM Life Cycle provide a first overview of different thrusts of BPM disciplines and repeat the basic concepts of process-orientation approaches and highlight the positioning of the overall course, namely BPM as a holistic management approach. It introduces BPM life cycle and maturity models like the Business Process Management Maturity Model (BPMM[19]) or the Process Management Maturity Check (PMMC[20]).

[19] Object Management Group Specification, Business Process Management Maturity Model, Version 1.0, 2008, http://www.omg.org/spec/BPMM/1.0/PDF/.

[20] The PMMC is offered by the company BOC Group, for further details, please see http://www.boc-pmmc.com.

Defining a company's strategy and getting a clear idea on how the processes have to be designed and streamlined is part of the Process Strategy theme of the life cycle. Besides a general introduction to strategy management principles, the Balanced Scorecard method is introduced.

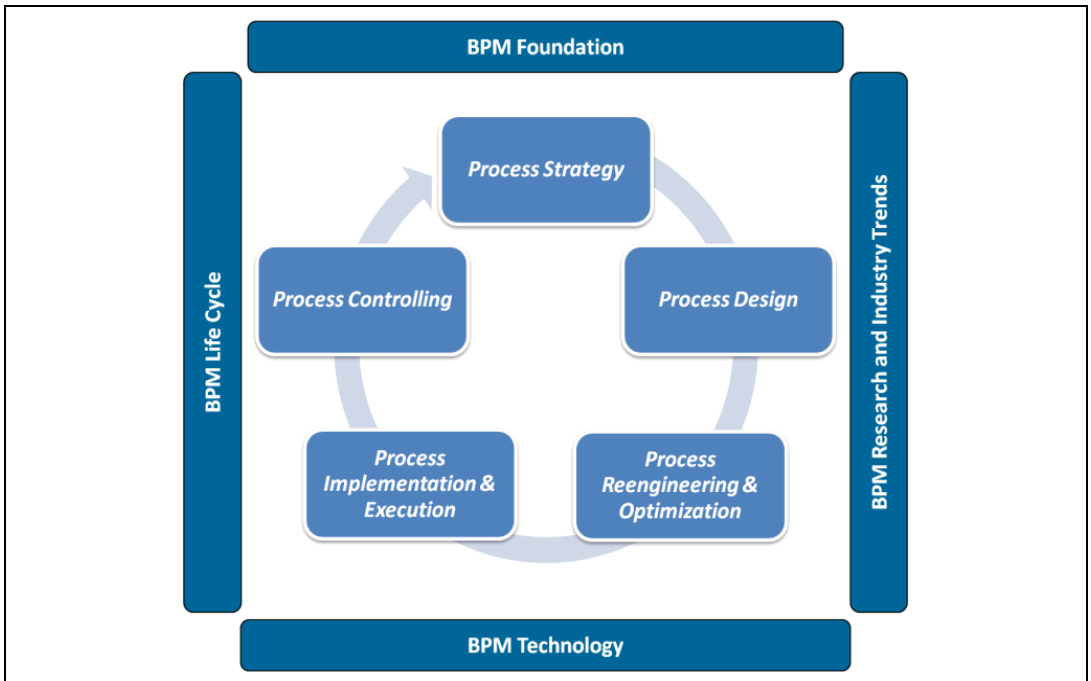

Figure 6. Overview of BPM Course Design

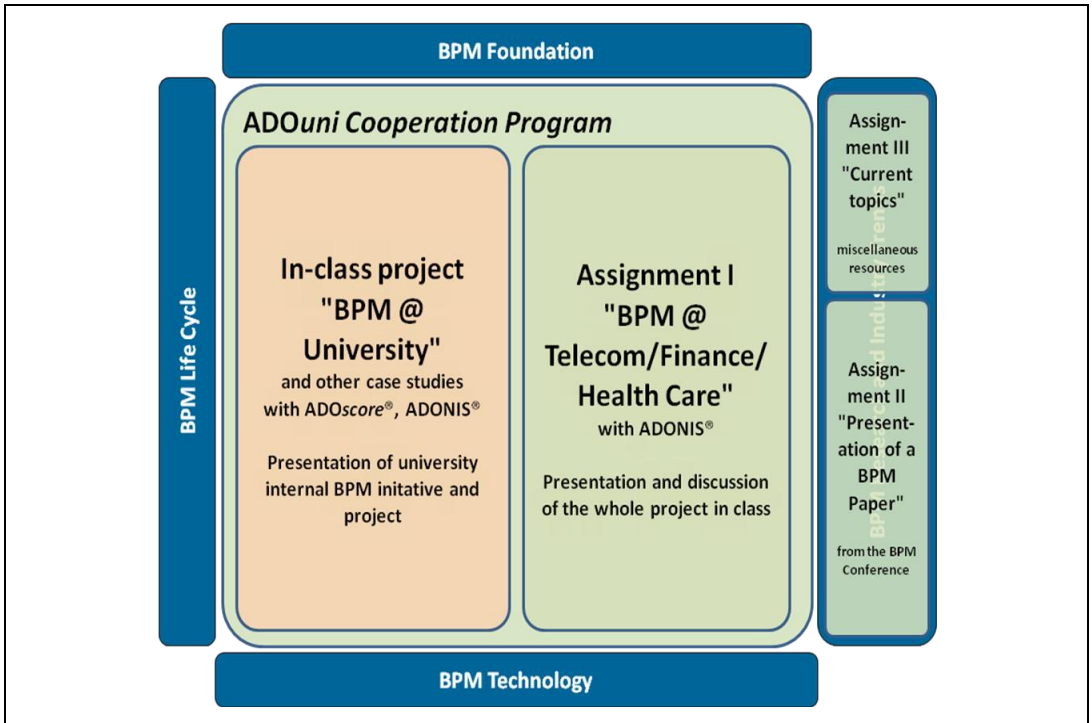

Figure 7. Topics Covered by Training and Assignments

In the Process Design theme, a short introductory theory is given on business process documentation, especially model-based approaches and methods on how processes can be raised, defined, and modeled. It also includes resource models like organizations and IT systems and is linked to documents and products. Students should understand that for a holistic process design and for the subsequent process optimization all of the main design elements of a company have to be considered (see Figure 8).

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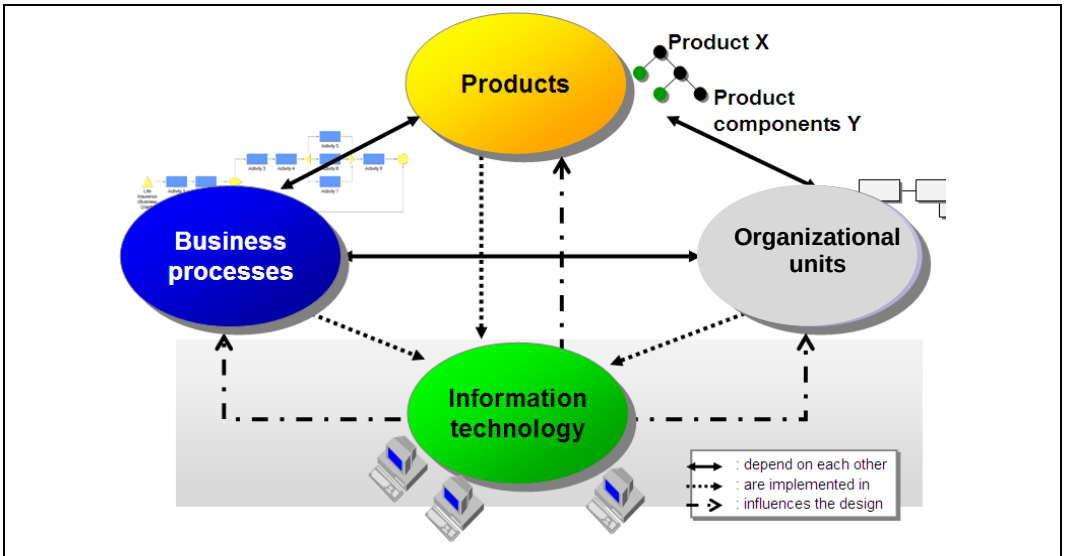

Figure 8. Organizational Design Elements

The Process Reengineering/Optimization theme deals with topics that need to be considered when reengineering/ optimizing a process. Students should get an idea of the pitfalls and resistors when trying to optimize a process in a real-world scenario and try to suggest reengineering options on sample processes.

The focus for the Process Implementation/Execution theme is on the organizational implementation as the technical implementation is covered by a separate specialized workflow–management course. From the organizational side, the discussion concerns what has to be done to transform the designed to-be process to a daily routine, which roles have to be defined, and how in general process management can be set up and institutionalized in organizations.

Finally, once a process is executed successfully in terms of organizational and technical infrastructure it has to be continuously monitored. In the Process Controlling theme, the students learn how a sustainable process controlling system can be set up and how the process controlling itself provides input to the process strategy, with deviations or other events as possible triggers to start the life cycle again.

For each covered topic in the life cycle the appropriate BPM Technology is discussed and students learn about current topics in the BPM Research and Industry Trends theme.

Each course theme within the BPM life cycle has a theoretical and a practical part. The theoretical part is taught in class, including discussions, case studies, and class exercises. Each theoretical part has a matching practice (see Figure 7). This is an instructor-directed project spanning across a term, called “BPM @ University.” The project is concluded with an invited speech by the Business Process Manager of the University of Vienna to allow a comparison of the outcomes of the in-class project with a real business scenario. The in-class project and the homework are delivered under the ADO*uni*® cooperation program with support of the Business Process Management tool ADONIS® tool and partly ADO*score*® for Strategy- and Performance Management.

Besides attending the classes and contributing to the in-class project the students have to accomplish three assignments as homework (see Figure 7). Assignment I is the “BPM@Telcom/Finance/Health Care” project. For every step shown in class for the university domain, the students have to work on a project for a different industry. They can choose a virtual company from the domains of telecom, finance and health care and are provided with a rough description and some key financial figures of the company that serves as the basis for the different project tasks for assignment I. The final project results are presented in class and graded in regard to content, innovative ideas, presentation, documentation, and implementation in ADONIS®. The assignment is done in groups of up to three students. The project tasks for assignment I and relevant deliverables are described in more detail in Table 7.

To make students aware of BPM as a research topic, for assignment II the students select a paper from the current BPM conference and present it in the class. Assignment III is an ongoing reading exercise to cover industry trends that are discussed in the class. Topics come from different sources, like newsletters and articles issued from BPTrends[21]. There is one exam at the end of the term. The teaching is supported by the eLearning infrastructure of

[21] For further details, please see www.bptrends.com.

the University of Vienna, where the students can access lecture materials, handouts, workshop results, and a tutorial on ADONIS®.

Table 7: BPM Assignments

Course theme	Task for Assignment I	Deliverables
Process Strategy	The students prepare a simple Balanced Scorecard for their company using the procedure taught in class: formulating a vision, a strategy to achieve the vision and defining key success factors, strategic goals, key performance indicators (KPI) and sample actions.	Document describing the vision and strategy and a cause-and-effect diagram with KPIs and a list of actions.
Process Design	Students model the process landscape in ADONIS® according to the structural criteria discussed in class. They further refine one of the processes in a business process model and argue according to which criteria they have selected the process. In another task they model the organizational structure with different roles, IT systems, documents and products and link the activities to relevant resources. The business process has to be presented in an alternative modeling language (EPC or BPMN).	Export of the models from ADONIS®, including: company map, business process model, organizational model, IT system model, document model, and product model.
Process Reengineering/ Optimization	Students add appropriate, reasonable information to the business process model in ADONIS® to prepare the model for simulation (e.g., adding times, costs, variables, or probabilities), run different mechanisms and compare and evaluate the results. They prepare suggestions for optimization and consider pros and cons of the alternatives. Based on the evaluation, they prepare a to-be version of the process.	Export of the models from ADONIS® and a document summarizing the simulation results.
Process Implementation and Execution	In this task the students prepare a concept on initiatives they plan in their company to establish the to-be process in the daily routine.	Rough project plan with description of work packages for setting up the to-be process.
Process Controlling	The students set up a small process controlling system for the selected process. This task includes defining key performance indicators for the selected business process and connecting them technically to an Excel-based data source in ADONIS®.	Students hand in their complete project as one document that concludes the separate deliverables and the models designed in ADONIS®. There is an end presentation and discussion of the project results in class.

Challenges and Lessons Learned

On theoretical level we identified three major challenging areas in BPM in general that we also regard as difficult to address in class.

One challenge in BPM that was noticed in its real world application is the successful institutionalization of BPM as a holistic management approach. It is regarded as vital for a company to establish BPM as life cycle management to achieve the hyped continuous improvement of a company's performance. This implies sustainable process controlling based on predefined metrics and their comparison to the defined process goals to achieve a lasting effect. Therefore, the course themes are designed according to a life cycle management approach that is used as a general course guide to make the students aware that the "M" in BPM does not solely stand for "Modeling." At the University of Vienna, BPM is BPM^3–Modeling, Management and Measurement—and once established, BPM needs a continuous self-assessment based of its achieved maturity.

For process design, it is important to highlight two challenges that are considered as most important: it is first to capture the real end-to-end process view when modeling a process and second the level of granularity in process design. Therefore, in the lectures, special consideration is given to the structural criteria for process landscapes and the degree of detail for process models.

As a third but nevertheless critical challenge, especially in the discipline of business informatics, it is important to mention the business and IT alignment that is not yet successfully established; neither in industry nor in the scientific approaches (see Figure 9). You have business departments on one side, IT staff on the other, business engineers in

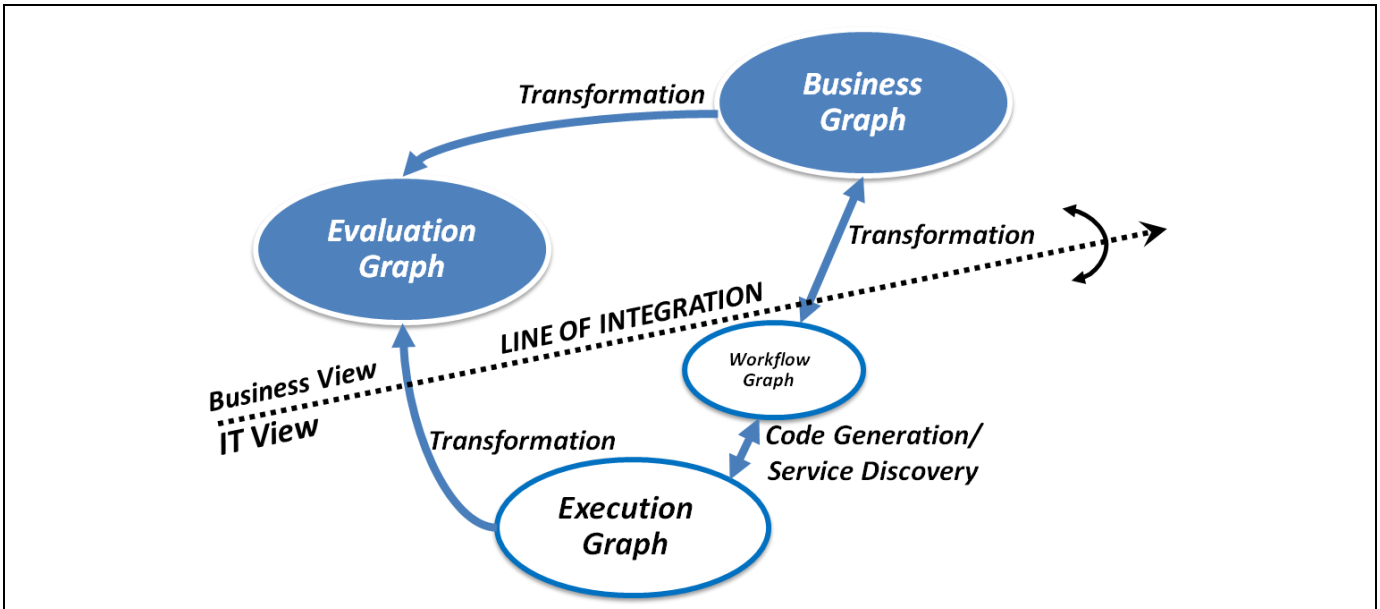

Figure 9. Structural and Logical Interdependencies Between the Graphs in a Business and IT Alignment Approach Based on the BPMS Paradigm [adapted from Karagiannis et al., 1996]

one scientific community and software engineers in the other. But only by aligning the views in a top down approach we can translate into practice what we preach in theory: IT follows Process follows Strategy—and not the other way round.

As concerning the practical training, two special lessons were learned: First, that the ADO*uni*® program was very helpful to set up the lecture and to ensure practical training on the topics. Feedback was received that the practical exercises and project work with the tools helped the students to better understand the BPM concepts. Second, the choice of applying BPM in the university context for in-class projects and to involve the BPM department from the University of Vienna, which is based on the argument that students are familiar with the domain and therefore know the basic processes. Furthermore, students are the users of the results, so it is important to extend our cooperation with the BPM department to involve students in current project tasks so they can bring in their ideas and learn about the general BPM concepts at the same time.

III. CONCLUSIONS AND FURTHER DIRECTIONS

BPM Education Approaches Around the World

The description of BPM education approaches at five universities around the world suggests that BPM courses at the graduate and undergraduate levels can be developed and delivered by different departments—Industrial Engineering, Computer Science, Computer Information Systems, Information Systems, or even the dedicated Information and Process Management—within schools of Business, Science and Technology, or Engineering (see Table 8). This dispersion of BPM courses across different departments seems to reflect the interdisciplinary nature of the field which focuses both on management approaches to define, improve and manage business processes, and the supporting technologies that make this possible [Antonucci et al., 2009; Harmon and Wolf, 2010]

BPM educators are pulling together a constellation of related ideas, concepts, tools, methods, and technologies around the core concept of a business process; its definition, improvement, managed execution, oversight, and insight (see Table 9). One interesting aspect of the various approaches is that the BPM concepts are sometimes taught as part of other courses (either business fundamentals or specially-designed degree-specific courses), rather than as a unified course with a BPM-related title. While this again reflects the interdisciplinary nature of the BPM field, it provides less visibility for the field among students, potentially failing to communicate the importance of BPM as a body of knowledge in its own right.

Table 8: BPM Education Examples from Five Universities Around the World					
University	**Location**	**School/ Faculty group**	**Department**	**Graduate Courses**	**Undergraduate Courses**
Bentley University	USA	Business	Information and Process Management (IPM)	Master of Business Administration (MBA) program (full-time and part-time, required)	Undergraduate business core course (required, planned) Undergraduate minor in IPM (elective)
Georgia State University	USA	Business	Computer Information Systems (CIS)	MBA (½ of required course) Master of CIS (required)	CIS Undergraduate BPM specialization
Queensland University of Technology	Australia	Science and Technology	Information Systems	Master of Business Process Management (full-time and part-time, required) Master of IT(full-time and part-time, elective)	Bachelor of IT (full-time and part-time, elective or required if a BPM minor or major is selected) Bachelor of Corporate Systems (full-time and part-time, required)
University of Pretoria	South Africa	Engineering	Department of Industrial Engineering	N/A	Undergraduate courses covering BPM-related topics in Business Architecture, Business Engineering, and Optimization areas (required)
University of Vienna	Austria	Computer Science	Department of Knowledge and Business Engineering	Computer Science—Master of Business Informatics ("Wirtschaftsinformatik") (required) and Economics—Master of Business Administration (elective)	BPM basics are part of more general introductory courses

Challenges and Lessons Learned

Delivering BPM-related content is often faced with challenges. Specifically, our comparative analysis of five universities suggests the following hurdles to be consistently present for BPM educators around the globe.

First, there is a lack of pedagogical resources in terms of both course materials and qualified instructors. There seems to be a lack of reliable, widely-accepted textbooks on BPM. The BPM body of knowledge [Antonucci et al., 2009] presents mostly a high-level overview of topics rather than an in-depth instructional text. As a result, as Table 9 shows, most universities rely on internally-developed materials and a combination of books, book chapters, and various research and industry articles. In addition, most universities recognize that having real world BPM input (through industry guest speakers) and experiences (through industry-based projects) is essential, albeit resource-intensive. And even when a strong curriculum exists, it is often difficult to match and tailor the BPM content to the diverse range of students enrolled in BPM courses. Another problem to overcome is the lack of qualified instructors to teach BPM. Most university programs seem to be built though the efforts of one or a handful of individuals who have taken it upon themselves to define and deliver BPM education, sometimes with little institutional support for the needs of the new courses or professional development in this ever evolving discipline.

Second, as Table 8 shows, there is quite a bit of variety as to where and how BPM course(s) and topics are positioned within existing degree programs. This invariably reflects factors such as the perceived importance of BPM as a subject students need to know about within various degree programs and specializations, the positioning of the unit offering these courses and their relative enrollment strength and expected demand.

Third, most BPM course offerings are based on a combination of managerial and technical topics, which usually require specific skills and more time to set up and teach than other existing courses. In most of the five BPM approaches presented here, the students are exposed, in one or two courses, to a variety of technologies for process modeling, simulation, optimization, and execution that would otherwise occupy one or several semester-long courses by themselves. Each technology requires negotiations for obtaining academic licenses and testing in a complex technology environment to ensure a reliable platform, especially when it is used by many students (as in the case of required courses). This heavy technology load requires specialized skills for course delivery, as well as additional administrative resources for technology support, exacerbating the resource challenge discussed above. In

addition, most commercial BPM systems are upgraded and modified at least yearly and generally more often, on schedules that do not align with an academic calendar. Keeping up with these updates is necessary, but difficult, from a skills, teaching materials, and technology support standpoint.

Table 9: BPM Education Curriculum at Five Universities Around the World

Topics	Course Materials	Technology	Assessments and Projects
Bentley University			
Business process definition, measurement, analysis, improvement, and control enterprise systems support for business processes, inter-organizational processes and systems	Reference book [Pande et al., 2001], book chapters [Laguna and Marklund, 2004], BPM-related articles (research papers and industry whitepapers), and internally-developed case studies, notes, and class exercises.	Process modeling (ProcessModel), live ERP platform (SAP).	Homework, cases, exams, and semester-long, separate, instructor-assigned team consulting project with major companies (day MBA) or ¾ semester, student-proposed project in a real-world organization (evening MBA).
Georgia State University			
Process-as-a-service, process discovery, process and user metrics and KPI's, process modeling (rules, forms, events, and roles), process improvement and innovation, incremental change management, process implementation and use using a BPMS platform	BPMN modeling books [Garimella et al 2008; Silver, 2009; White and Miers, 2008], whitepapers (BP Trends, vendors, Gartner), articles and whitepapers on process improvement and innovation.	Process modeling (previously TIBCO Business Studio v3, now BizAgi Process Modeler), IBM's INNOV8 business process simulation/ game, BPMS platform (previously Cordys; now BizAgiXpress).	Exercises, exams, tutorials, cases, student team identified and scoped real-world business process project (first course defines and creates as-is and to-be versions; second course implements).
Queensland University of Technology			
ERP, process management, process modeling, case studies, management issues, smart services	BPM articles (research papers, industry reports, internally-developed), industry guest speakers, BPM websites, and core texts used across the different units [Becker et al., 2003; Bryson, 2006; Burlton, 2001; Davidson, 2006; Davies and Brabaender, 2007; Dumas et al., 2005; Harmon, 2007; Shanks et al., 2003; Sharp and McDermott, 2009; Smith and Fingar, 2007; vom Brocke and Rosemann, 2010a, b; Weske, 2007].	Process modeling tools (ARIS, YAWL and itp-Commerce); activity-based costing tools; simulation tools (ARIS); ERP platform (SAP); J2EE, .NET, Microsoft IIS, Sun Glassfish, Oracle BPEL, MySQL, Microsoft SQL.	Project proposals, recommendation reports (including consultation, process modeling and analysis reports), reflections, issue discussions, business case studies, tutorial participation, lab practices and demos, presentations, mid-semester and end of semester exams.
University of Pretoria			
Business architecture (systems engineering, information systems design), business engineering (operations), optimization (modeling and simulation, operations research)	Readings consist of published books, articles, and internally-developed materials. Topics range from professional ethics to business engineering. International popular readings are used for each subject area.	Microsoft Visio, KBSI's Enterprise Workbench, and ARIS, ADONIS, Bonitasoft, and Alfresco.	Most subjects include the use of exams, projects, tests, in-class exercises, and graded and ungraded homework. Community-based projects are also embedded.
University of Vienna			
BPM foundation, BPM life cycle (process strategy, design, reengineering and optimization, execution, controlling), BPM technology, BPM research and industry trends	BPM articles (research papers, industry reports, BP Trends articles) and internally-developed presentations and materials.	Process design, reengineering and optimization (ADONIS) and strategy (ADOscore) tools delivered under ADOuni cooperation program.	Assignments, assessments, instructor-directed team project for hypothetical university (in-class) and telecom, finance or healthcare virtual companies (at home).

Fourth, BPM courses may face challenges related to the willingness (or lack thereof) of the university administration to forgo minimum course enrollment requirements in order to build an interest for BPM education among students. Successful BPM approaches seem to require decisive action from university administrators to create and staff required courses within professional degree programs (MBA, Master of Business Informatics, Master of Computer Information Systems and their undergraduate equivalents), or a specialized BPM degree program or "certification." To overcome administrative (as well as curriculum and technical) challenges, some institutions such as Bentley University have formally created a BPM process owner—a faculty member with specifically-assigned duties for curriculum coordination and oversight, while for others this role remains ad hoc.

Fifth, there is limited pedagogical research related specifically to BPM education that might assist others in identifying best practices and pedagogical strategies applicable for courses that combine such a wide variety of topics and require close academic–industry collaboration for delivering reliable real-world experiential learning.

Sixth, career pathways and positions for students who enroll in BPM courses and programs have been unclear; in fact, what constitutes a BPM professional depends on one's definition of the term. Larger private and public organizations are beginning to seek out business process professionals under a variety of labels (such as business process analyst, business process improvement consultant, or process auditor) and students are receiving offers for these positions, both from organizations seeking to develop or improve their business processes as well as consultancies working with such companies.

Still, with challenges come opportunities. Early adopters of BPM-related courses are finding that students, once exposed to these concepts, are recommending them to other students (viral marketing) with the result that enrollments in these courses are steadily increasing. For example, at Georgia State University, an initial (non-required) course offering netted only fifteen students in its first year. By the end of the third year, enrollments exceed two sections of more than twenty-five, and this demand continues to increase. This, in turn, allows follow-on courses to be demanded and offered. As importantly, while the course is offered out of the computer information systems department, many of those taking the course are not CIS majors. Similarly, while several years ago there were no graduating student placements in BPM-related business process analysis, now more students are finding career opportunities directly in this area which in turn further reinforces the enrollment trends. At universities where this has become a required course, enrollments are much higher for both the required course as well as the follow-on elective courses.

Conclusions: The Way Forward

This article is a formal compendium of the dialogue that started at the 2009 BPM panel at the *European Conference of Information Systems* [Chircu et al., 2009]. The sample BPM education courses and programs described in-depth in this article provide a glimpse of how BPM education is evolving across the globe. Together they validate BPM to be an academic area that can flourish in academic departments and/or schools, varying from engineering to business. At Bentley University in the U.S., a foundational course on BPM has been a core requirement in its MBA program for ten years. At Georgia State University in the U.S., the primary audience of the BPM course, also located in its business school, is the undergraduate information systems majors population. At Queensland University of Technology in Australia, the science and technology unit offers both undergraduate and graduate courses and programs in BPM. At the University of Pretoria in South Africa, BPM education is integrated in its industrial engineering program. And at the University of Vienna, BPM is part of the business informatics concentration within the school of computer science.

At Bentley University BPM is a required part of its MBA program because business processes are viewed as the means for executing business strategy and the ability of a firm to compete depends on its capability to manage its business processes. This capability of managing business processes separates BPM from earlier process-oriented initiatives like BPI and BPR. Further, managing business processes is more than using the quantitative Six Sigma approach to remove defects and stabilize process performance. As business strategy evolves or changes, business processes need to be aligned. Without the current BPM technologies, such as BPMS platforms and SOAs, one cannot mold business processes dynamically. These technology components are pushing the development of BPM courses in the CIS curriculum at Georgia State University. The focus of the specific BPM module at the University of Vienna is on the design, reengineering, and organizational implementation of the processes, since the technical implementation is covered in a separate workflow management course. The Queensland University of Technology has developed a set of BPM technologies and BPM management courses to prepare a BPM professional. Because the information systems programs are housed within the faculty of science and technology at Queensland University of Technology, the faculty were able to innovate BPM courses across the dimensions of BPM management and BPM technology. Similarly the location of BPM courses in the industrial engineering department at the University of Pretoria has driven the development of BPM technology and reengineering courses. In summary, these five BPM

education initiatives further validate that BPM as a field is driven by both the approaches of managing business processes and the associated workflow, business process modeling, and process integration technologies.

Irrespective of where BPM education is located, one common challenge all universities encounter is a lack of textbooks and teaching materials. The success of BPM initiatives at these universities is because one or a few key faculty members at these universities took the initiative to develop the courseware, learn the technologies, deliver the course, and then diffused it among other interested faculty. These initiatives, although understood and appreciated at their local universities, are not disseminated across the academic community. There is an urgent need to develop a repository of courseware and learning that can be shared across universities.

Since a field cannot be sustained without continual research, these BPM curricula initiatives need to be supported by active BPM research. Although there is one Business Process Management Journal and BPM publications do appear in many traditional IS academic journals, BPM publications and writing are dominated by consultants and the producers of BPM tools. Thus, there is a need to expand the outlets for BPM research and more significantly attract faculty to the BPM area. Having served as chairs of BPM tracks at professional conferences, we have observed the lack of qualified BPM faculty to undertake the task of reviewing BPM research manuscripts.

Finally, because BPM is deeply rooted in practice, it is important for BPM faculty to link with industry. The semester-long BPM project at Bentley University is one such academic–industry collaboration. For BPM to flourish and grow, there is need for close industry and academia partnerships that will result in joint seminars and workshops and the creation of research-informed communities of practice around BPM topics.

In conclusion, this article provides a sample view of BPM initiatives across the globe and the challenges of implementing such initiatives. Individual institutional strengths and challenges, as perceived by the authors (drawing from their extensive experience with BPM education at their institutions), are revealed, opening doors for potential collaborations for the progression of BPM education. The article consolidates the core challenges and recommends future direction, calling for action from academia and industry to make contributions toward enhanced BPM training and education. We believe it is a reasonable prediction that business process management will become a required course in the foreseeable future in all IT- and business-related degree programs. The progress toward this has already occurred. The most recent curriculum guidelines by the *Association for Computing Machinery and Association for Information Systems* [Gorgone et al., 2006; Topi et al., 2010] recommending BPM in the Information Systems Curricula are early evidence for this. Follow-on specialist courses can then use these required courses as a basis for delving more deeply into topics and methods related to their discovery, improvement/innovation, and realization, their ongoing management as a defined corporate asset as well as more advanced topics. Interested academics once again have an excellent opportunity to embrace a new, exciting, cross-functional discipline—BPM—and to create the curricula that provide appropriate learning platforms for building these competencies. We hope this article will serve as a first step toward the development of a BPM academic strategy.

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Editor's Note: The following reference list contains hyperlinks to World Wide Web pages. Readers who have the ability to access the Web directly from their word processor or are reading the article on the Web, can gain direct access to these linked references. Readers are warned, however, that:

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