

# STUDENT PERSPECTIVES ON A REAL WORLD PROJECT

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## ABSTRACT

This paper reveals students' reaction to their work on an Assessment System for use by the Computer Science Department at Iona College. It describes their reactions to various aspects of the software project, both positive and negative and also describes feedback on their skills from some of their current employers.

## 1. THE SOFTWARE ENGINEERING PROJECT

At Iona College, both undergraduate and graduate students complete a two course capstone experience. The first course is dedicated to the design and analysis of a software project and the second to its implementation. This arrangement is typical of many Computer Science programs and shares both the successes and frustrations of other institutions. Among the primary goals of our capstone experience is to prepare our students to tackle the real world problems they will encounter in their future careers. Overall, the educational community has failed to meet the demands of the IT community, since in many programs, theoretical knowledge is stressed to the detriment of the skills required in the workforce (Varol & Bayrak, 2005). Typical project courses face numerous challenges. If the student knows that the software will never be used beyond the course, there is little incentive to produce a robust system, other than passing test data designed by the instructor. If the course material is of little interest, the motivation to excel is limited. Often, even if the student has the determination to succeed, they have other courses to complete and lack the time that a professional can dedicate to the project (Coppit & Haddox-Schatz, 2005). One way to face some of these challenges is to create a situation for “. . . students to understand the concepts and see themselves in their future role . . .[by] having a realistic customer with real expectations in a software engineering course.” (Tadayon, 2004, p. 133). At Iona, some real world problems have been used from time to time in the capstone experience. In 2002, we made the decision to embark on a more formal effort by engaging our qualified students in an Assessment System to be used by the Computer Science Department.

## 2. THE ASSESSMENT SYSTEM

The need for a viable assessment system has become a priority for colleges and universities throughout the world. Encouraged by their own institutions and external accrediting bodies, departments have been forced, sometimes reluctantly, to examine their program goals and objectives and to insure that each of their courses contributes to the fulfillment of these goals. The Computer Science Department at Iona College

has been actively engaged in such a process since 2002. In preparation for a visit by The Accreditation Board for Engineering and Technology (ABET) in 2004, the department developed a mission statement and specific goals and objectives drawn from that statement for its BS in Computer Science program.. The objectives and prerequisites of each course were examined and mapped to the program objectives. An Assessment Committee was formed to develop mechanisms by which we could ensure that we were meeting our program goals and thus verifying that we were delivering to our students the program that we claimed. The many stakeholders of the program had to provide input to this system: students, faculty, alumni, employers and an external advisory board. Since the ultimate goal of an assessment system is to identify and solve problems to improve the program, often referred to as “closing the loop,” obtaining results in a timely fashion is critical. It soon became apparent that to compile and analyze all the material in an efficient manner would be extremely difficult without an automated system (Poger, et al, 2005). One way to implement the system was by using our undergraduate and graduate students.

The use of this assessment system for our capstone students was motivated by several factors. Exit interviews with students revealed their desire to have experience with “real” problems as opposed to examples often found in textbooks. The Computer Science Department has an Advisory Board composed of faculty, alumni, IT professionals and representatives of other institutions of higher learning. Their evaluation of our program strongly recommended the incorporation of real world problems into the curriculum. In response to the need, the department decided to ask the first author, who is the instructor for the capstone courses, to use some of her students to implement an automated assessment system for the department. She agreed and worked on the initial design from the requirements set by the Assessment Committee. Since one of the goals of this project was to provide students with a real world experience, a project management team was formed consisting of the instructor as project manager, the department chair as user, and a third faculty member as database consultant and liaison with the Assessment Committee. A pilot group of four undergraduates and one graduate student was asked to volunteer to work on the design of the project. Not all students were viable candidates for the system. They had to be able to learn new technologies like JSP and to work independently. Only a limited number were chosen and agreed to participate. Students were formed into groups to more accurately represent a real world environment and to reinforce student’s interpersonal skills. The development of group skills is a key objective of the BS in Computer Science program as well as the capstone courses. Employers regularly cite these skills as essential for college graduates.

Students worked on the system design in the 2002-2003 academic year. From the database design they were to implement a relational database, create the system design, user interfaces and perform testing and system integration. Key functions of the system were to provide student evaluation of course prerequisites and course objectives, to allow graduating seniors to evaluate program objectives, and to permit faculty to evaluate course objectives. The system was web-based so that access to entering data and procuring statistical reports could be done from any computer with Internet access. System security was another key issue that required significant effort to implement. By the summer of 2003, students were ready to begin implementation of various modules. Although some students had graduated, others took their place. Implementation and testing continued and by Fall 2004 the system was ready for use by faculty and students (Poger, et al, 2005). As we received feedback from students

and faculty, modifications and improvements were designed and implemented. Students continue to maintain and extend the functionality of the system.

The benefits of the system to the department have been substantial. Assessment is a key element in the ABET accreditation process and the reports generated by the system were extremely useful in demonstrating our assessment process to the visiting team. Faculty input has been significantly improved so that the accomplishment of each course objective can be accurately tracked throughout each course. Anecdotal evidence indicated that students appeared to have benefited from their participation in the system but there was no formal empirical evidence of their reactions to this experience.

### 3. STUDENT REACTIONS

To evaluate student impressions of working on this assessment project, a survey was developed and administered to as many students as possible. Some students had graduated and we were unable to contact them. In all, thirteen students worked on the project but we were able to locate only nine students for the administration of the survey. Table 1 displays the results of the objective questions where students were asked to rate the degree to which they agree or disagree with a statement. The scale for the survey was: 4 = strongly agree, 3 = agree, 2 = disagree and 1 = strongly disagree.

**Table 1: Student Survey Objective Responses**

| <b>Statement</b>  | <b>Mean</b> | <b>Standard Dev</b> |
|---|-------------|---------------------|
| At the outset of each task, I received a clear description of what I was asked to accomplish.             | 2.3         | .82                 |
| I received helpful assistance when I ran into problems I could not handle.                                | 3.0         | .47                 |
| I took changes to the requirements in stride.   | 3.4         | .70                 |
| I was motivated to succeed because I was working on a project that would actually be used.                | 3.3         | .67                 |
| Working on the Assessment System challenged my analytical skills.   | 3.2         | .79                 |
| I found working with others a satisfying experience.  | 2.9         | .31                 |
| Given my choice, I would prefer to work alone rather than in a group.                                     | 2.9         | .93                 |
| I believe working on the Assessment Project improved my group skills.                                     | 2.9         | .93                 |
| The experience of working on the Assessment System was beneficial in my internship or full time position. | 2.8         | .90                 |
| I believe working on the Assessment System better prepared me for a career in software applications.      | 3.3         | .67                 |

The survey also contained several open ended questions to elicit more detailed responses from the students. Seven of the students reported that they had worked on group projects in other classes. Students reported little difference in their learning experience on the assessment project as compared to their work on other group projects. Coursework that appeared to be most beneficial were database and advanced database courses as well as software engineering and Java. Four of the students cited that what they liked best about the project was learning new technologies such as JSP, Java Script and Oracle. Two of the students responded working on a system that was actually used. When asked what they liked least about the project, students were not

shy about expressing their complaints. Seven of the students voiced concern on the organization and planning of the project. The tasks seemed confusing to many, especially since students were coming and going and they found it difficult to pick up code written by others. Although they enjoyed learning new technologies, they would have preferred more guidance and technical assistance. One student was unhappy working with students who were not motivated and another did not like to do documentation. When asked if they would recommend this project to others, seven students responded positively. They felt it was an excellent way to learn both the advantages and disadvantages of how a software project works in the business world as opposed to a classroom and being exposed to technologies that were not part of the regular curriculum was a definite plus. Two students felt that the project was too disorganized to provide any real benefit and would not recommend it to other students.

#### 4. EMPLOYER REACTIONS

Since several of the students had graduated and are currently employed in IT positions, we were able to locate five of the students' managers. We decided it would be beneficial to determine if their experience with the assessment project had any effect on their performance in a full time position. We developed a short survey to ask the employers how well these students were doing as compared to other college recruits. Four of the employers responded to the survey. Table 2 displays the results of the objective questions where employers were asked to rate the degree to which they agree or disagree with a statement. The scale for the survey was: 4 = strongly agree, 3 = agree, 2 = disagree and 1 = strongly disagree.

**Table 2: Employer Survey Objective Responses**

| Statement  | Mean | Standard Dev |
|--|------|--------------|
| The employee consistently applies analytical skills to design solutions to practical problems. | 3.5  | .50          |
| The employee exhibits excellent oral communication skills.                                     | 3.3  | .43          |
| The employee exhibits excellent written communication skills.                                  | 3.3  | .43          |
| The employee exhibits excellent interpersonal skills.  | 3.3  | .43          |
| The employee works well in a group.  | 3.8  | .43          |
| The employee is an asset in software development projects.                                     | 3.3  | .47          |
| The employee is on track for a successful career in computing.                                 | 3.8  | .43          |

When asked to make additional comments, employers were overwhelmingly pleased with our graduates, noting especially their positive attitude, initiative and problem solving skills.

#### 5. RESULTS ANALYSIS

Examining the results of the objective questions on the student survey, it was heartening to see that students were particularly motivated working on a real project for a real user, that the project challenged them to develop their analytical skills, and that they felt the project was good experience for their careers. It was somewhat surprising to find that their group skills were not especially enhanced and that many of them would prefer to work alone rather than in a group. Because students worked for

varying lengths of time on the project, it was not always possible to keep the same groups intact at all times. Some students found it difficult to adjust to change. In addition, perhaps the academic situation where group grades are often shared can be discouraging to good students, particularly when other students in the group do not contribute equally. However, they will quickly learn that in a business environment they have little choice but to work collegially with others, regardless of their ability and motivation. Lack of clear direction and assistance with problems was further exemplified in the open ended responses. Students who were involved with the project from the start might have sensed a lack of organization as new and adjusted requirements necessitated refinements in the problem analysis. In most classroom projects, the specifications are laid out at the start and are static. On the other hand, the design phase of a real world problem often necessitates several iterations before a working model can be developed. Even then, the design is prone to change at various stages in the software development cycle as users change their minds and add new requirements. Many students were excited to learn new technologies but this was also the source of many difficulties. In general, none of these technologies were part of the Computer Science curriculum, so essentially the students were learning on their own. Students are accustomed to learning new material in a classroom setting, so although they received guidance and assistance when difficulties arose, the burden of learning and problem solving on their own rested on their shoulders. Setting up the system was a challenge for our system support staff and there were many false starts and system crashes that set back the development of the project. Essentially these students witnessed the growing pains inherent in setting up a new system, particularly using technologies that had never been implemented in our environment. While these problems can be frustrating, they are not unusual and understanding the stress involved is part and parcel of the learning experience.

Feedback from the students' employers was extremely positive, with all employers responding agree or strongly agree to all the statements. It is most encouraging to note that managers gave students very high marks (3.8 out of 4) on their group skills and also believed students were headed toward a successful career in computing. We were particularly heartened by these results since a major program goal is to develop student skills necessary to excel in the workplace. Despite the fact that the numbers are very small and it is not possible to make any generalizations from these results, the uniform satisfaction of employers is very encouraging. Although it is impossible to isolate work on the assessment project as having a specific effect on the students' performance in the workplace, it is not unrealistic to conclude that this experience was at the very least a contributing factor to their current success. In their comments, employers consistently praised the students' ability to adapt to the business environment and contribute at an early stage in their employment.

## 6. CONCLUSION

The experiment of introducing a real world problem into the capstone experience for graduate and undergraduate students at Iona College has, for the most part, taught our students many valuable lessons. It introduced students to the somewhat unstable environment that occurs when a new system is designed and requirements shift until the user is satisfied with the plan. Students also learned that their best efforts often need to be discarded when the user is dissatisfied with the interface, functionality or both. New tools and technologies must be mastered "on the job" and they must become skilled at dealing with the frustrations of problems that appear to defy solution. They must learn to produce under pressure and accommodate to group members of varying abilities. Students reacted well to the rigors of the project and,

while not overwhelmingly positive, reported satisfaction with the experience. To overcome some of the student difficulties, it would be beneficial to apprise students in advance of the pitfalls they may encounter when working on a real world problem as opposed to a classroom exercise and to intervene more quickly to get them back on track before they become too discouraged. Another strategy that might be helpful would be to get the students involved at an earlier stage (perhaps in the first capstone course on software engineering) so they would have more time to become familiar with the system and learn the new technologies. Manager feedback indicates that we are on the right track by emphasizing critical thinking skills. We believe that the concept of using real world problems is crucial in preparing students for successful careers in software development and that we need to work hard to adapt this model into the academic environment to provide our students with the best possible experience.

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