Survey Analysis of the Expectations and Outcomes of a Computing and Technology Interdisciplinary Capstone

A. Nettles, J. Livingston, K. Willett, A. Douglas (students), and M. Estep (faculty)
Department of Computing and Technology, Cameron University, Lawton, OK, USA

Abstract - *The Cameron University Computing and Technology Capstone course was an interdisciplinary project that allowed students to develop a real-world software application. Despite having been taught this way for years, a study had never been initiated that determined whether outcomes intended by students, teachers, and clients were being met. A student group in Cameron's Research Topics in IT course endeavored over the course of the spring 2016 semester project to propose such a study to conclude whether this class was achieving its goals for all parties affected. To accomplish this goal, the group utilized Google Forms software to compile two brief online surveys for Capstone students, which would be conducted at key points in the Capstone class. Once an adequate number of responses had been collected, the group compiled the results in order to analyze the outcomes.*

Keywords: Capstone, survey, case study, research, analysis

1 Introduction

The Computing and Technology interdisciplinary Capstone course was designed to meet the needs of students destined to make their mark in the technically challenged world by developing a real-world software application. Not only does this prepare students for future careers, but the integration of multiple disciplines provides an environment "for the challenges of any one computational domain by virtue of their exposure to multiple domains in which computational thinking plays prominent a role" [1]. Previous case studies were written by and conducted from the perspective of faculty members. Research Topics in IT, the compliment course to Capstone, was created as a way for students to conduct case studies on the Capstone experience from their own perspectives [2]. In an effort to assess the efficiency of this program for the first time this year, a study was now being initiated by students to determine whether the needs of students, teachers and clients were met. With combined team effort, periodic assessment, and a compiled analysis of results, a selection was made to determine the best viable product which could be used as a solution to meet the expected demands of a client.

1.1 Capstone overview

1.1.1 Structure

An authoritative explanation of the structure of the Capstone class is available in the paper: *Web-Based Database Project for the Lawton, OK Police Department: Interdisciplinary Systems Software Development at Cameron University* by Cameron faculty Smith, Zhao, Estep, and Johari [3]. The goal of the class was to complete a moderately sized software project that used software engineering principles to construct a web-accessible database program for a local business or government entity on a *pro bono* basis. This program could be completely original or based on an existing website, as was the case at one University of South Carolina Capstone course [4]. The class was structured as if it were a mock company with two teams competing to produce the product they hoped the client would use as their solution. Separate Multimedia (MM), Computer Information Systems (CIS), Computer Science (CS), and Information Assurance and Security (IAS) sections, each headed by a faculty member, existed for each respective discipline in the school of Computing and Technology.

When not needed for part of the Capstone, the students met after class to perform tasks deemed necessary by their respective professors. From time to time, especially after the end of the first half of the 16-week term, the individual sections met as a collective whole to work on the project. Each subsection, be it CS, CIS, etc., met at the beginning of the semester, and two leaders were selected by the faculty in charge of that section. Then through review of blind resumes, these leaders formed two separate teams. These teams were then further divided according to what the sub-team leader felt was appropriate and could be fluid during the semester project. The team leader selected at least one assistant leader who served as leader upon the main leader's absence and gathered reports from others as the main leader needed. The leader could also delegate other positions, such as being in charge of documentation, online research, or tracking teammates' PHP code contributions. Each of these sub-teams formed two super teams, each with a representative sub-team from the areas of CS, CIS, MM, and IAS. In addition to having a representative of each sub-team in each instance of the super team, there was also a chief leader of the super team from the CIS section who served as a mock boss of all the sub-team leaders and coordinated the teams' overall work. A

backup person was chosen by the faculty to compliment the chief leader in case of absence or other difficulties that could have prevented him from fulfilling his duties. Outside the command structure described above was a group from the English department that had helped the Capstone class over the last few iterations. This group consisted of one senior tech editor and two tech writers who assisted the super teams in reviewing documents and work sent between the super team and the client. Each super team was assigned one tech writer, but the senior tech editor position was not under the chain of command of either super team.

1.1.2 Time flow of product development

The class had a tentative structure timeline presented to each team member at the beginning of class on what was expected and when. The class began with the above described resume writing and readings as well as the dividing of the classes into sub-teams. Next to happen was the initial interview of the combined class of the client. During this meeting the students got to know exactly what the client wanted in the finished product. The professors left the exact questioning of the client to the students and were more than willing to let the students struggle with this part and fail to ask pertinent questions as part of the learning experience. The first eight weeks of the class were primarily the domain of the CIS sub-teams. They were responsible for setting up the backend database by designing first a plan for how entities in the database would be represented and later implementing said database. While the CIS team was designing the database, they held meetings with the heads of the CS and IAS teams to see if their plans were feasible.

Approximately eight weeks into the class, the teams held their first in progress report (IPR) for the client. This meeting served to reassure the client that work was indeed getting done on their project and allowed the client to provide feedback. This part was important because the client would not always know what was wanted, and the requested solution was not necessarily what was needed. After the first IPR, the project largely changed hands from the CIS team acting as the lead team to the CS team acting as the head team. The role of the CIS team did not end completely however because they were still needed to make changes to the SQL database as necessary. At this point in the class, the IAS team, through the use of penetration testing, analyzed the security mechanisms of the database and made change requests to he CIS team. Despite these other teams' involvement, the work in this second half was mostly the domain of the MM and CS team. The CS team began the arduous task of making a web interface using PHP code that would access the database previously completed that would try to meet three seemingly mutually exclusive goals: being feature complete, being user friendly, and being secure. The MM team at this point assisted the CS team by working on the aesthetics of the web pages constructed by the CS team and doing any graphic work for the web pages.

Approximately one month before the project was due in May, the super teams held a second IPR, this time headed by the CS team that presented the almost finished version of the project to the client. The client had the chance to point out anything that was miscommunicated to the team or any last minute wish list items for the team to add in time permitting. The end of the class was unique for many students because the university opened up the computer labs on one or two Saturday and Sundays for the team members who were able to come in and rush to meet deadlines. The class concluded by giving the client a final report, and students were required to dress in business formal attire and participate in group presentations to the client. After the presentation, the client was to choose between the two products developed by the competing super teams, but the client chose to merge the best features of each finished product into a third product. As Smith mentions, this practice provided internship opportunities for interested students to then work over the summer or fall semesters on the new final project [3].

2 Survey overview

2.1 Motivation

After reading relevant research papers on the subject, the group discovered that the approach they would be using was not unwarranted. Mitchell Jareo, in his paper Tool for Assessing Student Outcomes, asserts that universities have been unsuccessful in assessing "whether their students are exhibiting the outcomes they desire" [5]. He goes on to say how "Researchers have pointed out that course grades do not, in and of themselves, provide good measurements of student outcomes," [5]. He elaborates on this claim by mentioning that because the average computing class contains a writing component, individual programming assignments, projects, and exams that a student could do very poorly or fail on any one component of the class and still survive with an A or B final grade [5]. He mentions in particular the writing component is difficult to assess because all of the other grades can cover poor performance in that area up [5]. Therefore, Jareo points out that a survey mechanism like this is warranted just to be able to see if a student is indeed learning what the teacher, department, and university is intending students to learn in any given class [5]. Furthermore, the approach to conducting web based surveys is warranted because Jareo mentions in his paper that research shows that typical paper surveys have a return rate below 25% [5].

2.2 Questions

All questions in the survey were reviewed by each team member working on this paper and were deemed worthy of asking. In constructing the survey, the group tried to make a survey brief enough to appeal to students and retain their attention. This challenge of having questions meaningful enough to be worth asking was discussed by Jareo [5]. In consulting his research as a source, the group also made the

survey web-accessible to aid in administration, collection, and analysis of the surveys. After undergoing three revisions by the team members, the first survey was distributed to the faculty member in charge of the overall Capstone experience this year, Mr. Dave Smith. Upon pointing out his objections as well as possible redundancies of some questions, the survey was revised one last time before approval was given to distribute the surveys on February 17, 2016. After approval was given, they were given out on February 24.

3 First survey

The first survey results were collected on February 24, and after analyzing the participation, the group found that by February 29 there were 26 responses. The survey participants were asked if both their sub-teams and their overall team were on track at this point in the semester, which is approximately halfway done, and 100% of participants said that they felt that the project was indeed on track. Concerning the two questions that were about how realistic this class was and whether it was worth their time, only one response on each of these questions said the class was not worthwhile. The multimedia team in particular felt like they were underused in this project and that the project could get done just as easily with far fewer participants from that department.

3.1 Analysis

The first survey yielded meaningful data, giving the Research Topics in IT group the opportunity to make important observations

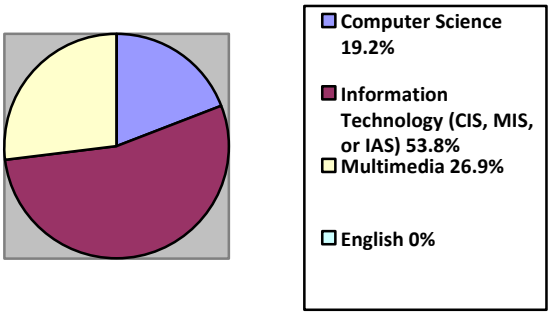

Figure 1

The chart shown in Figure 1 indicates the major concentrations of all participating students. Information Technology was the majority, and no English major participated.

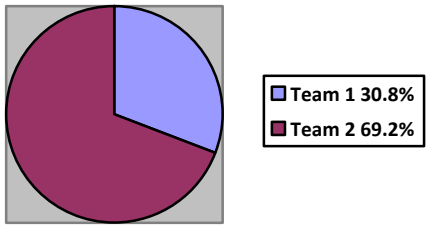

Figure 2

The chart shown in Figure 2 indicates the teams that participated in the survey. Of two teams, the majority of the students that participated were in team 2.

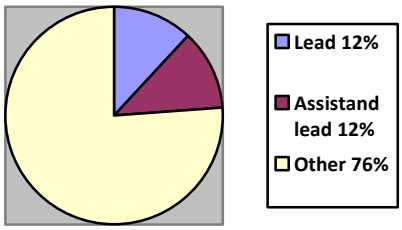

Figure 3

The chart shown in Figure 3 indicates the role each participant played in the project, for which the majority of students chose roles other than lead or assistant lead. It was vital consider the opinion of the students that were not in a lead role.

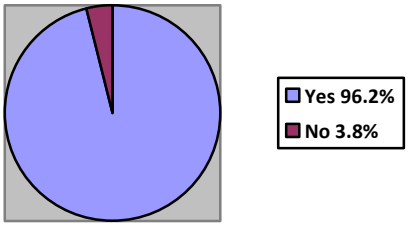

Figure 4

The chart shown in Figure 4 indicates the expectations of the project and whether or not it was valuable to the participants' major. One Multimedia student responded no and briefly explained that he believed multimedia students were not given enough tasks and that the part of the project they were working on was not benefiting them.

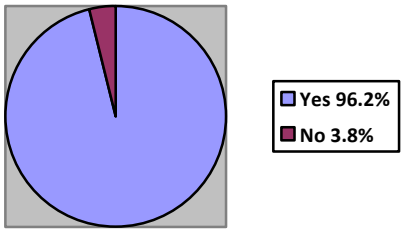

Figure 5

The chart shown in Figure 5 indicates the opinions of the participants on whether the Capstone course had been worth the time. All but one participant selected yes, who was the same student that selected no in Figure 4.

4 Second survey

The second survey results were collected on April 6, and after analyzing the participation, the group found that by April 13 there were 18 responses. The survey participants were asked if their sub-teams were on track at this point in the semester, which is nearly finished, and 94.1% of participants said that they felt that the sub-teams' project was indeed on track. Participants were also asked if the project teams were on track at this point, to which 70.6% responded that the project was on track.

4.1 Analysis

The second survey yielded important data for the research team to work with, including new information about the class's pacing and worthwhileness.

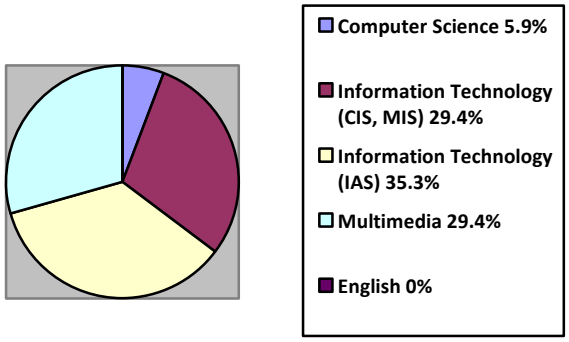

Figure 6

The chart in Figure 6 indicates the major concentration of all participating students. Information Technology (CIS, MIS), Information Technology (IAS), and Multimedia participants were the majority. Only one Computer Science major participated, and no English or other majors participated.

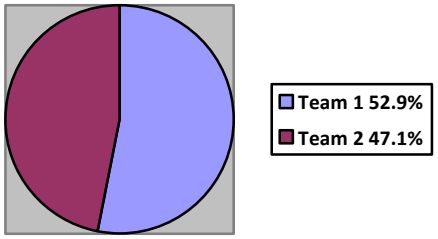

Figure 7

The chart in Figure 7 indicates the teams that participated in the survey. Team 1 had the most participants with a slight majority.

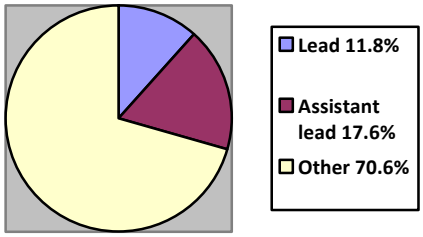

Figure 8

The chart in Figure 8 indicates the role each participant played in the project, for which the majority of students chose roles other than lead or assistant lead.

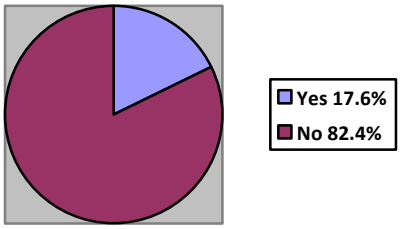

Figure 9

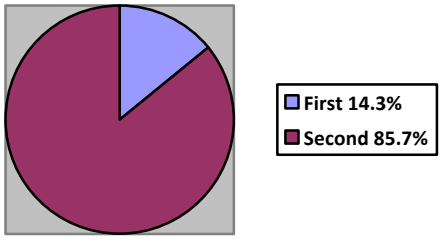

Figure 10

The charts in Figures 9 and 10 indicate students' opinions about the pacing of the class. Figure 9 shows students' responses to the question of whether the pacing between the first and second eight weeks was even. Three students felt that the pacing of the first and second eight weeks was approximately the same. As shown in Figure 10, 12 of the 14

students who thought the pacing was unequal said that the second eight weeks was faster-paced than the first.

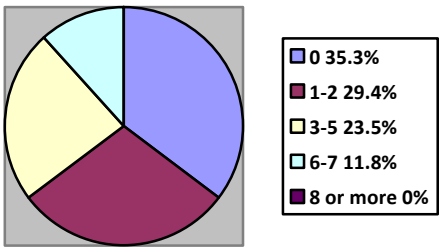

Figure 11

The data in figure 11 displays students' opinions about how many days the Capstone course was not worth their time. The most frequent answer was zero with six responses.

4.2 Changes made

Since the first survey, several questions were added, modified, or removed. In the question about what major the students had, the IT answer was split into one answer for IAS and one answer for CIS or MIS. A question asking what students are personally working on was removed. A question asking if the project was sufficiently complete in order to meet the next deadline was also removed. Three questions about the pacing of the class were added along with one question asking how many days the students felt that coming to class was not worth their time.

5 Analysis of results

Key findings extrapolated from the surveys are as follows: 1) most students felt that the Capstone course was worthwhile and beneficial to them, 2) Multimedia students did not feel that the class was worthwhile, 3) the majority of students (82%) felt that the course was unevenly paced and the faculty should address this issue, and 4) six people found at least three class meetings not worth their time. The group recommended the faculty remedy these issues by making every class a worthwhile learning experience for all students to attend.

6 Conclusion

This new initiative taken by the Cameron University Computing and Technology Capstone course was one that demanded coordination, cooperation, and team effort. Good leadership, delegation, coordination, and completion of tasks assigned, were all essential factors that determined the quality software application produced. The competitive nature of the study would certainly add volume, as teams were expected to work efficiently to get their final product pleasing to the client, thus chosen to be used as a solution to meet the needs of a business government entity. It was a hope that this study would aid in fulfilling the expectations of all concerned.

7 References

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