Planning *and* Sprinting: Use of a Hybrid Project Management Methodology within a CIS Capstone Course

Aaron Baird
Assistant Professor of Health Administration and Health Information Systems
Institute of Health Administration, J. Mack Robinson College of Business
Georgia State University
P.O. Box 3988, Atlanta, GA 30302-3988
abaird@gsu.edu

Frederick J. Riggins
Associate Professor of Management Information Systems
College of Business
North Dakota State University
NDSU Dept. 2410, PO Box 6050, Fargo, ND 58108-6050
fred.riggins@ndsu.edu

ABSTRACT

An increasing number of information systems projects in industry are managed using hybrid project management methodologies, but this shift in project management methods is not fully represented in our CIS curriculums. CIS capstone courses often include an applied project that is managed with traditional project management methods (plan first, execute second). While agile methods (adapt to change through iterations) are making inroads, little research has been conducted on using a hybrid of these two project management methods in a capstone course. In this paper, we explain the hybrid project management methods we used in four sections of an undergraduate CIS Capstone course during the Fall and Spring of the 2011-2012 academic year. We also present the results of an end-of-term student satisfaction and critical success factor survey. We find that overall satisfaction with the hybrid approach is high among our sample. We also find that more client involvement and a pragmatic approach to initial project planning are areas for future improvement. The results of our experience and survey provide lessons learned and best practices for those who wish to provide students with applied experience that combines waterfall (traditional) and Scrum (agile) project management techniques in their own courses.

Keywords: Capstone course, Project management, Student perceptions, Teaching Tips, Curriculum design & development

1. INTRODUCTION

Plan first, execute second—this is the paradigm of traditional project management. Adapt to change as you iterate—this is the paradigm of agile project management. These competing methodologies represent two ends of a spectrum between linear (traditional) and non-linear (agile) project management processes. While early debate raged as to which methodology was best (Glass et al., 2001; Nerur, 2005), the debate now seems to be settling on middle ground. Gartner recently forecasted that a majority of software development projects will use some form of agile project management methods by 2012 and also acknowledged that most software projects use a combination of waterfall and agile methods (Murphy et al., 2010; Norton, 2008).

Even though this shift toward middle ground is occurring within industry, this shift has not necessarily been reflected within information systems education. Studies suggest (either directly or indirectly) that traditional project management methods are often the focus of project management education in information systems courses (e.g., Du et al., 2004; Lesko, 2009; Reinicke and Janicki, 2011; Smith et al., 2008). While there are some exceptions (e.g.,, Jones, 2003; Tan et al., 2010; Yue et al., 2009), and demand for more variation in project management methodologies may be increasing, to our knowledge research on the effectiveness of hybrid project management methodologies within information systems classes has not yet been conducted.

Our primary objective within this paper is to demonstrate the validity of using a hybrid project management process for an applied project within a computer information systems (CIS) capstone course. We explain how we organized and delivered four sections of an undergraduate senior-level CIS

capstone course during the 2011-2012 academic year within which teams of students were asked to develop prototypes for a real-world client using a process combining traditional (waterfall) and agile (scrum) project management methodologies. We also report the results and analysis of a survey taken by the students at the end of the course. Specifically, the cross-sectional survey assesses student perceptions associated with the hybrid project management methodology implemented within the course. Survey questions were based on the following theoretically motivated constructs: satisfaction (Melone, 1990; Hayes, 1998), behavioral predictors of adoption and diffusion of innovations (Moore and Benbasat, 1991; Rogers, 2003), critical success factors of traditional projects (Pinto and Prescott, 1988), and critical success factors of agile projects (Chow and Cao, 2008).

The remainder of the paper is organized as follows: 1) We discuss the background of traditional project management, agile project management, and the hybrid approach, 2) We present the teaching methods used in our redesigned CIS capstone course, 3) We report the results of an end-of-term survey designed to assess student perceptions of our hybrid approach, and 4) We conclude with discussion, lessons learned, implications, and best practices.

2. BACKGROUND

2.1 Traditional Project Management (TPM)

Traditional project management (TPM) is defined by Wysocki (2009) as a linear or incremental approach to project management that consists of five primary phases or process groups: scoping, planning, launching, monitoring and controlling, and closing. The linear approach, often called the "waterfall" approach, assumes that once a phase is complete, it will not be returned to for the duration of the project. The iterative approach uses the same phases, but typically involves scoping and planning the entire project first, then launching and delivering increments of the software sequentially, while not returning to the scoping or planning phase for the duration of the project. Such linear and incremental methods are also taught by the Project Management Institute (PMI) in their Project Management Body of Knowledge (PMBOK) Guide (ANSI and PMI, 2004) using five similar process groups: initiating, planning, executing, monitoring and controlling, and closing.

Traditional approaches such as this are often taught in project management and applied CIS courses due to the perceived simplicity and belief that such methods are still adhered to in industry projects. However, a shift is occurring whereby non-linear approaches to project management are making significant inroads due to the realization that information leading to change is often costly, especially when obtained later in the course of the project (Pich et al., 2002). While strong project planning has been shown to lead to high quality and improved project outcomes (Zwikael and Globerson, 2006), it is well-known that linear waterfall methods often become risky (and costly) as a project progresses if requirements are subject to change (Krutchen, 2001). However, if critical success factors are present, especially at the beginning of the project, some of these risks can be mitigated. Critical success factors identified as having significant impacts on the early phases of a project life cycle include: strength of the project mission, client consultation, support from top management, client acceptance, and scheduling/planning (Pinto and Prescott, 1988). We applied these success factors to the development of our course and these success factors also form the basis for the portion of the end-of-term student survey that assessed the perceptions associated with the use of traditional project planning within the course.

2.2 Agile Project Management (APM)

Agile Project Management (APM) is defined by Wysocki (2009) as a non-linear, iterative or adaptive approach to project management (consisting of the same five process groups as mentioned above). APM projects are typically completed in cycles with the next cycle returning to the planning phase prior to launching. Additionally, APM methods prioritize the values specified in the Agile Manifesto (Fowler and Highsmith, 2001): "Individuals and interactions over processes and tools, working (products) over comprehensive documentation, customer collaboration over contract negotiations, (and) responding to change over following a plan."

While agile methods, including one particular agile method referred to as "Scrum," have been shown to be beneficial when used on projects where requirements changes are unavoidable, it is often reported that Agile works best with skilled developers working on small-to-medium sized projects in environments that facilitate communication (Dyba and Dingsoyr, 2008; Lindvall et al., 2002). Additionally, it has been found that efficiency often suffers if change requests require extensive responses (Lee and Xia, 2010). Therefore, overall project goals, objectives, and success criteria must be considered when applying agile project management methods.

Critical success factors of agile methods include: culture, communication, and people (Lindvall et al., 2002), as well as delivery strategy, software engineering techniques, team capabilities, management support, customer involvement, and strength of the process (Chow and Cao, 2008). Therefore, project success when using APM is contingent upon multiple factors, not just a high degree of expected change. We applied these success factors to the development of our course and these success factors also form the basis for the portion of the end-of-term student survey that assessed the perceptions associated with the use of agile project methods.

In our use of Agile in the capstone course, we applied the Scrum methodology. Scrum is described by Rising and Janoff (2000) as, "… a software development process for small teams…. The entire team must have a single focus. The priorities must be clear" (p. 30). Scrum is made up of sprints (short durations of time, from about 2 to 4 weeks, where potentially deployable features must be completed) and backlogs (prioritized lists of tasks or user stories that are waiting to be completed). Within each sprint, a small team of developers selects a subset of prioritized activities they believe they can complete within the duration of the sprint from the backlog. Each day during the sprint, the team gets together once per day—huddles in a scrum—to individually answer the following questions: 1) What have I completed since our last stand-up meeting?, 2) What do I plan to do between now and our next meeting?, and 3) Are there any

obstacles that will prevent me from completing my tasks? At the end of the sprint, the potentially deployable features are demonstrated to the product owner (the individual who manages the product backlog) and/or the client as well as other members of management.

2.3 Hybrid Project Management

Research has found that many firms are now using a combination of both agile and traditional methods for information systems projects and suggests that such an approach provides better support for both explorative and exploitive capabilities (Vinekar et al. 2006). Recent studies also suggest that structure and agility can complement each other when used together in hybrid form on the same project (Batra et al., 2010; Fernandez and Fernandez, 2008; Karlström and Runeson, 2005). Such findings are supported by innovation literature suggesting that a combination of both structure and chaos (both planning and emergence) may lead to the most innovative outcomes (in the context of product development) (Cunha and Gomes, 2003). While such a hybrid approach may introduce more overhead in regards to additional project documentation and planning, which typically is not the primary focus of agile methods (Karlström and Runeson, 2005), the benefits of a hybrid approach include: a focus on business value versus time and budget only (Hass, 2007), ability to customize the project management methodology to the problem at hand rather than applying a single method to all projects (Vinekar et al., 2006; Wysocki 2009), and higher software quality on complex projects (Beckett, 2008).

3. CAPSTONE COURSE ORGANIZATION AND TEACHING METHODS

3.1 Course Overview

The CIS capstone course described in this study was taken by CIS undergraduate students enrolled in a business school at a major university in the U.S. in the Fall and Spring of the 2011-2012 academic year in four sections (131 total students). All students enrolled in the capstone course had previously completed many CIS courses providing basic to advanced core knowledge in areas including: computer programming, system analysis and design, database concepts and design, and e-commerce concepts and design. The capstone course consolidated and expanded upon learning objectives from prior courses by applying a hybrid project management process, which combined the best practices of waterfall (traditional) methods and Scrum (agile) methods, to the required course project. While the CIS capstone course had always included some sort of real-world or prototype project, traditional project management methods had typically been taught and applied. The completely redesigned course sought to prepare students for a shift toward the middle ground of project management methodologies, while also bringing together and building upon learning objectives from the entire CIS curriculum.

The course was organized into three learning modules (each comprising about 5 weeks during the course of a typical, 16-week semester): 1) Project Management (using Wysocki, 2009), 2) the view from the CIO's office (use of select case studies to expose students to enterprise systems issues), and 3) an ERP simulation (exposure to a simulation enterprise system environment). The learning objectives in the course included: 1) Obtain an understanding of the tools, techniques, and methodologies used to analyze, design, and implement enterprise-level information systems, and 2) Demonstrate knowledge acquired throughout the CIS program (and this course) through the development of a prototype of an enterprise-level information system applied project. This paper focuses on the project management aspects of this capstone course and the work toward completion of the final deliverable for the applied project: a working prototype of a web-based or cloud-based information system for a local non-profit organization.

3.2 Redesign of the CIS Capstone Course

In the school's information systems curriculum, the CIS undergraduate capstone course is where students "put it all together" and apply concepts from their entire undergraduate curriculum to design, build, implement, and understand the role of IT in business today. The motivation for the pedagogical course redesign was based on the following points that are derived from existing literature on IS and business education:

- Provide a functionally integrative curriculum experience and deliver the capstone course within a specific experience-based business context (Abraham et al., 2006). In this sense, the goal is to draw together learning from all CIS core courses and allow students the opportunity to apply these concepts to a real-world business problem setting.
- Integration of IS and business environments where an outcome IS artifact solves a specific business problem (Carlsson et al., 2010). To do this, students must interact with the business setting, understand the specific needs within the context, and develop an IS solution to solve a problem.
- Design a solution using best-practice tools and methodologies, and apply technical capabilities to be able to build a working IT artifact (Bowden, 2004). For this to happen, students must be current in practice capabilities both technically and organizationally.
- Engage in agile practices based on iterative prototyping making use of management and user feedback for subsequent iterations (Schon, 1983). This challenges the students to engage in reflective learning through multiple learning cycles for the development of tacit knowledge.

We used these theoretical underpinnings to completely redesign the CIS capstone course using a number of pedagogical methods that were captured with the course syllabus all the way through final project presentations and deliverables. Specifically, the course was designed around a major applied team project where teams would design, develop, and install a working prototype of an enterprise system for a real industry client that had to address a real business problem of the client. Second, students learned current techniques of project management as outlined by the Project Management Institute (PMI) in the Project Management Body of Knowledge (PMBOK), and were expected to apply these techniques to their team project. Third, since no single methodology fits all situations, students learned and applied multiple project management

methodologies including traditional project management, agile project management, and a hybrid approach. Fourth, since many graduating students would later pursue an MBA to enhance their career options, students were expected to prepare and discuss graduate-level Harvard Business School cases on topics relevant for the management of projects similar to their applied project. Finally, students concluded the CIS program by participating in the ERPsim simulation game as developed at HEC Montreal to learn how enterprise systems integrate the functions of marketing, finance, accounting, and production operations.

3.3 Hybrid Project Management Approach

Deliverables for the final project (discussed further in the next section) were organized into three sprints. However, rather than follow the typical agile life cycle and have the students jump right into development in the first sprint (following the selection of tasks, stories, or activities from a "product backlog"), they were instead asked to use Sprint 1 to develop a traditional project plan and presentation (to be given at the end of the sprint). This change to the typical agile process was significant and represented a hybrid between the traditional and agile methodologies. The goal was to search for a potential solution while working their way through traditional project planning activities. The project planning deliverable would provide a strong foundation for the next two sprints.

Once the project plan and proposal were completed, we continued the use of a hybrid project management methodology in the following important ways: 1) The deliverables for scrum-based Sprints 2 and 3 were prototypes and proofs-of-concept rather than final deliverables of immediately deployable software, where the first prototype was supposed to represent the "critical path" of the final prototype, 2) The students developed their backlogs (prioritized lists of activities) themselves without direct involvement from the client (although the instructor and TA were available to act as client proxies), and 3) Scrum meetings were held twice per week in-class, rather than daily, and involved the instructor or TA meeting briefly with each team individually to answer the three questions often seen in Scrum: What did you do since last time? What are you going to do between now and the next time we meet? Are you having any problems you need help with?

We believe this approach was *realistic* given that the students were still learning to be information systems professionals and *helpful* given that we guided the students through the process with a helping hand. Specifically, developing the traditional project plan and proposal in Sprint 1 gave them time to brainstorm, but also required them to establish goals, objectives, success criteria, and initial requirements (with the stated understanding that the requirements would almost certainly change as time progressed). Keeping the client involved at arm's length (i.e. not involved in every aspect, with the instructors as proxies) gave the students access to information, but also did not bog the client down with an undue amount of work or requests. Focusing on prototypes, rather than immediately deployable software, gave the students room to explore and make mistakes with the understanding that their final prototype had to work (i.e. be as bug free as possible), be user-friendly (i.e. be as easy-to-use as possible), meet specific business goals and requirements, and could be deployable in the future. Additionally, students were asked to develop solutions that were targeted (aimed at solving a specific business problem), innovative (representative of new business strategies, new digital platforms, or new approaches), and professional (appropriate for the client's situation).

3.4 Course Organization and Delivery

After the initial introduction of the syllabus and structure of the course, the client representative for the project came to speak directly to the class to provide unique insights into the business strategy, mission, wants, and needs of the non-profit organization. The client representative concluded the presentation with an extensive question and answer session with the students, providing an opportunity for clarification and requirements gathering. The students were tasked with developing "targeted, innovative, and professional" prototypes of a portion of the web site (of their choice, subject to instructor approval), based on a cloud-based technology (e.g., developed with WaveMaker and deployed on Amazon's EC2 infrastructure) or built on top of an existing web-based content management system (e.g., WordPress, Joomla!, etc.). Students proposed their initial recommendations at the end of Sprint 1, the planning sprint, when student teams presented their concepts (prior to any development) and traditional project plan (consisting of five individual components explained in the next section). The client remained involved throughout the project and frequently responded to requests for more information via e-mail (through the instructors), but did not return to the class until the final presentations. Prior to initially proceeding with the project, however, and to reduce the risk of "jumping right in," students were guided through a series of project planning assignments, lectures, and activities.

The first learning module of the course was dedicated to project planning concepts and providing the student teams (3 to 5 members each) with the time needed to develop a concept and traditional project plan. The project management learning module was designed to expose students to both traditional (linear) and non-traditional (agile) project management processes. Lectures and class activities were based on Wysocki (2009) and learning outcomes included: 1) understanding of how project management methodologies differ, 2) experience with project planning and management, 3) knowledge of how project management methodologies impact system analysis and design, and 4) understanding of how risk and change management impact project management decision making processes. The first project management lecture provided an overview of the "project management landscape" and emphasized how the various project management methods are suitable to projects of specific types. For instance, traditional project management is often best applied when the goal and solution are clear (as specified by Wysocki, 2009). Agile project management is often best applied when the goal is clear, but the solution is not (e.g., I know where I want to go, but not how to get there). For the remainder of the project management learning module, a combination of lectures, group exercises, in-class activities, and homework assignments was used to demonstrate how linear and non-linear methodologies approached the execution of the five

main process groups: scoping, planning, launching, monitoring and controlling, and closing. While these lectures and in-class activities were on-going, students were also responsible to begin working on their applied projects, outlined in the following section.

3.5 Course Assignments and Deliverables

The following summarizes the assignments given to students associated with planning and completing their final prototypes. The applied project was divided into three, primary sprints: 1) Project plan and proposal, 2) Draft prototype consisting of the critical path of the proposed project, and 3) Development of a final prototype. Figure 1 provides a visual overview of the how the applied project was organized.

3.5.1 Prior to Sprint 1 (The Project Planning and Proposal Sprint): Prior to the beginning of Sprint 1, students were asked to create a team web site (using private Google Sites) to facilitate online collaboration between team members. The project plan and future sprint backlogs would be placed on the site and shared by all team members (and the instructors) throughout the semester. Each team was asked to develop an initial backlog (list of prioritized tasks) that would be required for creating the project proposal and plan in Sprint 1.

3.5.2 Sprint 1: Traditional Project Plan and Proposal: Sprint 1 required each student team to create a traditional project plan consisting of five components (one page each): the proposed project, the project goal, specific objectives, success criteria, and a final section dedicated to assumptions, risks, and obstacles. The RBS was formatted as a list of high level functional, non-function, global, and constraint requirements (expected to change as the course progressed). The WBS was a list of task and activities, directly related to the requirements, which would need to be completed to conclude the project (also expected to change as the project progressed). The BPD was a swimlane diagram illustrating some aspect of the "critical path" (the core process) of the project. Finally, the students were asked to represent either a technical or business process aspect of their project with a single UML diagram and many chose the UML activity diagram.

Sprint 1 culminated in a presentation given to the instructor and TA by each team (no other teams were present). Feedback was provided in-person and additional feedback was provided in the grading reports. Suggestions resulted in refinements to the project plans prior to the beginning of Sprint 2.

3.5.3 Prior to Sprint 2 (First Prototype—"Critical Path"): Before the kickoff of Sprint 2, in which the first prototype would be assembled and built, student teams were asked to create a backlog for all activities they could foresee requiring completion in Sprint 2. The backlogs were created on each team's private Google Site. We asked the students to keep their backlogs updated throughout the entire sprint. We also asked that the Sprint 2 backlog represent the "critical path" (the tasks representing the core, essential components)

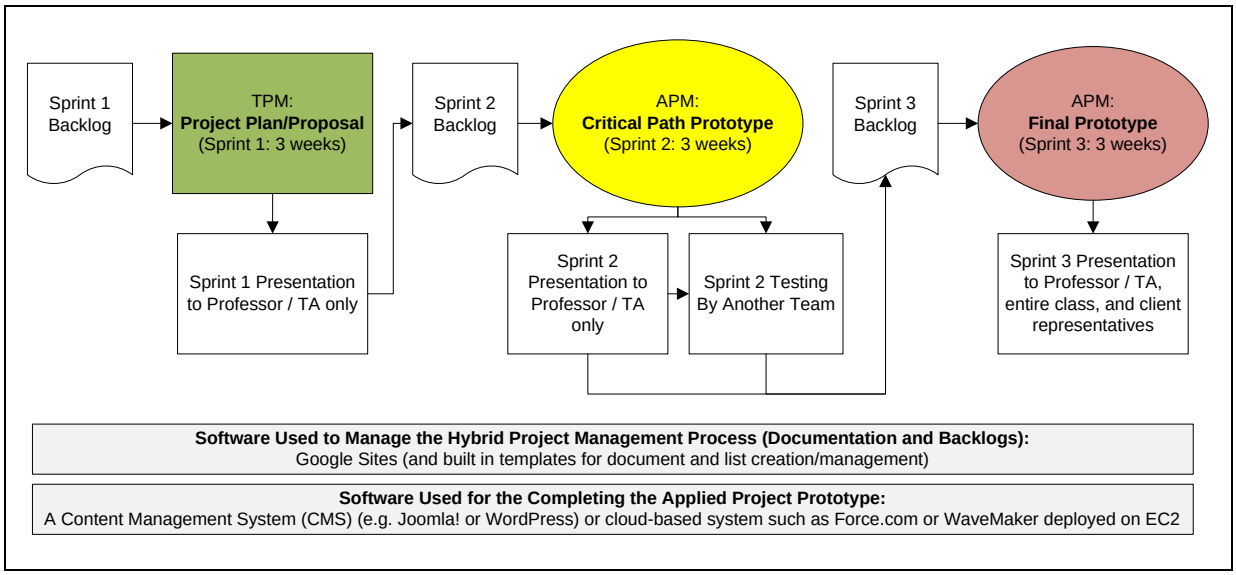

Figure 1: Applied Project Process, Schedule, and Deliverables

1) Project Overview Statement (POS), 2) Requirements Breakdown Structure (RBS), 3) Work Breakdown Structure (WBS), 4) Business Process Diagram (BPD) in swimlane format, and 5) a Unified Modeling Language (UML)[1] diagram of their choice applicable to their project context. The POS was based directly on the format recommended by Wysocki (2009, p. 94) and consisted of sections dedicated to outlining the business problem or opportunity addressed by of the project. The next sprint, Sprint 3, would be used for fixing bugs, adding additional features, and additional graphic design, but Sprint 2 activities needed to be focused on the most essential aspects of the prototype.

3.5.4 Sprint 2: Development of a Critical Path Prototype: The majority of the work for the development of the critical path prototype was conducted during Sprint 2. We suggested

that they develop the most comprehensive prototype possible during this sprint to avoid undue pressure at the end of the course. At the end of Sprint 2, student teams once again presented to the instructors (no other teams present). Feedback was provided in-person and on the grading reports. Suggestions for improvement (or change) were expected to be handled in Sprint 3.

3.5.5 Prior to Sprint 3 (Final, Full Featured Prototype): Between Sprints 2 and 3, black-box testing occurred. Each student team was assigned to test another team's prototype and write-up a one-page test report. Prior to testing, the team would read the other team's Project Overview Statement (POS) (see Appendix A) and reviewed their Sprint 2 backlog. Testing reports specified: 1) whether or not the prototype matched the goal and objectives specified in the POS, 2) whether or not the "requirements" (activities) had been completed, and 3) major bugs that had been found. After the completion of testing and trading of test reports between teams, the backlog for Sprint 3 was created. Student teams were asked to prioritize bug fixes, instructor suggestions, and requirements issues (identified by the test report) prior to the inclusion of activities for additional features.

3.5.6 Sprint 3: Development of the Final Prototype: Sprint 3 was also about three weeks in duration and focused on completing the items in the Sprint 3 backlog. The final prototype was presented at the end of Sprint 3 to the entire class and to the board members of the client.

4. STUDY DESIGN AND RESULTS

4.1 Study Design

To assess the students' perception of the value of using a hybrid project management methodology within the capstone course, we developed and administered a theoretically motivated student satisfaction and perception survey in two course sections at the end of the Fall 2011 semester and two course sections at the end of the Spring 2012 semester. Institutional Review Board (IRB) approval (as an exempt study) was obtained prior to administering the survey. Survey questions were based on theoretically-derived constructs (satisfaction and behavioral perceptions of innovations), critical success factors associated with traditional project management, traditional success factors associated with agile project management, and two additional questions developed by the authors.

4.2 Method

To assess the satisfaction and perceptions of the use of a hybrid project management methodology, we used the following methods: 1) descriptive statistics for each the sample (Table 1) and individual questions (reported in detail in Appendix A), 2) descriptive statistics and Cronbach's α (a measure of reliability) for composite scores associated with each construct (reported in Tables 2 and 3, correlations reported in Appendix C), and 3) a regression of satisfaction on the other composite scores (and control variables) to assess the most significant impacts on overall satisfaction (reported in Table 4). Additional "ordered probit" models, which do not assume a linear relationship between the independent variables and the dependent variable, were also run to verify the findings. Due to the insignificant differences between the ordered probit models and the linear regression models, linear regression results are reported in this paper.

4.3 Data Analysis and Results

41 students were registered for the two sections of the CIS Capstone course in the Fall of 2011 (11 students in the first section and 30 students in the second section) and 90 students for two sections of the same course offered in the Spring of 2012 (40 students in the first section and 50 students in the second section), for a total of 131 students. 113 students responded to the voluntary survey resulting in a response rate of 86.3%. Students received a small amount of extra credit for participating in the survey, but were offered an alternative form of extra credit if they decided not to participate in the survey. There was very little missing data (i.e. unanswered questions). The total missing data rate was 0.88%. Table 1 describes the demographics and characteristics of the sample. The research measures are fully described in Table 2. Composite scores and related descriptive statistics are reported in Table 3.

Characteristic	Qty	%
Gender		
Male	92	81.42%
Female	21	18.58%
Employment Status		
Full-time	15	13.27%
Part-time	62	54.87%
Do not work	36	31.86%
Student Status		
Full-time undergraduate	102	90.27%
Part-time undergraduate	11	9.73%
Previously taken or currently taking separate Project Management elective course[2]		
Yes	92	81.42%
No	21	18.58%
Age		
Mean	23.91	--
Std. Dev.	4.12	--
Min.	20	--
Max	43	--
131 students registered for the two sections of the CIS capstone course; 113 responded to the survey; 86.3% response rate		

Table 1: Sample Characteristics

Construct	Abbr.	Description	# of Items
General Theoretically-Based Constructs based on Satisfaction (Melone, 1990; Hayes, 1998) and Behavioral Innovation Constructs (Moore and Benbasat, 1991; Rogers, 2003)			
Satisfaction (with the use of the hybrid methodology).	SAT	The perceived satisfaction with using a combination of Tradition Project Planning and Agile / Scrum in the course.	4
Relative advantage	RA	The perceived advantage the respondent sees in using the hybrid method over other methods.	4
Compatibility (with preferred work style)	CPT	The perceived compatibility of the hybrid methodology with the current work style preferences (i.e. someone who already makes plans and then works adaptively may be more attracted to the hybrid approach).	3
Ease-of-use	EU	The perceived ease-of-use associated with learning and using the hybrid methodology.	3
Traditional Project Management (TPM) Constructs associated with Traditional Project Management Critical Success Factors (Pinto and Prescott, 1988)			
Project expectations	TPM_PE	Perceptions associated with the expectations for the final outcome of the project conveyed by the client and by the instructors.	4
Client presentation and information	TPM_CPI	Perceptions associated with the presentation and information given by the client at the beginning of the semester.	4
Planning process	TPM_PP	Perceptions associated with developing a traditional project plan prior to beginning the Agile process.	6
Agile Project Management (APM) Constructs associated with Agile Critical Success Factors (Chow and Cao, 2008)			
Technical	APM_Tech	Perceptions associated with Agile/Scrum delivery strategy and software engineering (e.g., simple design and refactoring).	7
People	APM_Ppl	Perceptions associated with the people involved in the project including: team member capabilities, management (instructors), and client involvement.	7
Process	APM_Proc	Perceptions associated with the Agile/Scrum processes (e.g., keeping track of progress and meeting regularly).	4
Additional Questions (created by the authors)			
(TPMOnly) I believe future offerings of this course should use TRADITIONAL PROJECT PLANNING / METHODS ONLY (*Agile / Scrum should not be used*).			1
(APMOnly) I believe future offerings of this course should use AGILE / SCRUM ONLY (*traditional project planning / methods should not be used*).			1

Table 2: Research Measures Used in the Student Satisfaction and Perception Survey

Composite	Obs	α	Mean	Std. Dev.	Min	Max
Satisfaction (SAT)	113	0.91	5.90	0.92	2.75	7.00
Relative Advantage (RA)	113	0.91	5.33	1.02	2.00	7.00
Compatibility (CPT)	113	0.93	5.48	1.29	1.00	7.00
Ease-of-Use (EU)	113	0.83	5.64	0.94	3.00	7.00
TPM Project Expectations (TPM_PE)	113	0.84	5.58	1.06	1.75	7.00
TPM Client Pres. and Info. (TPM_CPI)	113	0.90	5.47	1.19	1.75	7.00
TPM Planning Process (TPM_PP)	113	0.90	5.21	1.10	1.67	7.00
APM Technical (APM_Tech)	113	0.83	5.47	0.93	1.29	7.00
APM People (APM_Ppl)	113	0.82	5.47	0.98	3.00	7.00
APM Proj. Mgmt. Process (APM_Proc)	113	0.84	5.47	1.16	1.25	7.00
Composite scores calculated in Stata with the 'alpha' command and represent composite inter-item correlations for the each group of survey items.						

Table 3: Survey Results Descriptive Statistics (Including Composite Scores)

All items (questions) associated with each of the research measures were answered using a seven-point Likert scale ranging from 1-Strongly Disagree to 7-Strongly Agree.

A mean of 5 or above suggests that, on average, students at least "Somewhat Agree" with the statement. A mean of 3 or below suggests that, on average, students' perceptions range from "1-Strongly Disagree" to "3-Somewhat Disagree." A mean of 4 is a neutral response ("4-Neither Agree nor Disagree").

In summary, the majority of responses averaged 5 ("Somewhat Agree") or higher on all questions. The questions associated with using Traditional Project Management only and Agile Project Management only (rather than the hybrid approach) received the lowest mean scores (1.92 and 2.83, respectively). One question resulted in a mostly neutral average response: "I felt a strong commitment by the client to the project" (m=4.37), which suggests that client involvement could have been somewhat stronger. When asked, "I believe future offerings of this course should continue to use a combination of Traditional Project Planning and Agile / Scrum," the mean fell between 6-Agree and 7-Strongly Agree (m=6.05), which provides support for using the hybrid method.

Composite scores for each construct were calculated in Stata 11 using the 'alpha' command. The results are reported in Table 4. The reliabilities (alphas) were all 0.80 or above. All composite means were 5 ("Somewhat Agree") or higher. Correlations are available in Appendix C.

To assess the most significant impacts on overall satisfaction, we regressed the satisfaction composite on the other composites, the two additional questions asked by the authors (TPM Only and APM Only), and controlled for demographics and sample characteristics. The model explains 69.25% of the variation in the student satisfaction composite score associated with satisfaction with the use of a hybrid project management methodology within the course. The results are reported in Table 4.

The results suggest that the hybrid methodology was a valuable format for this sample. For the question regarding whether or not the use of only Traditional Project Management (TPM Only) would have been preferred, the responses did not have a significant impact on satisfaction. Interestingly, though, when respondents were asked if they would prefer the use of Agile only (APM Only), the results suggest a negative and significant effect on satisfaction, suggesting that the hybrid method was preferred over an Agile-only approach.

Among the composite variables, three had a significant impact and three had a marginally significant impact on satisfaction. Compatibility (CPT) and the TPM Planning Process (TPM_PP) had significant and positive impacts on satisfaction. Interestingly, the composite variable representing the Agile Project Management Process (APM_Proc) had a negative effect on satisfaction. This suggests that more could have been done to encourage regular meetings between team members and taking the time to update the sprint backlogs.

Variables	β	Std. Err.
Individual questions created by the authors for TPM Only and APM Only		
(TPM Only) I believe future offerings of this course should use TPM only	0.035	0.053
(APM Only) I believe future offerings of this course should use APM only	-0.083*	0.040
Composite Variables		
Relative Advantage (RA)	0.180+	0.094
Compatibility (CPT)	0.153*	0.069
Ease-of-Use (EU)	0.131+	0.068
TPM Project Expectations (TPM_PE)	0.116+	0.063
TPM Client Pres. and Info. (TPM_CPI)	0.096	0.060
TPM Planning Process (TPM_PP)	0.148*	0.074
APM Technical (APM_Tech)	0.119	0.094
APM People (APM_Ppl)	0.152	0.109
APM Proj. Mgmt. Process (APM_Proc)	-0.283**	0.084
Control variables		
Gender	-0.133	0.143
Age	0.000	0.014
Employment Status	-0.006	0.064
Student Status	0.014	0.196
Project Management Course (previous or current)	0.296*	0.145
Constant	1.748**	0.559

Composite score for Satisfaction (SAT) is the dependent variable; results reported from OLS estimation using linear regression; +p<.10 *p<.05 **p<.01 ***p<.001; R^2=69.25%

Table 4: Student Satisfaction and Perception Survey Composite Score Regression Results

Relative Advantage (RA), Ease of Use (EU), and TPM Project Expectations all had positive and marginally significant (p<0.10) impacts on satisfaction. This suggests that students perceived a positive relative advantage of the hybrid approach, perceived the method as easy to use, and perceived the project as having reasonable expectations. Demographic variables (control variables) did not significantly impact the results, but having previously taken a project management course positively impacted satisfaction. Implications of these results and the other results are discussed in the next section.

Finally, we also ran an 'ordered probit' model, which does not assume a linear relationship between the dependent and independent variables. The results were not significantly different than the regression results reported in Table 5 with the exception of the APM Only and Relative Advantage (RA) variables. In the ordered probit model, the APM Only coefficient was not significant and the RA coefficient was significant at p<0.05 instead of being

marginally ($p<0.10$) significant. Therefore, we report the results from the linear regression in Table 4 due to the more straightforward interpretation of the coefficients.

5. DISCUSSION AND CONCLUSION

This study described the teaching methods and survey results associated with our use of a hybrid project management methodology combining the best practices of waterfall (traditional) and Scrum (agile) in an undergraduate CIS Capstone course. Our primary finding is that satisfaction with the use of this hybrid methodology is high among our student respondents and that many theoretically motivated variables (e.g., compatibility, relative advantage, etc.) had significant impacts on satisfaction associated with the use of a hybrid methodology. We also find that our respondents do not believe that future offerings of the course should use only traditional methods or only agile methods. Secondarily, we find that overall satisfaction can be lowered if the client is perceived as having limited involvement and that efforts need to be made to ensure that student teams are meeting regularly and updating their sprint backlogs.

These results provide several valuable lessons and best practices for those who wish to use this approach in their own courses. While traditional project planning was useful to initiate a strong initial backlog and give the student teams a well-researched head start, it was not perceived as the ideal solution to solving future problems or overall project time savings. Therefore, traditional project planning should be used as a catalyst to get the project moving in the right direction and used to develop a strong backlog, but should not be expected to reduce unknown, potential bugs or shorten the duration of the project—especially when the students are still inexperienced and very new to many aspects of the project. Many student teams ran into unexpected issues in Sprint 2 and, while the agile methodology provided the flexibility needed to overcome these issues, getting involved in the project was an essential part of the discovery (and "fail forward") process.

It should also be noted that the clients only came to class twice: once at the beginning of the semester to give a presentation and answer questions, and once at the end of the semester to view the final presentations. While the instructor and TA acted as proxy clients, traded e-mails with the client, and conducted conference calls with the client (and reported back to the students, including providing answers to questions that had come up), the student perceptions associated with client involvement were somewhat low. Therefore, having the client show up more during the semester or answering a few questions directly (perhaps even through video conferencing) may improve this aspect of satisfaction. Additionally, such an approach may provide additional motivation for students to keep working on the project, especially for students who are graduating, due to the fact that motivation tends to attenuate as the semester progresses.

While not reported directly in the survey results, we should also mention that we found success with encouraging the student teams to perform the majority of the designing, developing, and coding work in Sprint 2. Motivation was high after spending time on the planning process. Most students just wanted to get going and tired quickly of performing the planning steps. After Sprint 2, though, motivation dropped off significantly as graduation was approaching. Therefore, encouraging students to create a strong plan followed by a strong development phase (Sprint 2) seemed to reduce stress and problems in the final sprint (Sprint 3). We did not have any complaints during Sprint 3 of not being able to get the project done on time or discovering significant problems that would result in delay. Such problems can often occur with traditional methods, especially when students procrastinate, but dividing the deliverables into three, separate segments significantly reduced the potential for such challenging issues to occur.

We also believe that our emphasis on developing a prototype contributed to overall satisfaction and success. Rather than asking students to develop a final, working product that would be deployed and used by the client immediately after the semester ended, we encouraged students to develop proof-of-concept prototypes. The prototypes had to be as bug-free and user-friendly as possible, but students were also given the flexibility to try new platforms, software packages, and cloud-based solutions with which they had limited experience. This approach resulted in more learning than may have occurred if we encouraged them to take the safest route possible. Additionally, it provided more variation in the final presentations (and more ideas) presented to the clients. Board members of the client were then free to pick-and-choose the best combination of features and platform(s) that would best serve their needs. Granted, they did not get a final, deployable complete solution in the end, but they were provided with a valuable base of information to use in their digital business planning decision making process that would have taken a significant and costly effort to obtain otherwise. In fact, the board members were very impressed with the capabilities of the web-based and cloud-based systems demonstrated by the students in the final presentations and commented on how professional the solutions had been. The board members went on to comment in private that they had been won over by how well the solutions had been directed at specific organizational needs and how the students had paid so much attention to solving specific business requirements. They commended them for their hard work, especially given that only a few members of the board had visited with the students on a limited basis to provide background, answer questions, and help establish requirements.

It is important to note that this approach is also unique because implementation of the final product was conducted outside of the classroom environment by the clients, after the students had demonstrated their prototypes. We initially explained to the clients (board members) that they would be receiving a wealth of information in trade for their time, however, they would not be receiving a fully deployable solution. Specifically, we told them that the students would be showing them the pros and cons of going with different platforms (e.g., Joomla! vs. WordPress and other cloud-based options) and, through the students efforts and brainstorming processes, the clients would be provided with new ideas on how to proceed that they may not have considered before (e.g., the inclusion of social networking in certain aspects of their digital business needs) as well as more detailed information regarding certain requirements

(e.g., how intensive of an effort might it be to create a "members-only" section containing secured content?). Overall, the clients were very satisfied with the approach and we attribute some of this satisfaction to setting initial expectations, which is an important aspect of an applied project focused on prototypes rather than deliverable solutions. Essentially, we were providing an opportunity for the clients to assess various risks (platforms, approaches, outside-of-the-box ideas, etc.) prior to full scale requirements gathering, development, and implementation, without the committing to the variety of risks associated with using students as professional developers. In the end, the board members commented how useful it was to have so many different ideas and possibilities demonstrated to them (and to have many requirements further solidified throughout the process), prior to conducting a larger scale development and implementation effort on their own.

In conclusion, we believe that this hybrid approach offers students a chance to use project management methodologies that are now becoming commonplace in the corporate environment while simultaneously improving the experience with completing a final, applied project in a capstone course. Such an approach provides a nice balance between rigid, traditional processes and flexible, agile processes. The comments we received on the course in the Senior Exit Interviews were very positive and it was mentioned that the project was a great bridge from the classroom to the real world of information systems projects. We suggest that CIS capstone course education and management methods should continue to evolve in such a way that gives students the knowledge necessary to compete and succeed in the ever-changing job market while providing them with an opportunity to learn, apply, and integrate these methods and overall CIS curriculum objectives within the classroom.

6. ACKNOWLEDGEMENTS

We would like to acknowledge Dr. Michael Goul, Professor and Chair, Department of Information Systems, W. P. Carey School of Business, Arizona State University, for his support of this research and teaching project. We would also like to thank the client representatives and board members who donated so much of their time and effort to make this project a success.

7. ENDNOTES

1: An anonymous reviewer suggested that the use of SysML requirement diagrams or FMC (Fundamental Modeling Concepts) as alternative or additional approaches to traditional requirements gathering and modeling. We appreciate the feedback and have included it here for others who may be interested in options beyond UML and/or traditional RBS/WBS approaches.

2: An elective, undergraduate course in Project Management was offered by our department. This elective course was not taught by the same professor who taught the course discussed in this study. The elective course focused on Traditional Project Management methods such as methods included in the Project Management Institute curriculum.

8. REFERENCES

Abraham, T. C., Beath, C., Bullen, C., Gallagher, K., Goles, T., Kaiser, K., and Simon, J. (2006) "IT Workforce Trends: Implications for IS Programs," Communications of the Association for Information Systems, Vol. 17, Article 50, pp. 1147–1170.

ANSI and PMI (2004) A Guide to the Project Management Body of Knowledge: PMBOK Guide, Project Management Institute, Inc.

Batra, D., Xia, W., VanderMeer, D., and Dutta, K. (2010) "Balancing Agile and Structured Development Approaches to Successfully Manage Large Distributed Software Projects: A Case Study from the Cruise Line Industry," Communications of the Association for Information Systems, Vol. 27, Article 21, pp. 379-394.

Beckett, R. (2008) "An Integrative Approach to Project Management in a Small Team Developing a Complex Product," Proceedings of the 2008 IEEE IEEM, pp. 1028-1032.

Bowden, J. A. (2004) "Capabilities-driven Curriculum Design," in Baille, C., and I. Moore (eds.). Effective Learning and Teaching in Engineering, New York: Routledge, pp. 36–47.

Carlsson, S. A., Hedman, J., and Steen, O. (2010) "Integrated Curriculum for a Bachelor of Science in Business Information Systems Design (BISD 2010)," Communications of the Association for Information Systems, Vol. 26, Article 24, pp. 525-546.

Chow, T. and Cao, D. B. (2008) "A Survey Study of Critical Success Factors in Agile Software Projects," Journal of Systems and Software, Vol. 81, No. 6, pp. 961-971.

Cunha, M. P. and Gomes, J. F. S. (2003) "Order and Disorder in Product Innovation Models," Creativity and Innovation Management, Vol. 12, No. 3, pp. 174-187.

Du, S. M., Johnson, R. D., and Keil, M. (2004) "Project Management Courses in IS Graduate Programs: What is being Taught?," Journal of Information Systems Education, Vol. 15, No. 2, pp. 181-188.

Dyba, T. and Dingsoyr, T. (2008) "Empirical Studies of Agile Software Development: A Systematic Review," Information and Software Technology, Vol. 50, No. 9-10, pp. 833-859.

Fernandez, D. J. and Fernandez, J. D. (2008) "Agile Project Management: Agilism Versus Traditional Approaches," Journal of Computer Information Systems, Vol. 49, No. 2, pp. 10-17.

Fowler, M. and Highsmith, J. (2001) "The Agile Manifesto," Software Development, Vol. 9, No. 8, pp. 28-35.

Glass, R. L. (2001) "Agile Versus Traditional: Make Love, Not War!," Cutter IT Journal, Vol. 14, No. 12, pp. 12-18.

Hass, K. B. (2007) "The Blending of Traditional and Agile Project Management," PM World Today, Vol. 9, No. 5, pp. 1-8.

Hayes, B. E. (1998) Measuring Customer Satisfaction: Survey Design, Use, and Statistical Analysis Methods, Milwaukee:ASQ Quality Press.

Jones, C. G. (2003) "Integrating Agile Development Methodologies into the Project Capstone–A Case Study," Information Systems Education Journal, Vol. 1, No. 18, pp. 1-12.

Karlström, D. and Runeson, P. (2005) "Combining Agile Methods with State-Gate Project Management," IEEE Software, Vol. 22, No. 3, pp. 43-49.

Krutchen, P. (2001) From Waterfall to Iterative Development–A Challenging Transition to Project Managers, Rational Edge, Rational Software.

Lee, G. and Xia, W. (2010) "Toward Agile: An Integrated Analysis of Quantitative and Qualitative Field Data," Management Information Systems Quarterly, Vol. 34, No. 1, pp. 87-114.

Lesko Jr, C. J. (2009) "Building a Framework for the Senior Capstone Experience in an Information Computer Technology Program," SIGITE '09 Proceedings of the 10th ACM conference on SIG-information technology education, pp. 245-251.

Lindvall, M., Basili, V., Boehm, B., Costa, P., Dangle, K., Shull, F., Tesoriero, R., Williams, L., and Zelkowitz, M. (2002) "Empirical Findings in Agile Methods," Extreme Programming and Agile Methods—XP/Agile Universe, LNCS 2418, pp. 197-207.

Melone, N. P. (1990) "A Theoretical Assessment of the User-Satisfaction Construct in Information Systems Research," Management Science, Vol. 36, No. 1, pp. 76-91.

Moore, G. C. and Benbasat, I. (1991) "Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation," Information Systems Research, Vol. 2, No. 3, pp. 173-191.

Murphy, T. E., J. Duggan, D. Norton, B. Prentice, D. C. Plummer, and S. Landry. (2010) "Predicts 2010: Agile and Cloud Impact Application Development Directions," *Gartner* (G00172203), December 3, 2009, pp. 1-10.

Nerur, S., Mahapatra, R., K., and Mangalaraj, G. (2005) "Challenges of Migrating to Agile Methodologies," Communications of the ACM, Vol. 48, No. 5, pp. 72-78.

Norton, D. (2008) "The Current State of Agile Method Adoption," Gartner (G00163591), December 12, 2008, pp. 1-4.

Pich, M. T., Loch, C. H., and De Meyer, A. (2002) "On Uncertainty, Ambiguity, and Complexity in Project Management," Management Science, Vol. 48, No. 8, pp. 1008-1023.

Pinto, J. K. and Prescott, J. E. (1988) "Variations in Critical Success Factors Over the Stages in the Project Life Cycle," Journal of Management, Vol. 14, No. 1, pp. 5-18.

Reinicke, B. and Janicki, T. (2011) "Real World Projects, Real World Problems: Capstones for External Clients," Information Systems Education Journal, Vol. 9, No. 3, pp. 23-27.

Rising, L. and Janoff, N. S. (2000) "The Scrum Software Development Process for Small Teams," IEEE Software, Vol. 17, No. 4, pp. 26-32.

Rogers, E. M. (2003) "Diffusion of Innovations, 5th Edition" Free Press, New York, N.Y.

Schön, D.A. (1983) The Reflective Practitioner: How Professionals Think in Action, New York: Basic Books.

Smith III, H., Smarkusky, D., and Corrigall, E. (2008) "Defining Projects to Integrate Evolving Team Fundamentals and Project Management Skills," Journal of Information Systems Education, Vol. 19, No. 1, pp. 99-110.

Tan, C. H., Tan, W. K., and Teo, H. H. (2010) "Designing an Information Systems Development Course to Incorporate Agility, Flexibility, and Adaptability," Communications of the Association for Information Systems, Vol. 26, No. 1, pp. 171-194.

Vinekar, V., Slinkman, C. W., and Nerur, S. (2006) "Can Agile and Traditional Systems Development Approaches Coexist? An Ambidextrous View," Information Systems Management, Vol. 23, No. 3, pp. 31-42.

Wysocki, R. K. (2009) Effective Project Management: Traditional, Adaptive, Extreme. Indianapolis:Wiley Publications.

Yue, K., De Silva, D., Kim, D., Aktepe, M., Nagle, S., Boerger, C., Jain, A., and Verma, S. (2009) "Building Real World Domain-Specific Social Network Websites as a Capstone Project," Journal of Information Systems Education, Vol. 20, No. 1, pp. 67-76.

Zwikael, O. and Globerson, S. (2006) "Benchmarking of Project Planning and Success in Selected Industries," Benchmarking: An International Journal, Vol. 13, No. 6, pp. 688-700.

AUTHOR BIOGRAPHIES

Aaron Baird received his Ph.D. in Information Systems from the W. P. Carey School of Business at Arizona State University. Before joining the Institute of Health Administration at the J. Mack Robinson College of Business at Georgia State University as an Assistant Professor, he was a board member at the Arizona Health Information and Management Systems Society (AZ HIMSS) and a software developer/architect/project manager for a variety of companies including Penton Media, the University of California San Diego, and Data Systems and Solutions (a joint venture between SAIC and Rolls-Royce).

Frederick J. Riggins is an Associate Professor of management information systems in the College of Business at North Dakota State University. His teaching interests include information technology management, electronic markets, data and telecommunications management, project management, and the economics of information systems. His research focuses on strategies for implementing interorganizational systems including RFID, new business models for Internet-based commerce, and the implications of the digital divide for managers and businesses. Dr. Riggins has published in many leading IS journals including *Management Science*, *Journal of Management Information Systems*, *Journal of the Association for Information Systems*, *Electronic Commerce Research and Applications*, and *Communications of the ACM*.

Appendix A:
Student Satisfaction and Perception Survey Results (Individual Questions)

Student Perception and Satisfaction Survey Results (Individual Questions)		
Question	**Mean**	**Std. Dev.**
Satisfaction (SAT)		
I enjoyed using a combination of Traditional Project Planning and Agile / Scrum in this course.	5.68	1.17
The combination of Traditional Project Planning and Agile / Scrum is a useful project management methodology in this course.	5.97	0.93
Overall, I am satisfied with the use of the combination of Traditional Project Planning and Agile / Scrum in this course.	5.91	1.01
I believe future offerings of this course should continue to use a combination of Traditional Project Planning and Agile / Scrum.	6.05	1.01
Questions Created by the Authors		
I believe future offerings of this course should use TRADITIONAL PROJECT PLANNING / METHODS ONLY (*Agile / Scrum should not be used*).	1.92	1.14
I believe future offerings of this course should use AGILE / SCRUM ONLY (*traditional project planning / methods should not be used*).	2.83	1.55
Relative Advantage (RA)		
Using the combination of Traditional Project Planning and Agile / Scrum enabled me to accomplish tasks more quickly.	5.20	1.19
Using the combination of Traditional Project Planning and Agile / Scrum improved the quality of my work.	5.14	1.14
Using the combination of Traditional Project Planning and Agile / Scrum made it easier to get my tasks done.	5.32	1.17
Overall, I find the use of the combination of Traditional Project Planning and Agile / Scrum to be advantageous.	5.67	1.08
Compatibility (CPT)		
I think that using the combination of Traditional Project Planning and Agile / Scrum fits well with the way I like to work.	5.54	1.35
Using the combination of Traditional Project Planning and Agile / Scrum fits into my work style.	5.46	1.37
Using the combination of Traditional Project Planning and Agile / Scrum is compatible with the way I like to complete projects.	5.43	1.39
Ease-of-Use (EU)		
Learning to use the combination of Traditional Project Planning and Agile / Scrum was easy for me.	5.65	1.14
Overall, I believe that the combination of Traditional Project Planning and Agile / Scrum is easy to use.	5.61	1.06
Using the combination of Traditional Project Planning and Agile / Scrum was clear and understandable.	5.66	1.07
Traditional Project Management: Project Expectations (TPM_PE)		
The project expectations were clear and understandable.	5.57	1.26
The project expectations were focused.	5.39	1.43
The project expectations were realistic.	5.75	1.14
The project expectations remained the same for the entire semester.	5.62	1.32
Traditional Project Management: Client Presentation and Information (TPM_CPI)		
The presentation by the client was helpful.	5.52	1.46
The presentation by the client gave me insights into his needs.	5.62	1.36

The information provided by the client was useful.	5.48	1.20
The information provided by the client helped us to complete our prototype.	5.27	1.38
Traditional Project Management: Planning Process (TPM_PP)		
Developing an initial, traditional project plan was useful.	5.46	1.29
Spending time up-front on the traditional product plan was worthwhile.	5.44	1.27
Our traditional project plan helped to keep my team focused.	5.20	1.32
The work spent developing a traditional project plan helped my team prevent potential problems.	5.01	1.32
Developing a traditional project plan before working on the prototype saved time in the long-run.	5.06	1.39
I expect to develop traditional project plans in the future.	5.07	1.44
Agile Project Management: Technical (APM_Tech)		
My team regularly delivered completed deliverables of the software.	5.42	1.40
My team delivered the most important deliverables of the software first.	5.32	1.38
My team pursued simple design.	5.52	1.19
My team re-factored (e.g., cleaned-up) our deliverable before completion.	5.65	1.16
My team documented our deliverables.	5.35	1.49
My team tested all deliverables before turning them in.	5.70	1.30
My team had appropriate training in Agile / Scrum.	5.30	1.32
Agile Project Management: People (APM_Ppl)		
My team members had high competence.	5.58	1.57
My team members were motivated.	5.21	1.66
My team was self-organizing.	5.47	1.57
My instructors were knowledgeable in Agile / Scrum	6.40	0.94
My instructors displayed an adaptive management style.	6.03	1.04
I felt that the class had a good relationship with the client.	5.23	1.41
I felt a strong commitment by the client to the project.	4.37	1.56
Agile Project Management: Process (APM_Proc)		
My team followed the Agile / Scrum project management process.	5.59	1.09
My team kept track of our progress.	5.55	1.28
My team had a good progress tracking mechanism.	5.27	1.56
My team met regularly (either in-person or online) to discuss progress.	5.45	1.66

All questions answered using a 7 point Likert scale ranging from 1-Strongly Disagree to 7-Strongly Agree; results from 113 responses out of 131 total students, 86.3% response rate

Appendix B:
Project Overview Statement (POS) Form and Grading Criteria

Form used for the Project Overview Statement (POS) based on Wysocki (2009):

Project Overview Statement		
Client Name:	**Team Number:**	**Team Members:**
Problem / Opportunity:		
Goal:		
Objectives:		
Success Criteria:		
Assumptions, Risks, Obstacles:		

Grading Criteria:

1. The entire form must be filled out (i.e. nothing left blank).
2. The writing must be clear, concise, and easily-understandable.
3. Ideally, the entire Project Overview Statement should not be longer than one page.
4. The *problem / opportunity* should identify a business problem (e.g., "The percentage of members who attend in-person and online events is low, less than 20%, and the client needs to increase member involvement"), not a solution (e.g., "They need a new web site").
5. The *goal statement* must be S.M.A.R.T. (Wysocki, 2009, pg. 97): Specific, Measurable, Assignable, Realistic, and Time-related.
6. Each *objective* should include (Wysocki, 2009, pg. 98): an outcome, a time frame, a measure, and an action.
7. The *success criteria* must demonstrate the measurable business value that will result.
8. The *assumptions, risks,* and *obstacles* should be drawn from the list of "influences that may inhibit project success" from the book (Wysocki, 2009, pg 101): technological, environmental, interpersonal, cultural, and causal relationships.

Appendix C:
Correlations

		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
A	**Satisfaction (SAT)**	1.00																
B	**Future offerings of this course should use TPM only**	-0.05	1.00															
C	**Future offerings of this course should use APM only**	-0.36*	0.42*	1.00														
D	**Relative Advantage (RA)**	0.69*	-0.09	-0.25*	1.00													
E	**Compatibility (CPT)**	0.65*	0.01	-0.27*	0.78*	1.00												
F	**Ease-of-Use (EU)**	0.52*	-0.06	-0.14	0.45*	0.43*	1.00											
G	**TPM Project Expectations (TPM_PE)**	0.50*	-0.13	-0.18	0.43*	0.36*	0.38*	1.00										
H	**TPM Client Pres. and Info. (TPM_CPI)**	0.45*	0.05	-0.10	0.36*	0.35*	0.31*	0.33*	1.00									
I	**TPM Planning Process (TPM_PP)**	0.60*	-0.02	-0.19*	0.61*	0.55*	0.43*	0.51*	0.44*	1.00								
J	**APM Technical (APM_Tech)**	0.37*	-0.00	-0.04	0.35*	0.34*	0.34*	0.45*	0.35*	0.43*	1.00							
K	**APM People (APM_Ppl)**	0.38*	0.06	-0.01	0.33*	0.37*	0.40*	0.35*	0.62*	0.50*	0.70*	1.00						
L	**APM Proj. Mgmt. Process (APM_Proc)**	0.19*	0.05	0.07	0.26*	0.32*	0.26*	0.36*	0.42*	0.47*	0.72*	0.77*	1.00					
M	**Gender (1=M, 2=F)**	-0.11	-0.07	0.04	-0.00	-0.04	-0.03	-0.05	0.12	0.01	0.08	0.13	0.20*	1.00				
N	**Age (mean=23.91)**	0.11	-0.06	-0.07	0.14	0.13	0.07	0.22*	0.05	0.10	0.14	0.08	0.20*	-0.01	1.00			
O	**Employment Status (1=PT, 2=FT, 3=Do not work)**	0.09	-0.06	-0.10	-0.06	-0.07	0.19*	0.08	0.05	0.20*	0.13	0.15	0.04	-0.00	-0.05	1.00		
P	**Student Status (1=FT, 2=PT)**	-0.06	-0.03	0.07	-0.05	-0.04	0.02	-0.03	0.05	0.11	-0.04	0.02	0.08	0.23*	0.22*	0.08	1.00	
Q	**Previously taken PM course? (0=No, 1=Yes)**	0.19*	-0.01	-0.02	0.09	0.06	0.03	0.09	0.07	0.05	0.19*	0.01	0.09	0.01	0.21*	0.10	-0.16	1.00

Composite and demographic variables are included in the correlation table; * $p<0.05$

STATEMENT OF PEER REVIEW INTEGRITY

All papers published in the Journal of Information Systems Education have undergone rigorous peer review. This includes an initial editor screening and double-blind refereeing by three or more expert referees.

ISSN 1055-3096