Assessment Report*

Dept. of Computer Science, Plymouth State College

April 10, 2002

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*This report has been unanimously adopted by the Computer Science faculty on April 10, 2002.

1 Introduction and Self-Study Methodology

The Computer Science Department sponsors two computer-based Bachelor of Science degree programs. One is called *Applied Computer Science*, and is a traditional Computer Science degree modeled after the Association for Computing Machinery (ACM) and Institute of Electrical and Electronics Engineers (IEEE) societies' curricular standards from the years 1991 and 2001. The other Bachelor of Science degree program is called *Information Technology*, which provides students with a more industry-driven course of study. Students have hands-on experience with programming, networks, databases, creating multimedia applications, and administering systems.

We are engaging in a self-study in order to determine if curricular changes for either degree program are necessary, and if our campus-wide and departmental facilities, such as computer labs and library resources, are adequate.

Our self-study has two primary categories of input. One category is survey and the other is an inventory of course competencies for each course in the curriculum. The survey category consists of three separate survey instruments administered to exiting students, alumni, and employers of our graduates. The three surveys are entitled *Exit Survey*, *Alumni Survey*, and *Employer Survey*. The course competency inventory enumerates each competency associated with a particular course and describes how the competencies will be conveyed to the students and assessed. For our Applied Computer Science degree program these competencies will be matched with the knowledge units outlined in *Computing Curricula 2001*. The results of the surveys will be analyzed and discussed in this report.

2 The Surveys

As stated in the introduction, the purpose of this report is to communicate the assessment results from the three surveys administered by the Computer Science Department. Each

survey instrument has a separate audience. The *Exit Survey* is administered to graduating students, and is a graduation requirement. These surveys are anonymous. The Alumni and Employer surveys are voluntary, and names are requested so that we may make followed-up requests from individuals who have not yet responded.

The computer Science Department sent out 76 alumni surveys, including and employer survey to be given to their current employer. We received 18 alumni surveys and 6 employer surveys. A summary of the survey results are attached to this report.

The Computer Science Department attempted to strike a balance in the nature of the surveys by providing a set of statements to be rated on a five-point scale, which can be readily assessed, with more open-ended questions, which allow respondents to provide unanticipated feedback. Respondents are asked to respond to certain statements by rating their agreement/disagreement with the statement on a five-point scale, with *one* indicating strong agreement, *two* indicating agreement, *three* indicating no opinion, *four* indicating disagreement, and *five* indicating strong disagreement. In other questions they are asked more open-ended questions and for general suggestions.

As indicated in the introduction, the purpose of the surveys is to elicit feedback on the quality of our curricula, and to establish how we can better serve the interests of our students. As such, the nature of the questions are geared to specific aspects of this objective. These aspects can be characterized as follows:

1. Specific aspects of the curricula
2. General satisfaction with the curricula
3. General satisfaction with faculty
4. Availability of educational resources
5. Preparedness for the work force

The following analysis will be organized around the above survey sub-goals. Within each of the sub-goals results from all three surveys will be discussed when appropriate.

3 Analysis

The polarity of all questions consisting of statements eliciting reaction on a scale from one to five is positive to negative. In other words, when evaluating average responses a lower score is considered to be a better result than a higher score. Some responses were not deemed appropriate to include in a summary document. These responses can be found in the summary of raw data included at the end of this report.

3.1 Specific Aspects of the Curricula

The surveys are intended to meet the needs of both our Applied Computer Science degree program as well as our Information Technology degree program. Each program has distinct curricular goals, so in assessing graduating students' reaction to specific aspects of our curricula, a separate set of questions was drafted for each degree program. The exit survey was the only survey that explicitly addressed these differences between the curricula. Certain specific aspects of the curricula are shared and are discussed together.

3.1.1 Applied Computer Science (ACS)

Graduating students responded unanimously with either *agree strongly* or *agree* when asked to react to their understanding of the following subject areas. This suggests our enrolled students are satisfied with our instruction in these areas.

- theoretical foundations
- data structures and algorithms
- software design
- concepts of programming languages
- computer organization and architectures
- distributed systems (like client/server applications)

Of the above list, software design distinguished itself as particularly strong, probably as a result of its emphasis in at lest three courses in the ACS curriculum, Programming in Java, Client/Server Programming, and Software Engineering.

3.1.2 Information Technology (IT)

Graduating students in the IT degree program were somewhat more negative in reacting to the following elements in their curriculum.

- computer system security
- configuration and administration of a server
- databases

- networks
- systems analysis

The average response to all of the above subject areas is a *2.2* with the exception of the subject of *databases*, which had the average response of *2.7*. The response 2.2 suggests that for the most part students agreed that they gained an adequate understanding of an area to apply this knowledge, with one or two students disagreeing or showing ambivalence. The reaction to the databases subject area indicates a higher level of dissatisfaction, and merits additional scrutiny.

It should be noted that we have recently introduced a course in computer security in the IT curriculum. Revisions to the database course have also been made, and the networking course has been revamped.

3.1.3 Shared Curricular Issues (ACS and IT)

Graduating students in both degree programs are assessed according to their satisfaction with the following competencies:

- Problem solving ability
- Creating clear technical documents
- Ability to conduct clear presentations
- Ability to work in a team
- Understanding of professional ethics and related social issues

The average responses ranged from *1.6* to *1.8* suggesting a reasonably high-level of satisfaction. Creating technical documentation and conducting oral presentations both had average response of *1.8*. The IT students responded somewhat more negatively than the ACS students, suggesting attention to this area in the IT curriculum.

Alumni were also asked to react to their satisfaction in the above shared subject areas. Their average responses ranged from *1.7* to *2.3*. Problem solving ability and clear oral and written communication skills average *1.7* and *1.8* respectively, suggesting adequate levels of satisfaction. The ability to work as a team received a *1.9* average score, suggesting a bit more attention is merited, and understanding professional ethics with associated social issues fared the worst at an average of *2.3*. This subject area requires the most attention.

Employers of our graduates were also asked to respond to the above shared subject areas. Employers unanimously strongly agreed that students had the ability to solve problems

with technology. They were in very strong agreement, with a *1.2* average response that students could effectively create technical documentation, but they awarded an average score of only *2.2* to their employees ability to communicate orally. Employers as a whole were also satisfied with our graduates ability to work well in groups as well as understand issues of professional ethics and relevant technology and society issues with average scores of *1.7* and *1.3* respectively.

3.1.4 Relevant Narrative Comments and Suggestions

Graduating students suggested that additional exposure to programming with C++ would be useful, and that the database course should include more exposure to SQL and Oracle syntax. One student requested a computer animation course. One student felt unprepared for the *Programming in Java* course, and suggested that the *Foundations in Computer Science* course include more programming concepts.

Alumni mentioned a number of computer courses that included discussion of ethics. Most of these courses were either electives or part of the IT curriculum. The only course mentioned that is required by ACS students is *Foundations of Computer Science*.

Two employers suggested that our students need more practice with public speaking.

3.1.5 Suggested Course of Action

The entire IT curriculum merits some review with special attention given to the topics included in the database course, ensuring significant emphasis on SQL. Both IT and ACS students should be given more opportunities for oral presentations, with instruction addressing how effective presentations are conducted. Our alumni were somewhat dissatisfied with their understanding of issues of professional ethics and associated social concerns. This suggests that relevant content should be brought out in appropriate courses with explicit assessment elements. A course devoted to professional ethics and how technology impacts society may also be considered.

3.2 General Satisfaction with the Curricula

Graduating students seemed satisfied with the depth and breadth of their curricula, by responding with an average score of *1.8* in both cases. Students felt much less grounded in mathematical foundations, by awarding an average score of *2.8*. This average is primarily due to a high representation of respondents in the IT curriculum, which requires significantly fewer math courses than the ACS major. When segregated out, the ACS students had an average *1.5* response. Thus, the IT students are quite ambivalent about their math

preparation. Students responded with an average of *1.9* to their liberal arts preparation, and an average of *1.5* to their team-work opportunities, suggesting a curricular strength. Students responded with an average score of *2.1* in response to whether they had been exposed to a variety of programming languages and systems, suggesting a weakness. Finally, students felt strongly with an average score of *1.3* that they could adapt to new technology independently.

Alumni were asked if they were exposed to a number of programming languages and operating systems, responding on average *1.8* and *1.3* respectively. They were asked if this exposure was sufficient to obtain an entry-level position, to which they agreed with the average score of *1.7*. Alumni were asked if they have been able to adapt to new technology independently, to which they strongly agreed with the average response of *1.1*. Finally, on a related matter, alumni were asked if their education in the Computer Science Department provided them with a general understanding of the discipline to be helpful at their place of employment to which they agreed with an average score of *1.7*.

Employers were asked if their employees who graduated from one of our programs have a general understanding of their discipline to be useful at their work place to which they strongly agreed with an average response of *1.2*. Employers were also asked if our former students are able to adapt to new technologies to which they agreed with an average response of *1.7*. Finally, they were asked if they are generally satisfied with our graduates' work performance to which they strongly agreed with an average score of *1.2*

3.2.1 Relevant Narrative Comments and Suggestions

Our graduates suggested that additional exposure to C++ would better prepare them for the work force.

Five (six) of our alumni suggested that we incorporate either the programming language C or C++ into the curriculum. Two alumni suggested that we offer programming experience in Java (C++ was the instructional language before our department selected Java as its instructional programming language.) Two alumni suggested that we emphasize project management (addressed in Software Engineering, which is in the ACS curriculum only). MS Windows programming experience and device driver programming experience were both requested, along with web-page design and exposure to scripting languages. Two alumni suggested more hand-on experience in classes, and another asked for a course in network security and a basic CISCO course. Finally, one person suggested that we emphasize program documentation and design more.

One employer suggested that our students need more work with project management.

3.2.2 Suggested Course of Action

The IT curriculum should be reviewed to determine if additional or alternate mathematics courses should be required. Also, both curricula should be reviewed to determine if additional programming languages, especially C or C++ can be incorporated into them. It may be appropriate to strengthen treatment of project management in *Software Engineering* for ACS majors and to ensure that IT students are exposed to project management and system documentation in *Systems Analysis*. Web-page design and scripting language programming will be available to students as electives with our new *Web Studies* minor.

3.3 General Satisfaction with Faculty

When our graduating students were asked if they felt that the Computer Science faculty were serious and knowledgeable, they agreed with an average score of *1.7*. They felt that the faculty set high standards and present rigorous and demanding classes with an average score of *1.8*. The students strongly agreed that the faculty challenged them and had them take responsibility for their own learning (*1.4*), and were available to answer questions (*1.7*). When asked if they had received sound academic advising, they were more ambivalent, responding with an average score of *2.3*.

3.3.1 Suggested Course of Action

Review advising materials and procedures in the department.

3.4 Availability of Educational Resources

Graduating students were generally ambivalent when asked to react to the statement that classes were well planned to accommodate their speedy graduation with an average response of *2.6*. They were somewhat less ambivalent when reacting to the statement that classrooms are well equipped (*2.2*). They were in agreement when asked if the computer labs were well equipped (*1.4*). Students were most ambivalent regarding resources provided by the library (*2.8*), which may be a result of students not being required to use the library sufficiently. Students were in strong agreement that the administrative staff of the Department were helpful and patient (*1.5*).

3.4.1 Suggested Course of Action

Review schedule planning process to ensure that students' course needs are met. Scheduling will always be constrained to some extent due to the size of our available faculty. All our classrooms have ceiling mounted projectors, so it is not clear in what way classrooms may be ill-equipped. Finally, ensure that students have adequate exposure to the library by requiring them to use library resources for certain research projects.

3.5 Preparedness for the Work force

Seventy percent of our graduating students indicated that they felt prepared to enter the job market. This response correlated completely with one exception with the response to whether students had engaged in an internship or not. In other words, with one exception, those that had had an internship felt prepared for the job market, while those that had not had such an experience did not feel adequately prepared. Finally, only two of our graduating students had had a job interview prior to graduation.

3.5.1 Relevant Narrative Comments and Suggestions

Two of our graduating students requested more help on getting internships and jobs.

3.5.2 Suggested Course of Action

Clearly internships are a wonderful means to ready our students for the work force, and 64% of our graduating students have engaged in an internship. We can perhaps attempt to encourage more students to pursue internships. The fact that only two of our graduating students had gone on job interviews seems like an alarmingly small number. Perhaps we can coach students on interviewing skills and encourage them to seek out interviews *before* graduation.

4 Conclusion

From the survey responses students appear pleased with their education in the Computer Science Department. However, there are a number of issues that merit attention, including the fact that IT students seem somewhat less satisfied with their courses-work than ACS students. It should be noted that efforts have already been made to make certain courses in the IT curriculum more hands-on, such as the networking course. Presumably future

graduates will reflect a higher level of satisfaction. Particularly close attention should be paid to the database course. Also, the topic of professional ethics needs to be more soundly represented in the course work, especially in the ACS curriculum. Based primarily on alumni feedback, introducing a course on the programming language, C or C++, seems appropriate to better prepare our students for the work force. It also appears that students feel much better prepared for the work force when they have engaged in an internship. We can perhaps incorporate job preparation skills in one or more of our senior-level courses and encourage more internships.

Students also responded favorably in their perception of computer science faculty and staff and other educational resources. Care in scheduling courses and advising students to expedite their graduation should be taken.

The following list summarizes the recommended points for action.

1. Review the IT curriculum, including mathematics requirements.
2. Review course content and objectives for the database course.
3. Review treatment of project management in the ACS and IT curricula.
4. Ensure that professional ethics and social responsibility are adequately reflected in both the ACS and IT curricula.
5. Introduce a course on the programming language C and/or C++ in both the ACS and IT curricula.
6. Encourage students to engage in an internship.
7. Find an opportunity to coach students on interview skills, encouraging them to interview before graduation.
8. Review course scheduling to determine if students can graduate in a more timely manner.