A PROPOSED TEACHING MODEL FOR A CAPSTONE CLASS IN THE IS CURRICULUM: A SURVEY ANALYSIS OF IS EDUCATORS AND IS PROFESSIONALS

Jack P. Russell, Northwestern State University, jrussell@nsula.edu
Barbara A. Russell, Northwestern State University, brussell@nsula.edu

ABSTRACT

The purpose of this paper is to provide IS educators with proposed course content and a strategy for teaching a capstone course in the IS curriculum that addresses both cognitive and affective learning experiences. To help architect the course content and sequence, a survey was administered to both IS educators and IS professionals. The results of IS professional's and IS educator's perceptions of key IS competencies are presented. The authors' understand the magnitude of difficulty in creating important linkages between the various courses within the IS curriculum to enable students to perform well during all phases of the systems development project. The authors believe that a required capstone course that addresses these linkages is critical to the success of an IS program. Course content for the capstone experience is founded largely on the IS 2002 Model Curriculum and Guidelines for Undergraduate Programs [2]. The capstone course objectives and course sequence are discussed. A statistical analysis is presented regarding some of the survey results from IS educators and professionals to help add relevance to the importance of this paper.

Keywords: IS Capstone Course, IS Skill Sets, IS Soft Skills, IS 2002 Model Curriculum for Undergraduates, IS Project, Teaming

INTRODUCTION

As IS educators, we are often challenged to understand important linkages between the various courses within the IS curriculum such that the curriculum is capable of producing not only a competent technical graduate, but one who also understands and is capable of performing within each phase of the systems development life cycle. The capstone course can be the bridge linking together the technical and soft skill aspects of the IS curriculum. If our IS graduates are going to be successful in their careers, then they must be able to communicate effectively both orally and in writing [3, 5]. While business schools have been probably the best at instilling teamwork skills, they have not been very successful at developing leadership skills or cultivating oral or written communication abilities [4, 5]. Therefore, the purpose of this paper is two-fold: 1) provide a teaching model based on a set of guiding assumptions and aligned with the 2002 Model Curriculum for Undergraduate Programs and 2) provide a statistical analysis of IS professional's and IS educator's perceptions of some of the behavioral objectives of the proposed course content. The authors are also interested in knowing if there is agreement between educators and IS professionals regarding various development paradigms.

GUIDING ASSUMPTIONS

The IS 2002 Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems [2] discusses guiding assumptions about the information systems profession. In conceptualizing the role of the IS profession, there are several elements that must be integrated into any IS curriculum. The elements include the following: 1) IS professionals must have a broad business and real world perspective; therefore IS graduates of IS programs must be enablers of successful performance; 2) IS professionals must have strong analytical and critical thinking skills; 3) IS professionals must exhibit strong ethical principles, possess strong interpersonal and written communication and teaming skills; 4) IS professionals must be able to plan, analyze, design and implement IT solutions; therefore, the IS graduate is expected to be able to model organizational processes and data, design and implement technical and process solutions.

The IS-2002-10 Project Management and Practice course includes learning experiences in managing the systems life cycle, requirements determination, design, implementation, system and database integration, project tracking, metrics, expectations of managers, clients, team members, cost benefit analysis, reporting and presentation techniques, team collaboration techniques and so forth. The IS 2002-10 course becomes the template for the formation of the proposed capstone course.

INTEGRATING BOTH SOFT SKILLS AND TECHNICAL SKILLS INTO THE INFORMATION SYSTEMS CAPSTONE CLASS

Integrating Soft Skills in the Capstone Experience

Industry recruiters continue to identify communication skills (both oral and written) as the number one determinant in hiring a candidate. Recruiters continue to indicate communication abilities, leadership and teaming traits as the most crucial in making hiring decisions [4]. Industry continues to observe that the student's ability to communicate, ability to cooperate, and ability to work in diverse environments are critical skills needed to perform successfully on mission critical IS projects [4]. Within the IS curriculum there does not seem to be a good fit for teaching soft skills, but the authors believe that it is of paramount importance to do a better job at teaching not only the technical skills but also teaching soft skills in the capstone course. The capstone experience should address a prospective IS graduate's ability to: 1) demonstrate effective interpersonal relations, 2) demonstrate self-management strategies, 3) demonstrate an ability to work within teams, 4) demonstrate an ability to solve problems (analytical skills), 5) demonstrate an ability to model business activities and data, and 5) make decisions. Essentially, these elements map to the underlying assumptions of the *IS Model Curriculum* previously discussed. The authors have developed the proposed capstone course that strives to teach, monitor and measure the affective learning outcomes described above.

Integrating Technical Skills in the Capstone Experience

Determining the technical skills for a capstone class is certainly not easy today with the rapid infusion of new technologies, methods, techniques, analysis and design software tools, development platforms and frameworks. The most significant of which is the movement toward objects for building information systems and the use of the Unified Modeling Language (UML). As IS development within organizations continues to move toward object-oriented analysis and design and the UML, a strong learning component is needed to address this important area [1]. On the other hand, survey results from this study also seem to point to the need to also teach structured methods as well, since much of the corporate documentation remains as ERDs, decomposition diagrams, data flow diagrams and structure charts. The authors believe, at least for the present, that the student must be able to perform in both development arenas.

BEHAVIORAL OBJECTIVES, CONTENT AND STRATEGIES

The behavioral objectives of the proposed capstone class are presented below. The general structure, content and strategies surrounding the course are included. A team-oriented and project-driven approach [4] is used. The proposed capstone course's syllabus, course outline, practice set of business modeling lab assignments and a semester project case can be found at http://users.nsula.edu/jrussell/. While the authors' students have learned both structured analysis and object-oriented analysis in the beginning systems analysis class, the authors believe it is also important to provide a review of both methodologies prior to starting the semester project.

Course Objectives:

1. Complete a business modeling review packet of assignments.
2. Participate as a team member or project leader in a semester project.
3. Participate in a "mock" data collection interview based on the semester project narrative.
4. Complete a feasibility analysis and report complete with payback analysis.
5. Complete the ERD for the semester project's business narrative using *Visible Analyst* (VA).
6. Complete a Class Diagram for the semester project's business narrative using VA.
7. Complete the Decomposition Diagram and Data Flow Diagrams using VA.
8. Complete a Use Case Diagram, a sequence diagram and state chart diagram using VA.
9. Compose and Present the Proposal to Perform Systems Design.
10. Design the business system. The deliverables will include: graphical user interface design, navigation design, database design and program design.
11. Program the sub-system from the design elements and test the sub-system.
12. Present the systems specification and demonstrate the sub-systems functionality.

Capstone Course Sequence

1. Team Leaders and Team Members are Chosen

Russell, Russell & Tastle [3] describe a method for choosing team leaders and team members. If the reader is interested in this method, it can be found at the primary author's web page at http://users.nsula.edu/jrussell/ .

2. Each Team Leader Receives a User Request

Once the teams are chosen, the teacher sends each team a user request statement that drives the semester project. Once the user request is received by each team, the project commences. The teacher establishes project milestone deadlines. Project team leaders study the project narrative and user request information for the purpose of preparing for a data gathering interview, creating a project work plan and determining project feasibility.

3. Team Members Prepare for a Data Collection Interview or Session

From this information each team prepares for a contrived interview involving two of the team members as analysts and the remaining member(s) role play the part of a manager or other identified user. The mock interview is performed in front of the class and is filmed. In some scenarios the teacher has one team role play a strategic level interview with top management, and another team will role play a tactical level interview with mid-management and staff. Students learn values and attitudes related to corporate strategy, competitive advantage and value added aspects of the proposed business system. The team as a whole and each individual team member's performance is measured using an interview evaluation instrument. This instrument measures student ability to introduce team members, proper professional attire, grooming, diction/enunciation, eye-contact, voice inflection, facial expressions, listening ability, knowledge of the subject, asking or answering closed-ended, open-ended and probing questions, ability to handle stress and the ability to avoid intimidating others.

4. Teams Present a Cost-Benefit Analysis and Project Work Plan to the Class

Subsequent to the interview the teams prepare for a strategic planning meeting. The teams do research on areas of the system to determine the level of process improvement or re-engineering that is required. From this analysis the team must estimate the potential cost-benefit to the organization. This is formulated into a cost-benefit analysis.

5. Students Write and Present a Project Proposal

The teacher provides a proposal outline and guidelines for the student to follow. The document may follow either MLA or APA rules. Students are evaluated in the following areas: 1) organization and writing ability, 2) adherence to an acceptable writing format, 3) adherence to proposal topic sequence, 4) paper coherence and transition, 5) illustrations and figures and the degree to which the illustrations and figures are clearly discussed, 6) ability to persuade, 7) factual content, and 8) convincing recommendation. The proposal will contain the following: 1) table of contents, 2) table of illustrations, 3) introduction, 4) problem and solution statement, 5) feasibility analysis, 6) work plan, 7) detailed requirements statement, 8) business model and 9) recommendations. A professional slide show is required that addresses the topics above. Dressed in business attire, the team presents a 15 to 20 minute proposal to the class. The presentation is filmed. The teacher evaluation is completed from viewing the film at a later time. The teacher prepares an evaluation sheet on each student.

The proposal presentation is measured by the following attributes: 1) quality of the slide presentation, 2) professional attire, 3) grooming, 4) diction/enunciation, 5) body language (eye contact, smile, voice inflection, facial expression, mannerisms and hand gestures), 6) knowledge of the subject, 7) organization and 8) an ability to convince. The teacher measures the student on each item using a Likert 5-point scale. The cognitive skills needed include a strong knowledge of either structured analysis or object-oriented analysis to create the appropriate business modeling diagrams. All diagrams must be prepared using a computer-aided systems engineering tool. To prepare students for the proposal the teacher presents lectures and discussions on the following: 1) how to dress for the presentation, 2) how to introduce within a group, 3) proper speaking habits – enunciation, articulation and voice inflection and 4) proper body language.

6. Students Write and Present a Systems Design Specification

Teams are required to deliver a design specification in both hard copy form and in presentation format including a slide show. The systems specification report must include the following: 1) executive summary, 2) graphical-user interface design, 3)

database design, 4) program design diagrams depending on the methodology followed, 5) test cases for designated modules, 6) a copy of source code, 7) various screen shots of key program functionality. Each team presents their systems specification and demonstrates their sub-system functionality to the class dressed in business attire.

VALIDATING THE CONCEPT OF THE CAPSTONE EXPERIENCE

The authors believe it is important to validate the general concept and philosophy surrounding the proposed capstone course based on the beliefs and attitudes of both the teachers who teach a similar course at their university or college and by IT professionals who are involved in building IT solutions for business. Two groups were surveyed: 1) IS educators and 2) IS/IT professionals. The survey instrument included statements requiring a Likert scale response from 1 to 5 where the value 5 indicated a very strong agreement with the statement and a value of 1 indicated a very strong disagreement with the statement. A cross-tabulated result of this survey can be found at http://users.nsula.edu/jrussell/ by clicking on 2006 Survey Results. The survey questions dealt with the degree to which respondents agreed or disagreed with a specific behavioral objective's relevance in the IS capstone course.

The reader may also find a document that equates various course objectives with respective survey questions. Not all objectives were converted into survey questions. The authors were also interested in knowing if IS professionals in general agreed or disagreed with the IS educators regarding the proposed IS capstone course; therefore, specific "agree/disagree" responses were required on some questions. The authors also wanted to know if both structured analysis and object-oriented analysis should be supported in the capstone course.

The research hypotheses tested in this study were

H_1: IS educators and IS professionals agree on the general content of the authors' proposed IS capstone course.

H_2: IS educators and IS professionals agree that both structured methods and object-oriented analysis methods be taught in the capstone course.

Testing the H_1 Null Hypothesis

To test the H_1 hypothesis, a t-test of independent groups was performed between the mean scores of IS educators versus IS Professionals. Figure 1 provides results of a t-test of the two group's mean scores to determine if there was general agreement or disagreement between the two group's perceptions of the content of the capstone course. There was a response mean of 3.971 for educators versus a 3.879 response mean for IS professionals. A p-value of 0.525 indicated that no significant difference exists in the means of the two groups. Therefore, the authors will retain H_1 and accept that both groups agree on the general content of the authors' proposed IS capstone course

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Two-sample t-test on MEAN_SCORE grouped by GROUP$
        Group          N         Mean           SD
            Educators 12        3.971        0.354
            IT LDRS   22        3.879        0.420
Difference in means       =        0.092
95.00% CI                 =       -0.187 to 0.371
t                         =        0.677
df                        =         26.3
p-value                   =        0.504

Difference in means       =        0.092
95.00% CI                 =       -0.199 to 0.383
t                         =        0.643
df                        =           32
p-value                   =        0.525
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Figure 1. Two-sample T-test of Independent Groups: Educators and IT Professionals

Testing the H_2 Null Hypothesis

The authors wanted to determine the level of agreement or disagreement between the IS educator and IS professional groups regarding the importance of 1) teaching both structured analysis and object-oriented analysis and design and 2) requiring students to only learn OOA concepts and UML. A χ^2 of the Difference Between Independent Proportions was calculated related to a forced choice response (agree or disagree) from the two groups. The two questions bulleted above, along with their respective χ^2 values are shown in Figures 2 -4. The first χ^2 calculation pertains to Question 40.

Question # 40:

> Do you agree or disagree that both structured methods and object-oriented analysis and UML be covered in a capstone class?

Figure 2 describes the 2X2 tables describing the survey responses for the question above.

	Frequency		Proportion	
	Agree	**Disagree**	**Agree**	**Disagree**
IS Educators	8	3	.73	.27
IS Professionals	20	1	.95	.05

Figure 2. 2X2 Chi Square Table Illustrating Frequency and Proportion of Agreement or Disagreement

The χ^2 for Question 40 is equal to 3.34. The calculated χ^2 of 3.34 falls short of the 3.84 proportion of the area in the tail of the distribution of χ^2 to be significant at the .05 level with one degree of freedom; therefore, since $3.34 < 3.84$, the H_2 hypothesis is retained that both IS educators and IS professionals agree that both object-oriented analysis and structured methods should be taught in the capstone class. Since the calculated χ^2 of 3.34 was almost significant at the .05 level, it is important to notice that there is a significant difference in the proportions at the .10 level.

Question # 38:

> Do you agree or disagree that only object-oriented analysis and UML be taught?

Since there was significance at the .10 level for Question 40, the authors still remained curious in learning why there was even this level of disagreement. This led the authors to want to know how the two groups agreed or disagreed with the concept of only teaching object-oriented analysis and UML instead of also teaching structured methods. Figure 3 reports on the results of this analysis. A Chi Square of Independent Proportions was performed. The calculated $\chi^2 = 0.36$. The χ^2 of 3.84 needed with one degree of freedom to be significant at the .05 level far exceeds the calculated χ^2 of only 0.36. The results support the idea that both IS educators and IS professionals definitely did not agree that only object-oriented analysis should be taught in a capstone class.

	Frequency		Proportion	
	Agree	**Disagree**	**Agree**	**Disagree**
IS Educators	2	9	.18	.82
IS Professionals	6	15	.29	.71

Figure 3. 2X2 Chi Square Table Illustrating Frequency and Proportion of Agreement or Disagreement for Q #38

CONCLUSION

In summary, both educators and industry professionals agreed with the proposed course content of the IS capstone course that supports the inclusion of both structured and object-oriented methods. With IS professionals and educators, with means of 3.97 and 3.88, respectively, from a maximum score of 5 manifests a strong agreement. Coupled with the small standard deviations of less than .4 the conclusion was easy to make that there was strong agreement. An examination was performed to determine if there were significant disagreements on individual test items. No significant disagreements among the test items were observed.

Moreover, educators and professionals showed support for soft skill learning outcomes that were addressed in the proposed capstone course. The two groups also agreed that both structured methods and object-oriented analysis and UML be taught in the capstone class; but, since the agreement between the groups was marginal, the authors plan to research this further. It was also interesting to note that both educators and professionals alike did not believe that only object-oriented methods should be taught. Since so many systems analysis textbooks are migrating toward OO and are tending to minimize structured analysis, the authors were interested in knowing if this trend is sound. The agreement between educators and professionals that both methods should be taught offers support to the over-all content of the proposed capstone course objectives. Based on the results, at least for now, the authors plan to continue teaching both methodologies in the capstone IS course.

Considering the magnitude of the mean scores on many of the questions related to the importance of various structured and OO concepts, the authors believe it is important to create learning outcomes that support both structured and object-oriented paradigms.

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