



Assessment of Program Effectiveness – Student Learning Outcomes

Year: 2006 – 2007 Academic Year

Department: Computer and Mathematical Sciences

Degree Program: Computer Science

Learning Outcome Goal: Fundamentals of Computer Programming

Graduates will master the fundamental concepts of computer programming, including data models and abstraction, control structures, symbolic logic, algorithmic thinking and testing and debugging with various computing environments.

Assessment Procedure:

The following courses which are part of the core CS requirement were designed to achieve this learning outcome: CS I (CS1410), CS II (CS 2310), Data Structures (CS 3304) and Discrete Mathematics (MATH 2305). First, the Computer Science Program Committee has identified a set of learning outcomes for each of these courses. Starting Spring/Fall 2007, questions in the final exams for CSI, CSII, and Discrete Mathematics were specifically designed to evaluate each of the learning outcomes identified for those courses. (We plan to apply this same assessment procedure to Data Structures (CS3304) beginning Spring 2008). For each course, our assessment procedure is as follows: (1) we map each question in the course's final exam back to one of the course's learning outcomes, (2) we average the total points awarded for each learning outcome (among the students who took the exam), and (3) we compute the "*mastery rate*" for each learning outcome by dividing the average points awarded for that learning outcome by the total points available to it. For the Discrete Math, in addition to the *mastery rate* of all students who took the exam, we also computed the *mastery rate* achieved by only students who passed the course (i.e. received a C or better grade).

The average *mastery rate* of a particular learning goal is in essence the average score attained by students in that goal. Since 70% is considered to be the C passing average in all of these courses, we consider 70% mastery rate for each individual learning goal to be the acceptable rate.

We also compute the *completion rate* for each course as the percentage of paid enrollments who took the final exam. The *completion rate* is important because students who enroll in a course but dropout before taking the final exam tend to be students who performed poorly in other evaluation aspects of the course such the midterms and projects.

The Computer Science Program Committee is responsible for conducting this assessment. Course instructors design the final exam questions and map exam questions to the course's learning goals. Course instructors also grade the final exams and send detailed exam scores to the Computer Science Program Committee. For Spring and Fall 2007 assessment, three faculty from the Computer Science Program Committee collected the data and computed the assessment measures discussed above for each course.

Assessment Results:

The following tables list the *mastery rate* of the learning outcome for CSI (CS1410) and CS II (CS2310) during Spring 2007, and for Discrete Mathematics during Fall 2007.

Table 1: Assessment Results for CSI

% Mastery of CSI Learning Outcomes	
Learning Outcomes	% Mastery Rate
1. Data models	65.7
2. Program execution	68.9
3. Control structures	69.7
4. Algorithmic thinking	63.6
5. Functional decomposition	81.1
6. Testing and debugging.	87.9
Overall Mean Mastery Rate	70.8
<i>Course Completion Rate</i>	<i>81%</i>

Table 2: Assessment Results for CSII

% Mastery of CSII Learning Outcomes	
Learning Outcomes	% Mastery Rate
1. Data models	70.7
2. Algorithmic Thinking	77.0
3. Object-oriented design	65.6
4. Dynamic data types	69.6
5. Recursion	53.9
6. GUI programming	60.3
7. Exception handling	No data
Overall Mean Mastery Rate	64.7
<i>Course Completion Rate</i>	<i>61%</i>

Table 3: Assessment Results for Discrete Mathematics

% Mastery of Discrete Math Learning Outcomes		
Learning Outcomes	% Mastery	% Mastery for C or Better Students
1. Logic	74	84
2. Proof	56	78
3. Set Theory	83	90
4. Functions	53	76
5. Number Theory	65	77
6. Sequences & Summation	69	92
7. Induction	69	92
8. Counting	65	80
9. Graph Theory	73	84
Overall Mean Mastery Rate	67	84

Based on these data we make the following observations:

- (1) The overall mean mastery rate for CSI was 70.4% which is acceptable (see Table 1). However, the mastery rate for two learning outcomes, Data Models and Algorithmic Thinking are considerably lower than the acceptable rate.
- (2) The overall mean mastery rate for all learning outcomes of CSII is significantly lower than the acceptable rate (64.7%). See Table 2.
- (3) The mastery rates for three extremely important leaning outcome of CSII, namely Object-Oriented design, GUI programming, and Recursion were significantly lower than the acceptable rate (see Table 2).
- (4) There was not sufficient time to cover Exception Handling, another important learning outcome of CSII (see Table 2).
- (5) The course *completion rates* for CSII classes were substantially lower than those for CSI classes.
- (6) For Discrete Mathematics the *mastery rate* was significantly below the acceptable rate for four learning outcomes (Proofs, Functions, Number Theory, and Counting) and either close or above the acceptable rate for the remain five learning outcomes (see Table 3).
- (7) For Discrete Mathematics all the course's learning outcomes were met by students who passed the course with a C or better. For those students the mastery rates were significantly above the acceptable rate for most learning outcomes (see Table 3).

Use of Results:

(1) Based on the observations of our assessment (see 2, 3, 4, and 5 of the section above), the Computer Science Program Committee recommended increasing the number of contact hours for CSII (CS2310) from 3 to 4 hours. The additional contact hour will provide students a better opportunity to gain more hands-on experience with object-oriented design, GUI programming, and recursion. It will also provide the additional class time needed to cover Exception Handling, which is currently not covered at all. This proposal was submitted to the University Curriculum Committee in Spring 2008.

Aside from the above action, the Computer Science Program Committee did not make any further recommendations as the results obtained represent the assessment of a single year only. These data will be combined with future assessment data and if certain patterns are identified to hold from semester to semester, the program committee will make the appropriate recommendations. The Computer Science Program Committee plans to assess this learning outcome goal again in Fall 2008.

Meeting Notes

The Computer Science Program Committee held several meetings during which assessment of the CS degree program was discussed. Those meetings were held on the following dates: November 1, 2006, February 2, 2007, and November 8, 2007, and February 15, 2008