Experiences in Designing an Undergraduate Project Management Degree

Jennie Carroll

Property, Construction and Project Management, RMIT University, Melbourne, VIC, Australia, jennie.carroll@rmit.edu.au

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Experiences in Designing an Undergraduate Project Management Degree

Jennie Carroll
RMIT University, Australia
jennie.carroll@rmit.edu.au

ABSTRACT
The popularity of project work in organizations has exposed a gap in project management education. To date, most project management education rests in a single undergraduate course or a Masters program, supplemented by professional training. This paper presents a different approach to filling the gap: a full undergraduate degree in Project Management. It describes the process of designing a four-year undergraduate Project Management degree. The paper details the implications of the degree design for our discipline. It highlights the opportunities offered by an Information Systems project management degree. It also illustrates how the degree design can provide be tailored for a three-year undergraduate IS project management degree. The paper contributes to the growing field of IS Project Management Education.

Keywords
Information Systems (IS) project management, Project Management Education, undergraduate project management program

INTRODUCTION
Project work, and the range of skills it requires, is an important aspect of the operation of contemporary organizations. This has highlighted the need for effective project management (PM) education.

The origins of PM are in the engineering disciplines. Early PM was underpinned by an instrumental or engineering philosophy that conceptualizes project success as conformance to cost, time and scope constraints (Maylor, 2001; Schwalbe, 2004; Winter and Szczepanek, 2008). The problem to be resolved is well-structured, requirements can be clearly specified ahead of time, and robust estimation tools are available. Initially PM education was located in engineering schools with a focus on quantitative techniques to plan activities and optimize resources.

More recently there has been a trend for organizations in a wide range of industries to undertake non-routine work through multiple, often inter-related, projects. This is described as projectification or project-based management (Maylor, 2001; Midler, 1995). A project structure is believed to provide greater agility than a bureaucratic, hierarchical organizational design (Davies and Hobday, 2005). The popularity of project-based management has led to broadening of the type of projects undertaken (Soderlund, 2004) and alternative perspectives on the nature of projects. Projects are viewed as value creation processes (Winter and Szczepanek, 2008), change management programs (Maylor, 2001), and as ways of implementing organizational strategy (Cooke-Davies, 2008). These broader applications of project management aim to deliver business benefits through projects (Morris, 2007: 194).

Project-based management has significant implications for employees. A range of project-related skills and knowledge are required. These include understanding of the basic principles, tools and techniques of project management as well as business and interpersonal skills such as communication, team working and negotiation.

These implications apply to workers in Information Systems (IS). The contemporary skill set extends far beyond those required for the role of IS project manager. Possible skills encompass: working as an effective project team member; administering IS projects; working on IS project quality, risk and procurement; and understanding the larger context of a program of IS projects.

These changes highlight the importance of educating people to work on projects. This paper addresses the research question “How can a project management degree be designed to meet the growing need for project management skills in the twenty-first century workplace?” by examining the design of an undergraduate PM degree.

The paper is structured as follows. It starts by placing PM in the context of modern work and outlining some of the key issues for PM education. The paper then describes the process of designing of a PM degree: the background, an initial ‘logical’ redesign of an existing degree, and the final design, a four-year program whose first year was implemented in 2010. The
paper concludes by raising some implications for IS educators and provides an example of applying the design for an undergraduate IS PM degree within universities.

**PM IN CONTEMPORARY WORK**

The current popularity of undertaking non-routine work through projects has highlighted difficulties in successfully completing projects. Problems with managing projects are evident in many domains and have significant economic and social consequences (Love, Edwards and Irani, 2008). Some of these problems arise from the greater complexity and uncertainty of business projects. Thomsett (2002:18) argues that PM originated in engineering where projects generally have formal and fixed specifications, well-established codes of practice, physical deliverables with modular components, clear and accurate performance indicators and a consistent and standard process that reduces variation. Business projects, in contrast, are characterized by flexible and informal specifications, poorly established codes of practice, abstract deliverables and unique components, poor performance indicators and metrics and individualism that amplify variation.

The uncertainties of business projects are intensified with IS projects. IS projects are undertaken to provide business value as part of implementing corporate strategy and goals (Carroll and Fidock, 2008; Klecun and Cornford, 2005). IS are composed of information technology (IT), people, processes and practices (Kling and Scacchi, 1982). IS, and each of their composite elements, are highly malleable and so the installation of IT into human systems is characterized by unintended impacts, workarounds and user creativity to shape the system to suit the particular context (Markus and Silver, 2008).

Efforts to improve PM capabilities to increase project success rates are evident in the activities of professional associations such as the Project Management Institute (PMI), codification of accepted practice into Bodies of Knowledge, and standardized processes for applying this knowledge in projects through PM methodologies such as PRINCE2 (OGC, 2005).

Wider application of project-based management raises issues of providing effective PM education to prepare young people for work in this environment. Some of the key issues are:

- Where to place PM education (faculty/discipline)?
- What are core skills (technical, managerial, interpersonal)?
- How to teach (given the importance of practical skills and experience)?
- What format (single course, major or program)?
- To what extent is PM domain-specific or generic?

These issues were confronted in the process of designing a four-year undergraduate PM degree that is described in the following sections.

**BACKGROUND**

The School of Property, Construction and Project Management (PCPM) at RMIT University in Melbourne, Australia is composed of three discipline areas: Property, Construction Management and Project Management. The school offers undergraduate degrees in each discipline and a range of technical and post-graduate programs. Many staff in Construction Management and Project Management have engineering backgrounds with some staff from architecture and building. Most Property staff have a business degree in Finance or Property.

A PM undergraduate degree was introduced in 2005 and focused on PM in a construction context. It had only 6 PM-specific courses with the remaining 26 courses drawn from Construction Management (14), Property (9) and electives (3). The first specialist PM course was taught in semester one of 2nd year. The primary emphasis was on PM knowledge areas rather than PM processes.

The author was employed at PCPM to strengthen its post-graduate supervision capability. At the start of the 2008 academic year, I was tasked with designing a new 4th year course, Advanced Project Management, as well as supporting another new 4th year PM course. I studied program and course documentation and interviewed academic staff who taught the earlier PM courses. Comparison of the espoused contents of the PM courses and assessment tasks identified gaps in key knowledge, skills and mastery of tools and techniques. Early in the semester, it became clear that the final year PM students lacked some core knowledge and skills; for example, students in both 4th year classes appeared unaware of the role and nature of the PMBOK.

I was then asked to review the undergraduate PM degree. I analyzed the content, learning and teaching approaches, outcomes, and resourcing. The findings were presented in a review report in late 2008. The report noted perceptions of the strength of the program—the high quality of the students, the strength of links with industry and the mixed background...
(academe and industry) of teaching staff—but recommended changes in the structure and teaching approaches employed in
the program. The report contained a skeleton outline of a suggested new curriculum. At the start of 2009, I was given
responsibility for designing a new PM program to be implemented in 2010 in parallel with new Property and Construction
Management programs.

The outcomes are described in two sections. The next section outlines the process of initial redesign that produced the
suggested new curriculum presented in the review report. The following section describes how this ‘logical’ design was
modified to produce the ‘practical’ design that was implemented from 2010.

INITIAL REDESIGN

Inputs to the Design

There were five main inputs to the initial redesign of the new program contained in the review report.

Publicly-available information

Information about PM education and required knowledge and skills of PM workers was gathered from:

- Education and training programs:
  - Educational courses and programs at tertiary institutions covering PM offerings at both under- and post-
    graduate levels
  - Training programs offered by commercial training companies, including those specializing in PM, as well
    as those run by the PMI and other PM associations.
- PM materials:
  - including the PMBoK (PMI 2005), PRINCE2 (OGC 2005) and PM textbooks.
- Research articles:
  - in the areas of education (including student engagement) and PM (especially skills of successful project
    managers)

The PMI's Project Manager Competence (2007)

The PMI sees the competence of Project Managers is comprised of three dimensions:

- Project Manager Knowledge Competence - knows about processes, tools & techniques
- PM Performance Competence – how this knowledge is applied
- PM Personal Competence – how the PM behaves

The University strategy

The new program had to address the university’s Graduate Attributes (RMIT Learning & Teaching Strategy 2007-2010):

- work-ready
- active learners
- life-long learners
- global in outlook and competence
- culturally and socially-aware
- innovative
- environmentally aware and responsible

Key stakeholders

The views of key stakeholders about shortcomings of the current PM program and the requirements for a contemporary PM
undergraduate degree were collected through interviews and focus groups.

- Interviews: an interview protocol was constructed and guided the semi-structured interviews. Insights from earlier
  interviews were used to adapt the protocol for subsequent interviews.
  - Industry – Individual interviews were held with an office bearer of the local PMI chapter and three PMs
    working in industry (two from construction/property development and one from business).
  - PCPM staff. The Head of School and a range of senior and long-serving PM staff were interviewed.
- Students. A focus group with all 4th year PM students was held as well as follow-up discussions with individual
  students to probe their suggestions for additional content areas, skills and courses.
Personal principles

The design reflected the author’s principles and beliefs. My expertise in IS project management guided the design in the following ways:

- **Breadth.** I believed that students should have a thorough grounding in one PM domain but this should be extended with introduction of other PM domains. Teaching activities and case materials, assessment, and guest speakers should incorporate PM in a range of domains.
- **Practice.** PM is a practical discipline so learning and teaching activities should be grounded in PM practices. As an IS academic I have observed a shift towards increasingly conceptual and abstract IS course content that has resulted in disengaged students. The new PM program has a focus on practical knowledge and skills underpinned by theoretical principles.

Report Recommendations

Mission statement

The report recommended that a concise mission statement for the program be constructed to address student learning and graduate outcomes. This would provide a point of reference for staff teaching into the program, the PM students and for planning changes to the program. Such a mission statement should support the University vision, be tailored for the PM undergraduate program and reflect the multi-disciplinary nature of project management. An example mission statement is:

> The undergraduate project management degree aims to foster creativity, independent thinking and analytical skills. It develops students’ knowledge, performance and personal competencies in order to enable professional performance of project management roles in diverse disciplinary, national and cultural domains.

New curriculum

The report recommended that a new curriculum be implemented.

1. New PM courses should be introduced:
   a. An introduction to PM should be taught in the first semester of year 1 of the PM degree.
   b. Additional courses are needed to deepen core PM knowledge, skills and mastery of PM tools and techniques.
   c. Greater attention be paid to the PM Personal Competence that includes communicating, leading, managing, and professionalism.
   d. PM domains other than construction should be introduced such as design, IT, entrepreneurship and facilities management. This would align the program with the School’s PM Masters program that was generic with many students from IS/IT backgrounds.

2. Teaching and Learning approaches and materials should be refreshed to:
   - provide sequential knowledge-building, so that students develop the essential knowledge, skills, tools and techniques for subsequent course. This requires careful specification of core concepts, knowledge, skills and tools and techniques that are covered in sequences of PM course.
   - foster essential PM computing skills in MS Excel and PM software such as MS Project and Primavera through ongoing activities that reinforce and deepen skills learned

The report recommended that the implementation of the new curriculum should be reviewed annually and revised at each review point if necessary. It stated that “the degree of culture change in shifting towards a collaborative rather than individual teaching approach is major and should be taken in small steps, reinforced and re-assessed before further change is attempted.”

PROGRAM DESIGN

The Process

The above section describes the inputs to producing a ‘logical’ curriculum. Moving towards a mature PM curriculum that was ready for implementation was an iterative process of discussions with PM staff in the School and then revising course content and sequences. There were ongoing negotiations with the leaders who were redesigning the Property and
Construction Management programs about the content and timing of their courses. These led to more discussions with PM staff, more revisions and then further inputs from students and industry representatives. A check list of the nine PM knowledge areas of the PMBOK (PMI, 2005) helped to ensure that all knowledge areas were covered in the program and that skills and knowledge were developed sequentially and reinforced over the four years. This process continued for most of 2009 and was complicated by decisions made by University staff about the implementation strategy (e.g. they mandated that the new programs were introduced a year at a time rather than the whole program at once).

Designing a new curriculum is a political process. Some of the political issues that arose were:

- Preparing students to be both work ready (as outlined in the university Graduate Attributes and industry demands) and prepared them for future management roles (that is implicit in university education programs)
- Engaging and preparing staff (building on existing expertise in the school and recruiting staff given that Australian academic pay rates are significantly lower than industry and the requirement for new staff to be research active)
- Balancing the existing engineering/construction focus in the school with requests from students and industry for a broader focus to include more management skills and domains such as events management.

### The New Program

Table 1 presents the final PM program for incremental implementation from 2010. Each course has 3 hours of formal instruction and students are expected to spend between 2 and 3 hours outside the classroom for every hour of face to face contact. There are 14 Project Management courses, 6 Construction Management, 5 Property, 3 joint and 4 electives. PM courses are shown in Bold + Italics while joint courses that are not discipline-specific are shown in Bold. These courses are briefly described in the text following Table 1.

<table>
<thead>
<tr>
<th>YEAR 1 - COMMON COURSE ACROSS THE SCHOOL</th>
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<tr>
<td>Semester 1</td>
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<td>Project Management Concepts</td>
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<td>Professional Communications</td>
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<td>Introduction to Buildings (CM)</td>
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<td>Valuations and Property (Property)</td>
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<td>Semester 2</td>
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<td>Project Management Techniques</td>
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<td>Managing for Sustainability</td>
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<td>Construction Processes (CM)</td>
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<td>Property and Capital Markets (Property)</td>
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<td>Semester 1</td>
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<td>Project Management Processes</td>
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<td>Management for Projects</td>
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<td>Building Measurement and Estimating (CM)</td>
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<td>Introduction to Law in the Built Environment (Property)</td>
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<td>Semester 2</td>
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<td>Project Quality Management</td>
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<td>Project Administration</td>
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<td>The Construction Enterprise (CM)</td>
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<td>Property Economics (Property)</td>
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<th>YEAR 3</th>
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<td>Semester 1</td>
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<td>Risk Management</td>
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<td>Leadership and Teams</td>
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<td>Construction Planning &amp; Design (CM)</td>
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<td>Elective</td>
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<td>Semester 2</td>
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<td>Project Management Domains</td>
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<td>Procurement for Projects</td>
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<td>Property Development (Property)</td>
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<th>YEAR 4</th>
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<tr>
<td>Semester 1</td>
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<tr>
<td>Advanced Project Management</td>
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<td>Project Planning and Reporting</td>
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<td>Industrial Experience</td>
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<td>Elective</td>
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</table>
Semester 2 | Capstone Project for Project Management  
| Research Project  
| Industrial Environment (CM)  
| Elective  

Table 1 The new PM program

YEAR 1

Project Management Concepts
An introduction to projects and PM. Topics include: the nature of projects; the role of projects in construction, property and the 21st century organization; the project lifecycle; roles & responsibilities of a project manager; and planning the project.

Professional Communications
A foundation in communication for professionals in the built environment. Topics covered include: communication channels; 21st century communication (email/mobile/Web 2.0), etiquette, security of data; and effective communication for the task.

Project Management Techniques
A tool kit of techniques that can be applied to planning projects. Topics include: constructing a business plan; project selection (including payback period and discounted cash-flow); scope (decomposing projects, WBS); managing time and cost (network diagrams, Gantt charts); resource planning; and an introduction to PM software and Excel.

Managing for Sustainability
The course aims to develop critical thinking about sustainability in relation to the environment; industry; economic issues and the triple bottom line; and sustainable management including ethics.

YEAR 2

Project Management Processes
An introduction to key PM processes and how they are managed and integrated in order to complete a project. Topics include: applying knowledge in PM processes; project integration; portfolios and programs of projects; PM methodologies; information management for projects including Building Information Modeling; and supporting PM processes through the Project Management Office.

Management for Projects
The key aspects of the organizational context for projects. Topics include legislative, trade union, economic and social influences; organizational structures, culture, politics & power; organizational behavior; and organizational goal-setting.

Project Quality Management
A broad perspective on quality in projects. It includes: viewpoints on quality (economics, ethics and social influences); project quality (constructing a project quality plan); and project improvement (Improvement and Maturity Models; implementing quality and continuous improvement).

Project Administration
Administrating the project. This course covers: the tendering process; award and project inception; contract administration; project monitoring, EVAs, project control; dispute avoidance and resolution; sub-contract administration and management; drawings, revisions, RFIs; and costs and project accounting. Students will develop and monitor cost plans using PM software.

YEAR 3

Risk Management
Concepts and standards necessary for managing project risk. Topics include: the concept of risk; identifying risk (viewpoints and values; qualitative and quantitative analyses); common sources of risk; principles, standards and processes for managing risk in projects; software to manage project risk; and disaster planning and recovery.

Leadership and Teams
Key capabilities for effective project teams. The course is divided into two sections: leadership (the nature of leadership; power and politics; motivating and managing; conflict resolution, negotiation and time management skills); and teams (stages in team development; working in teams; individual preferences and styles; negative aspects of teams).

Project Management Domains
Projects in domains other than construction such as IT, supply chain management and entrepreneurship. Topics covered include: key concepts, terminology and issues from the selected domain; project risks; and typical product/service lifecycles.
Procurement for Projects
Project procurement with an emphasis on relationships with other stakeholders in the supply chain. Topics include: delivering value and benefits management; the project supply chain; project procurement options; project procurement processes and documentation; contracts, SLAs, governance and ethics; and stakeholder management.

YEAR 4

Advanced Project Management
Capabilities for global professionals in the twenty-first century. Topics include: cross-cultural management; international financing; agile project management; PM and innovation; and managing yourself as a PM professional.

Project Planning and Reporting
Work in a team on a real-life scenario. Students bound a problem situation, analyze key aspects of the problem and generate options. Teams then undertake a Feasibility Study for one of the options and produce a Business Case for that option. This leads on to the Capstone Project.

Industrial Experience
Preparing for professional practice. This course provides face-to-face seminars on: ethics, ethical behavior and the law; sustainable practices; and improving practice: the reflective practitioner. These feature guest lectures by industry personnel as well as sessions by regular teaching staff. They are supplemented by readings and workplace analyses.

Capstone Project for PM
Students work in a team, and collaborate with other teams, to produce project planning documents including risk, quality, procurement and communication plans for a project as part of a program of projects. Projects include planning infrastructure (e.g. a desalination plant, an urban bike path) or a major event (e.g. Grand Prix, rock concert). The consequences of changes in the project environment are analyzed and negotiated by the teams.

Research Project
An introduction to the research process. Students select a PM issue and work in teams to complete a research report. Topics include: the nature of research (in contrast to consulting or anecdotal learning); critical analysis of existing knowledge (the literature review); identifying a research topic; and constructing a research design.

Outcomes of the New Program
Gaining employment has not, to date, been an issue for our students. Students usually find part-time work in the 3rd and 4th years of their courses; roles include project contract, administration and assistant project manager. The mining boom in Western Australia has increased opportunities and some of our graduating students move west or overseas to work in junior project roles. We are too early in teaching the new curriculum to gain any industry feedback about the skills and knowledge of students studying the new curriculum.

Implementing the first two years of the new program have surfaced issues in attracting and retaining teaching staff who have breadth of PM knowledge, particularly around management and interpersonal skills. The program has had to rely on sessional staff. This has affected detailed course design and transferring course knowledge across semesters and years. Also, several core skills (e.g. in Excel) ‘fell through the cracks’ between disciplines in the first year. Articulation of skills and knowledge across semesters and years remains a problem, due to changes in discipline leadership and loss of experienced teaching staff.

Finally, the report’s recommendation for “shifting towards a collaborative rather than individual teaching approach” was rejected by the School’s management.

IMPLICATIONS FOR IS PM EDUCATION
Education in project management provides a huge opportunity for the IS discipline at a time of declining enrolments in IS programs. Expanding into PM education builds on IS expertise in practical learning and practice-based research. It also harnesses many years of experience in undertaking and evaluating IS projects. IS project management emphasizes human skills (management, communication, negotiation, leadership and teamwork) more than engineering or IT project management. Its focus is on business value rather than purely technical skills. Many undergraduate IS programs currently incorporate a single PM course. Is there an opportunity to expand this into a major or even a whole IS PM program?

Content of the Program
The curriculum described in this paper can provide a foundation for both an IS-specific PM program and a business PM program with specialization in IS projects. An example of a three year IS PM undergraduate degree is presented in Table 2. It
builds on the joint ACM/AIS 2010 Curriculum Guidelines for Undergraduate Degree Programs in Information Systems (Topi et al., 2010). Courses included in both the new PM program in Table 1 and Table 2 are in bold and italics. All are 3 credit point course.

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Table 2 Example of an undergraduate IS PM program

Table 2 includes 11 PM-specific courses and Professional Communications (in bold + italics). It also includes 6 of the 7 core courses in the 2010 IS curriculum (Topi et al., 2010): Foundations of Information Systems, Data and Information Management, Enterprise Architecture, IT Infrastructure, Systems Analysis and Design, and IS Strategy, Management, and Acquisition; IS Project Management is omitted. Additional IS courses are Business Process Management, Enterprise Systems, and IS Change Management (that could incorporate IS innovation and uptake). Two core business courses are included in first year and an elective in the final year. This program provides a combination of managerial and interpersonal skills coupled with technical knowledge in both PM and the IS discipline. It is designed to meet a variety of IS project roles beyond that of project manager because IS professionals may work in a project office, identify and manage risk and security, implement enterprise systems or work on a program of IS projects.

A major challenge is to provide an engaging experience for students when grounding the PM courses in an IS context. In the construction industry, site visits, building plans and property development layouts are commonly used to provide concrete experiences of the built environment context. IS lacks the ability to provide such vivid, tangible project experiences. The research and practitioner literature, along with press articles, provide ample stories about IS projects. Project plans and ‘war stories’ by practitioners of the problems when implementing these plans for IS projects, may provide further concrete experiences of IS project management.

Placement of IS PM Education

The issue of where to place an IS PM degree—in engineering (the source of PM education), in IT (where technical expertise is strongest), in business (where management and interpersonal expertise is strongest), or in an IS school (where PM can be most effectively contextualized)—is complex and may be resolved according to available resources. Ideally, building on my experiences, IS PM education should be placed in either an IS or a business school.
Examination of PM programs taught in Engineering and IT schools reveals a focus on technical knowledge and quantitative skills. When designing the PM program described in this paper, students and industry advisors emphasized the need for additional management and interpersonal skills. In contrast, internal engineering and construction staff called for ‘more science’, greater technical skills and enhanced problem solving while minimizing the importance of management, interpersonal skills or professional development. The program design in Table 1 incorporates elements from all these areas however implementing the latter areas has been challenging but has received excellent feedback from our students.

Placement in an IS school enables the content to be contextualized for work on IS projects. Placement in a business school provides clear understanding of the value of management and interpersonal skills, staff with expertise in teaching and learning in these areas, and a large potential pool of students likely to work in project-based management.

CONCLUSION

This paper examined the process of designing a four-year undergraduate PM program. It describes the inputs to the design process, the influences on the program design and its final content. The program was designed principally for the construction and property development domains. However, the curriculum can be easily adapted for other domains; an example of its application to IS in included in Table 2. An IS PM degree offers the potential of revitalizing IS education. Much IS work is based around projects—where roles include those as a project manager, project administrator, IS project team member or specialist in IS project quality, risk or procurement—and so an undergraduate PM degree or major provides a practical and theoretical education that is relevant and prized by industry. More generally, a generic business degree or major in PM would generate high demand given the increased popularity of project-based management in business and the range of project-related roles that are required in such work. These degrees and majors would meet the growing need for PM skills in the twenty-first century workplace.

REFERENCES


