

Learning Outcomes and Assessment Plan

1. Introduction

This document describes the learning outcomes for the undergraduate program in computer science and an assessment plan to evaluate these outcomes. The primary purpose of the assessment is to ascertain the effectiveness of the undergraduate program and to improve the instructional process and curriculum in order to enhance student learning. To that end, this document specifies the desired learning outcomes, identifies the procedures used to assess these outcomes, and describes the manner in which the results of the assessment will be used to improve learning and instruction.

2. Intended Learning Outcomes

Within the context of the goals of a liberal education as defined by the College of Liberal Arts and Sciences, the educational objectives of the undergraduate program in computer science are stated as follows:

1. Majors will acquire an education in computer science that will prepare them for life-long learning and continued professional development.
2. Majors will learn the fundamental concepts and theories of the discipline of computer science.
3. Through laboratory experiences, majors will apply theories to the synthesis and analysis of computing systems.
4. Graduates of the program will be prepared to pursue advanced studies in computer science and/or assume professional computer science positions in business, industry, and government.

The following intended learning outcomes, modified to be in alignment with ABET CAC outcomes (after attending an ABET Webinar in December 2007), quantify our educational objectives in a manner that makes them amenable to measurement and assessment.

- A. An ability to apply knowledge of computing and mathematics appropriate to the discipline.
- B. An ability to analyze a problem and identify and define the computing requirements appropriate to its solution.
- C. An ability to design, implement, and evaluate a computer-based system, process, component or program to meet desired needs.
- D. An ability to function effectively on teams to accomplish a common goal.
- E. An ability to understand professional, ethical, legal, security, and social issues and responsibilities.
- F. An ability to communicate effectively with a range of audiences.

- G. An ability to analyze the local and global impact of computing on individuals, organizations, and society.
- H. An ability to engage in continuing professional development.
- I. An ability to use current techniques, skills, and tools necessary for computing practices.
- J. An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems that demonstrate comprehension of the tradeoffs involved in design choices.
- K. An ability to apply design and development principles in the construction of software systems of varying complexity.

3. Assessment of Intended Learning Outcomes

Several methods are used to assess the outcomes of learning and instruction to determine if departmental objectives are being achieved.

- The single-most important process we use to assure that graduates are achieving the program outcomes is the continuous monitoring of student work by the faculty who teach the respective classes. The faculty are usually those involved in preparing course objectives and outcomes, so that the assessment is a part of their ongoing responsibility. These data are reflected in homework, projects, laboratory work, and examinations that the students take regularly. Faculty tend to recognize that if one or two people in a class do not master a major concept, then there probably is a difficulty that can be attributed to the student. If, however, a substantial fraction of a class fails to master a major concept, then remedial action by the instructor is in order. While informal, this assessment is rapid and important in our activity.
- A second process that we follow is the informal feedback loop from instructors in follow-up courses. Faculty compare ideas regularly, and our Undergraduate Committee facilitates this comparison. Members of the Undergraduate Committee carry forward ideas to the larger group of faculty when appropriate. Problems are generally not allowed to continue. A similar facilitation also happens with our Equipment Committee for continuous improvement of instructional laboratories. Feedback obtained in this fashion is used to make improvements to our short-term objectives as well as our long-term objectives.
- Another assessment tool that relates here is the exit survey of graduating students. This survey has been used since the year 2000 and was modified a little bit in Spring 2008 to align itself with recent recommendations from the Computing Accreditation Commission, which we learned by attending an ABET Webinar in December 2007. Prior to graduation, all graduating seniors are invited to complete an exit questionnaire and an outcomes assessment survey (both attached as an appendix). This provides students with the opportunity to assess, from their personal learning experiences, the effectiveness of the program in achieving the program outcomes and their own expectations.

- From time to time, this outcomes survey is also sent to computer science alumni. It allows graduates, in the context of their professional experiences, to reflect on their undergraduate learning experiences and to assess the effectiveness of the undergraduate program in achieving its intended learning outcomes. Survey forms are also sometimes given to alumni during their campus recruitment visits.
- Faculty members are active in interacting with industry professionals and recruiters who conduct on-campus interviews. Many of these recruiters are former students of ours. Some faculty are involved in software associations in the state of Iowa. Our department chairman was a past President of the IEEE Computer Society. Input from such professionals assist us in making timely changes to the curriculum so that our students are prepared in an ever-competitive job market.
- Recommendations from the Computing Accreditation Commission are used to periodically guide changes to our curriculum and program. The Bachelor of Science program is nationally accredited by the Computing Accreditation Commission of the Accreditation Board of Engineering and Technology. The process of accreditation requires periodic external reviews of the undergraduate program by computer science educators and professionals, each review consisting of a detailed examination of the depth and breadth of the curriculum and an examination of the department/college/university infrastructure to insure effective delivery of the curriculum. The content and quality of subject matter in each course required of majors is ascertained through an examination of course descriptions, textbooks, and sample homework and examinations. From personal vitae, university data, classroom and laboratory visits, and interviews with students, faculty, advisors, and administrators, the quality of the supporting infrastructure is examined – including required supporting coursework in other disciplines, faculty resources, and laboratory space and equipment. The quality of the program is contrasted with nationally established standards for accreditation. In addition, Iowa State University is periodically accredited by the Higher Learning Commission of the North Central Association of Colleges and Schools.
- The undergraduate advisors are in charge of collecting the assessments from graduating seniors. They are also members of the Undergraduate Committee and distribute the results to members of that committee and to the faculty for subsequent improvements to courses.
- The department chair speaks regularly with graduating seniors each semester and takes their comments to the various departmental committees. One outcome of this process has been an upgrade of both the computing equipment and the policies for using it.
- Student Forums: Students are encouraged in an open, friendly manner to comment on strengths and to express concerns. Faculty and administration also attend. While the format is anecdotal rather than systematic, the intent of the standard will be met in the sense that we will find out where problems exist in a way that we simply could not do otherwise. Meeting notes from these forums are given to the department's undergraduate committee and distributed to the faculty.

Figure 1 below describes the process.

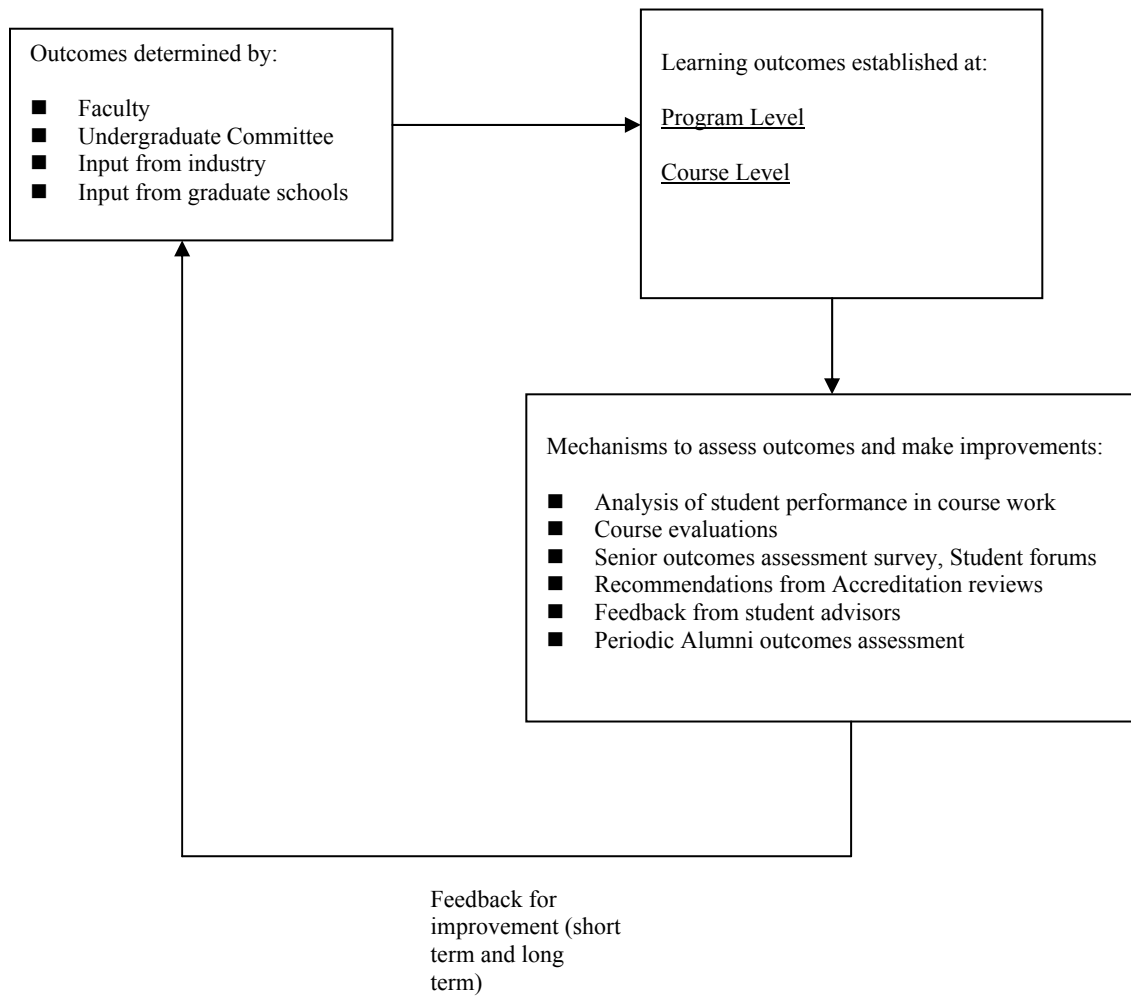


Figure 1. Assessment of Outcomes

4. Use of Outcomes Assessment Data

Assessment data gathered from accreditation reviews, student and alumni questionnaires, student forums, and employment information are given to the department's Undergraduate Committee and distributed to the faculty for subsequent modification of the curriculum. Summary results are shared with higher administration through the annual report prepared by the department chair.

Outcomes Assessment Survey
(Spring 2008 onwards)

I am a Senior

Alum

<p>The Department of Computer Science requests your opinion on two questions that are relevant to our accreditation and to our efforts to continually improve our program. The rows represent the learning outcomes of our curriculum. The columns are places that we ask for your rating on these outcomes through the courses you have taken.</p> <p>Please also answer the additional questions at the bottom of the table. Thank you.</p> <p>Gurpur Prabhu ABET Coordinator for the Department of Computer Science</p>	<p>1. In your opinion, how well did your total educational program at Iowa State University develop each of the indicated outcomes?</p>				<p>2. In your opinion, how important is this outcome to you as a computer scientist?</p>		
	Very Well	Well	Adequately	Not at all	Low Importance	Medium Importance	High Importance
A. An ability to apply knowledge of computing and mathematics appropriate to the discipline							
B. An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution							
C. An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs							
D. An ability to function effectively on teams to accomplish a common goal							
E. An ability to understand professional, ethical, legal, security, and social issues and responsibilities							
F. An ability to engage in continuing professional development							
G. An ability to use current techniques, skills, and tools necessary for computing practices							
H. An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems that demonstrate comprehension of the tradeoffs involved in design choices							
I. An ability to apply design and development principles in the construction of software systems of varying complexity							

1. Would you have liked an introductory course in computing before you took Comp Sci 227 (i.e. your first programming course)?

2. List the course(s) that aided you in your ability to use current techniques, skills, and tools necessary for computing practices:

3. List the courses that enhanced your ability to apply design and development principles in the construction of software systems of varying complexity:

4. What were you satisfied with in the curriculum?

5. List some improvements that can be made in the curriculum.

Post Graduation Plans

1. Did you use career services to find a job or internship? What other avenues did you use?

2. Did you attend the career fair? Why or why not?

3. Did you have geographic preferences or other restrictions that may have limited your opportunities?

4. Did you do an internship/co-op? How was this obtained?

5. How many companies did you contact?

Internship/Co-op

1. Was coursework useful in your internship?

2. What did you learn during your internship, including technical, business, or otherwise?

Any Other Comments

Outcomes Assessment Survey (Fall 2004 to Fall 2007)

Data collected will be interpreted to make changes as needed.

<p>To our seniors:</p> <p>The Department of Computer Science requests your opinion on two questions that are relevant to our accreditation and to our efforts to continually improve our programs in Computer Science. The nine rows are the attributes or outcomes that we are trying to develop. The columns are places that we ask for your opinion on the two questions in the respective columns.</p> <p>Please note also that there is a comment space at the bottom.</p> <p>Thank you very much.</p> <p>Gurpur Prabhu Accreditation Coordinator for the Dept. of Computer Science</p>	<p>1. In your opinion, how well did your total educational program at Iowa State University develop each of the indicated outcomes or attributes?</p>					<p>2. In your opinion, how important is the outcome or attribute to you as a computer scientist?</p>		
	Very Well	Well	Adequately	Not at All		High Importance	Medium Importance	Low Importance
a. impart an understanding of fundamental principles of computing								
b. impart an understanding of basic foundations of mathematics, statistics, and physical sciences								
c. impart an understanding of design and implementation of programs								
d. develop proficiency in formulating and solving problems in computing								
e. develop proficiency in understanding design and performance requirements of software systems								
f. develop proficiency in applying sound principles to the synthesis and analysis of computer systems								
g. ability to engage in lifelong learning								
h. ability to communicate effectively and think critically and creatively, both independently and with others								
i. knowledge of social and ethical issues relating to computers in society								

1. Please consider your total program, and tell us what you believe to be the strongest features. _____

2. Please consider your total program, and give us one important idea that you believe would really improve it.

3. Additional comments are welcome

EXIT QUESTIONNAIRE FOR GRADUATING SENIORS
Department of Computer Science

1. Career prospects were a major factor in my decision to major in computer science.
(a) strongly agree (b) agree
(c) neutral or don't know
(d) disagree (e) strongly disagree
2. Computer science is interesting to me, and this was a major factor in my decision to major in computer science.
(a) strongly agree (b) agree
(c) neutral or don't know
(d) disagree (e) strongly disagree
3. I plan to spend most of my career working as a computer scientist in industry.
(a) strongly agree (b) agree
(c) neutral or don't know
(d) disagree (e) strongly disagree
4. I plan to start graduate school in computer science within one year of graduation.
(a) strongly agree (b) agree
(c) neutral or don't know
(d) disagree (e) strongly disagree
5. I plan to attend graduate school in computer science someday, but not within one year of graduation.
(a) strongly agree (b) agree
(c) neutral or don't know
(d) disagree (e) strongly disagree
6. I would like to spend at least part of my career teaching computer science at some level.
(a) strongly agree (b) agree
(c) neutral or don't know
(d) disagree (e) strongly disagree
7. I would like to spend at least part of my career doing original research in computer science.
(a) strongly agree (b) agree
(c) neutral or don't know
(d) disagree (e) strongly disagree
8. If I work in industry and it makes no difference to my salary, I would prefer a technical position to a management position.
(a) strongly agree (b) agree
(c) neutral or don't know
(d) disagree (e) strongly disagree

9. Overall, the instruction I received in lower division (100-200 level) computer science courses was
 - (a) excellent (b) good (c) fair
 - (d) adequate (e) poor
10. Overall, the instruction I received in upper division (300-400 level) computer science courses was
 - (a) excellent (b) good (c) fair
 - (d) adequate (e) poor
11. Compared with the university as a whole, the quality of teaching in the computer science department was
 - (a) excellent (b) good (c) fair
 - (d) adequate (e) poor
12. My coursework gave me a good understanding of the fundamental concepts and theories of computer science.
 - (a) strongly agree (b) agree
 - (c) neutral or don't know
 - (d) disagree (e) strongly disagree
13. My laboratory experiences in the computer science program taught me to apply computer science concepts to the synthesis and analysis of computing systems.
 - (a) strongly agree (b) agree
 - (c) neutral or don't know
 - (d) disagree (e) strongly disagree
14. The computer science department has good computing facilities for undergraduate students.
 - (a) strongly agree (b) agree
 - (c) neutral or don't know
 - (d) disagree (e) strongly disagree
15. Overall, my undergraduate education helped me develop good communication skills.
 - (a) strongly agree (b) agree
 - (c) neutral or don't know
 - (d) disagree (e) strongly disagree
16. My coursework in computer science included valuable experience working in teams on problems and projects.
 - (a) strongly agree (b) agree
 - (c) neutral or don't know
 - (d) disagree (e) strongly disagree
17. The computer science academic advising office was helpful to me.
 - (a) strongly agree (b) agree
 - (c) neutral or don't know

- (d) disagree (e) strongly disagree
18. I believe that I now have the necessary education to begin a professional career in computer science.
- (a) strongly agree (b) agree
(c) neutral or don't know
(d) disagree (e) strongly disagree
19. I believe that I now have the necessary education to begin graduate study in computer science.
- (a) strongly agree (b) agree
(c) neutral or don't know
(d) disagree (e) strongly disagree
20. Based on my experience, I would encourage entering freshmen to consider pursuing a B. S. in computer science.
- (a) strongly agree (b) agree
(c) neutral or don't know
(d) disagree (e) strongly disagree
21. At this time, I have
- (a) at least one job offer
(b) been accepted for graduate studies
(c) both (a) and (b)
(d) none of the above
22. Please add any comments that you believe may be helpful.