

# THE INCLUSION OF PROJECT MANAGEMENT COMPONENTS IN UNDERGRADUATE INFORMATION SYSTEMS CURRICULA

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## ABSTRACT

*This research establishes a baseline for the level adoption of the fundamental project management components as recommended by IS'97 into undergraduate Information Systems programs in the United States. This research is useful to information systems educators as a barometer against which they can measure their own programs. This research is useful to employers interested in the responsiveness of the educational community to their calls for the inclusion of project management skills in information systems degree programs. This research is important to curriculum developers needing to know whether and how quickly their recommendations are being adopted and integrated into degree programs.*

**Keywords :** Project Management, Project Manager, Undergraduate Information Systems Curriculum, Model Information Systems Curriculum, IS'97

## INTRODUCTION

Information Systems curricula require that students be educated in many facets of information systems including fundamental understandings of hardware, software, networks, databases, languages, system development methodologies, and other related topics. Due in large part to the discipline's relative youth (the discipline did not exist prior to the proliferation of computers), there is minimal standardization of curriculum content across institutions. Instead, curriculums are developed based upon the experiences of program faculty and are based upon preferences expressed by the local business community and by employers of the program's graduates.

Formalized development of Information Systems (IS) curricula began in the early 1970s (2, 4). Since that time, both the ACM and DPMA have offered their respective versions of IS model curricula in the 1980s (12). Over the years, several groups such as the Association for Computing Machinery (ACM) and the Data Processing Management Association (currently AITP – Association of Information Technology Professionals) developed model curricula that were adopted by many institutions as a basis for their degree programs. Supporters of the ACM and AITP model curricula, together with the designers of other curriculum models, have worked together to develop the IS'97 model curricula for information technology education (7), which consists of eleven courses.

An important component of the IS'97 model curriculum is a course titled Project Management and Practice. The Model Curriculum lists project management as one of twenty Significant Sub-areas in an IS curriculum, specifying that project management literacy is required for all IS minors and that project management usage is required for all IS majors (6). Since the IS'97 effort, work has begun to update the model curriculum (8). Indications are that the updated model curriculum will continue to recommend the inclusion of project management skills with an emphasis on applying these skills in an online e-commerce development environment.

## REVIEW OF LITERATURE

Project Management has long been discussed as an important component of IS education. In model curricula dating back to the 1960s, project management topics are recommended for a variety of courses. In particular, project management topics have long been recommended for systems design and implementation and for information systems analysis courses (4,12).

Nunemaker et al (12) proposed a course-by-course coverage of project management, indicating the weights of importance of project management in these courses at both the undergraduate and graduate levels. Similarly, in 1989 the Software Engineering Institute (SEI) proposed a course in their Masters of Software Engineering model curriculum specifically geared to software project management. This included issues of project planning, control, leadership, and team building (5). These recommendations recognized the importance of IS project management skills. An important goal was to educate and develop IS specialists with planning and resource management skills.

In Nunemaker et al's recommendations, five percent of the undergraduate Information Analysis course consisted of project management skill development. Twenty percent of a recommended prerequisite quantitative methods course was devoted to project management topics (such as CPM, PERT, etc.). At the graduate level, the recommended IS Policy course included strong project management components.

Numerous reports in the academic literature attest to the importance of project management in contributing to the success of IS development. Lyytinen (9) conducted a literature survey regarding IS problems and identified three categories of problems that could be alleviated through project management education.

- Administrative - primarily concerned with the structure (hierarchical, matrix, parallel) of project teams.
- Interaction structures – focused on patterns of communication among development personnel and between developers and users.
- Interaction strategies – concerned with how participants effectively fulfill their roles in the development process.

Approaches to project management coverage vary in information systems curricula. Busenburg and Tam (3) described a "clinic" approach in which students gained practical experience in applying project management skills to real-world software development efforts, consisting of teams of students working together and taking turns with project management responsibilities. Pfall et al (13) describe a computerized simulation model for teaching software project management. Anido-Rifon et al (1) describe a web-based simulation model that incorporates a project-management component into an overall software development group project. McDonald (10) described a software project management course that was converted from a week-long industry seminar into a semester-long college course. Sullivan (15) created a role-play exercise in which teams of students exercised project management techniques in fictitious software projects. Murphy (11) described a "response-interaction" approach, largely emphasizing in-class and out-of-class exercises, team projects, and class presentations.

Notwithstanding the recommendations and findings just cited, empirical attitudinal studies do not always indicate that project management skills are considered by practitioners to be important

for the success of entry-level IS professionals. Snoke and Underwood (14) found that project management skills ranked toward the bottom in a list of 29 competencies required for entry-level IS employees, as articulated by academic and industry representatives. A survey conducted by the IS 2001 model curriculum project members showed that the IS Project Management course ranks extremely highly in terms of relevance for IS curricula (somewhat lower for CS curricula). However, in the same survey the importance of project management skills for IT analysts ranks relatively low compared to team and interpersonal skills, systems analysis, software/web development, and general business knowledge (8).

Nevertheless, IS'97 and IS2001 both incorporate project management into several layers of their model curriculum (7,8). Recognizing that project management and team skills are strongly related, the incorporation of PM skills into the model curriculum is logical and appropriate.

### **HYPOTHESIS**

Given the existence of the IS'97 model curriculum since 1997 and supported by the recognized need for project management related skills in IS professionals, it is reasonable to expect that the project management-related aspects contained within the model curriculum are evident in IS programs offered by educational institutions in the United States.

### **RESEARCH METHODOLOGY**

Ideally, it would be desirable to poll program or department heads at each academic institution, using the course and learning unit terminologies defined in IS'97, to determine which courses and which learning units have been adopted by each institution. Unfortunately, this approach was not feasible due to several limitations. First and foremost was the limitation that most institutions have not adopted the course titles suggested in the IS'97 model for their IS program. Identifying an accurate list of all IS programs and their respective heads presented a second challenge. A third limitation emanated from our desire to inquire about both general and detailed aspects of the information covered in individual courses. It was felt that the best information would be gathered from faculty who had recently taught the affected courses.

Recognizing these limitations, an alternative research methodology was developed. The learning units described in the IS'97 model curriculum were used as the basis for polling individual IS faculty who had recently taught IS courses to determine which, if any, IS'97 learning units were covered within the courses that each faculty member taught. In lieu of a comprehensive listing of IS faculty, we choose to rely upon a list of faculty subscribers to the IS World listserver. For this survey, we chose to limit our scope to institutions located in the United States.

We believed that our response rate would be greatly affected by the level of effort required by each respondent to provide the information that we sought. In response to our perception, we developed a short on-line web survey that took faculty between five to ten minutes to complete. The data collected during the survey provided us with demographic information about the faculty member, their institution, the courses that they taught, and the project management related learning units covered in each of their courses.

The following sections discuss the courses that comprise the IS'97 Model Curriculum, the results of our mapping of the 127 individual learning units to the courses contained in the Model Curriculum, and the set of web pages that were used to collect data from faculty members.

### IS '97 MODEL CURRICULUM COURSES AND LEARNING UNITS

The IS'97 model curriculum for information technology education (7) consists of a core of ten courses plus a prerequisite elementary course that, together, encompass 127 learning units. The course names and a brief description of each are provided in Appendix A.

Each of the eleven IS'97 Model Curriculum's courses and 127 Learning Units were reviewed and a map depicting where project management related Learning Units were included in each of the Model Courses was created. This map appears as Table 1, below.

<b>Learning Unit</b>	<b>IS'97.P0 Knowledge Work Software Tool Kit</b>
3.7.1	Project planning and selection of appropriate process model; project scheduling...
3.10.7	Software project management: scoping, scheduling, configuration manage...
	<b>IS'97.1 Fundamentals of Information Systems</b>
3.7.4	Project staffing considerations: e.g., matrix management, human factors, team...
3.7.5	Project control: planning, cost estimation, resource allocation, software tech...
	<b>IS'97.2 Personal Productivity with IS Technology</b>
3.7.1	Project planning and selection of appropriate process model; project scheduling and milestones
	<b>IS'97.3 Information Systems Theory and Practice</b>
3.10.7	Software project management: scoping, scheduling, configuration manage...
	<b>IS'97.7 Analysis and Logical Design</b>
3.10.7	Software project management: scoping, scheduling, configuration manage...
	<b>IS'97.8 Physical Design and Implementation with DBMS</b>
3.7.1	Project planning and selection of appropriate process model; project scheduling...
3.7.2	Project organization management, principles, concept and issues
3.7.4	Project staffing considerations: e.g., matrix management, human factors, team...
3.7.5	Project control: planning, cost estimation, resource allocation, software tech...
3.7.14	Project tracking: e.g., PERT, Gantt
3.10.7	Software project management: scoping, scheduling, configuration manage...
	<b>IS'97.9 Physical Design and Implementation with Programming Environments</b>
3.10.7	Software project management: scoping, scheduling, configuration manage...
3.7.1	Project planning and selection of appropriate process model; project scheduling...
3.7.2	Project organization management, principles, concept and issues
3.7.6	Managing multiple projects
3.7.4	Project staffing considerations: e.g., matrix management, human factors, team...
	<b>IS'97.10 Project Management and Practice</b>
3.7.1	Project planning and selection of appropriate process model; project scheduling...
3.7.5	Project control: planning, cost estimation, resource allocation, software tech...
3.7.14	Project tracking: e.g., PERT, Gantt

**Table 1 – IS'97 Learning Units Contained within Model Courses**

## WEB PAGE SURVEY COLLECTION INSTRUMENT

The web page survey collection instrument consists of three main pages. The first page collects demographic information about the faculty respondent, their institution. The second page inquires about which courses that the respondent has taught within the past 24 months. This information is used to generate a customized page that offers a matrix showing each of the courses that the faculty member taught and a list of the IS'97 learning units associated with each course. Respondants are asked to indicate whether or not each learning unit was covered in each of their courses. A sample of this custom-generated page is offered as Figure 1. For the reader's convenience and reference, the web pages used in the survey are available from the authors.

**Survey -- Use of Project Management in IS Curricula**

Step 3: for each class that you teach, please indicate the Project Management topics that you cover in the class:

	E-Business	Systems Analysis	Information Security
Project planning: selection of process models	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Project organization	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Work breakdown structures, scheduling	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Staffing considerations: matrix mgmt., human factors, team building	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Project control: cost estimation, resource allocation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Managing multiple projects	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Management concerns: stress and time management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scoping and scope control	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Project tracking: PERT and/or Gantt	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Project close-down	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Applying PM to Software projects, including configuration management	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Submit    Reset

If you want to re-enter the classes you teach, click the BACK button on your browser

Figure 1 - Web Page Collecting Faculty Data

## RESULTS, CONCLUSIONS AND NEXT STEPS

The results of this research are in the process of being collected and tabulated. As results become available, we will draw conclusions from them and present both at the conference.

It is our intent to follow the activities of the IS 2002 (formerly IS 2001) committee as they examine updates to the Model Curriculum. The information available at this time suggests that the recommendations regarding project management components will not differ significantly from those contained in the IS'97 Model. This will allow us to update this study in the coming years to discover whether the adoption rate increases over time. We are also considering of expanding our survey to include educational institutions outside of the United States.

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## Appendix A – List and Description of IS'97 Model Curriculum Courses

<b>IS'97.P0 Knowledge Work Software Tool Kit</b>
This prerequisite course offers an elementary exposure to software tools useful for knowledge workers (spreadsheets, databases, presentation graphics, database retrieval, statistics, word processing, and Internet and electronic mail). This material can be delivered as self study modules, as modules associated with other courses using the software, or as a full course.
<b>IS'97.1 Fundamentals of Information Systems</b>
This course provides an introduction to systems and development concepts, information technology, and application software. It explains how information is used in organizations and how IT enables improvement in quality, timeliness, and competitive advantage.
<b>IS'97.2 Personal Productivity with IS Technology</b>
This course enables students to improve their skills as knowledge workers through effective and efficient use of packaged software. It covers both individual and group work. The emphasis is on productivity concepts and how to achieve them through functions and features in computer software. Design and development of solutions focus on small systems.
<b>IS'97.3 Information Systems Theory and Practice</b>
This course provides an understanding of organizational systems, planning, and decision process, and how information is used for decision support in organizations. It covers quality and decision theory, information theory, and practice essential for providing viable information to the organization. It outlines the concepts of IS for competitive advantage, data as a resource, IS and IT planning and implementation, TQM and reengineering, project management and development of systems, and end-user computing.
<b>IS'97.4 Information Technology Hardware and Software</b>
This course provides the hardware/software technology background to enable systems development personnel to understand tradeoffs in computer architecture for effective use in a business environment. System architecture for single user, central, and networked computing systems; single and multiuser operating systems.
<b>IS'97.5 Programming, Data, File and Object Structures</b>
This course provides an understanding of algorithm development, programming, computer concepts and the design and application of data and file structures. It includes an understanding of the logical and physical structures of both programs and data.
<b>IS'97.6 Networks and Telecommunication</b>
This course provides an in-depth knowledge of data communications and networking requirements (networking and telecommunications technologies, hardware, and software), emphasizing management, analysis and design of networking applications in organizations. Students learn to evaluate, select, and implement different communication options within an organization.
<b>IS'97.7 Analysis and Logical Design</b>
This course provides an understanding of the system development and modification process. It enables students to evaluate and choose a system development methodology. It emphasizes the factors for effective communication and integration with users and user systems. It encourages interpersonal skill development with clients, users, team members, and others associated with development, operation and maintenance of the system. Object oriented analysis and design. Use of data modeling tools. Development and adherence to life cycle standards.
<b>IS'97.8 Physical Design and Implementation with DBMS</b>
This course covers information systems design and implementation within a database management system environment. Students will demonstrate their mastery of the design process acquired in earlier courses by designing and constructing a physical system using database software to implement the logical design.
<b>IS'97.9 Physical Design and Implementation with a Programming Environment</b>
This course covers physical design, programming, testing and implementation of the system. Implementations of object-oriented, client-server designs using a programming environment.
<b>IS'97.10 Project Management and Practice</b>
SCOPE This course covers the factors necessary for successful management of system development or enhancement projects. Both technical and behavioral aspects of project management are discussed. The focus is on management of development for enterprise-level systems.