

Stevens Institute of Technology

BS in Computer Science

Plan for Continuous Improvement

June 2014 update

History

The Stevens Computer Science department began systematic quantitative assessment of educational outcomes during the 2006-07 school year. In 2009-10, we instituted an earlier version of this plan for continuous improvement. In 2011-12, we changed our program outcomes to match exactly the ABET A-K outcomes. We also changed many course outcomes at that time, for the most part reducing and simplifying the outcomes for each course. The continuous improvement plan was revised in 2011-12 based on the effect of the new program outcomes and a streamlined set of course outcomes. The latest update to our plan, in June 2014, makes small corrections to the document, mostly to update URLs since during 2013-14 Stevens changed its web CMS with the result that URLs changed.

Program Objectives

1. What They Are

The following objectives appear on the CS department web site at http://www.stevens.edu/ses/cs/about/accreditation/bs_cs_prog_obj:

Program educational objectives are broad statements that describe the career and professional accomplishments that the program is preparing graduates to achieve. These are the professional accomplishments that students are expected to have achieved three years after graduation.

1. **[skills development]** Be able to acquire new skills and knowledge on one's own.
2. **[skills application]** Be able to create solutions to complex problems in computer system design.
3. **[communication]** Be proficient in both oral and written technical communication.
4. **[teamwork]** Be effective as either a member or a leader of a small team.
5. **[impact]** Be able to evaluate the impact of one's work on the intended users and on society.

2. How They Are Assessed

Performance in achieving objectives is assessed using one form of indirect evidence: alumni are contacted and asked to fill out a survey. The survey is intentionally kept very simple to encourage responses; 5 of the 6 questions map one-to-one with the objectives.

One example of the alumni objectives survey is at <https://www.surveymonkey.com/s/2WCGNPF>. The survey is summarized as follows:

- Purpose: gather alumni opinions about their success in achieving program objectives by three years after graduation.
- Survey audience: alumni who graduated approximately three years ago.
- When administered: every summer, to those who graduated in January or May three years before; e.g., January 2011 and May 2011 graduates were surveyed in summer 2014.
- How administered: commercial Internet survey site <http://www.surveymonkey.com>
- How delivered to audience: most alumni can easily be found on LinkedIn or Facebook.
- Data collected: there are 6 questions. For each of 5 questions that map one-to-one with program objectives, the graduate is asked to rate to what degree he/she thinks he/she has attained the objective. A sixth open-ended question asks the graduate for "any comment you wish to make about how your Stevens computer science education succeeded or failed to prepare you adequately for your career after graduation. If possible, please suggest how weaknesses of the Stevens computer science education could be remedied."
- Data retention: survey responses are downloaded from SurveyMonkey and kept forever.
- Data reduction: for each question, SurveyMonkey computes the average score and the distribution of scores.
- When data analyzed: after the survey closes in late summer or early Fall.
- Data analysis: the program director is responsible for presenting the results to the department curriculum committee once per year in Fall following that summer's data collection activity. The reduced scores, the committee's conclusion about what the data mean and what, if any, actions will be taken to modify the program so as to improve objective performance are recorded at http://www.stevens.edu/ses/cs/about/accreditation/prog_rev_history/bscs

In 2011-12 and before we also attempted to also survey employers, asking their opinion about how well Stevens BS-CS graduates satisfy program objectives. This practice was stopped following 2011-12 because employer surveys were unsuccessful, sometimes yielding no responses at all. There are two problems with doing an employer version of the objectives survey. First, alumni are understandably reluctant to provide employer contact information knowing that their employer will then be asked to evaluate them. So we received contact information for very few employers. Second, many employers are prohibited from releasing, even within their organization, any information that might be considered to be employee performance evaluation information. For a few years we tried to provide employers a way around this prohibition by asking them to rate all Stevens graduates generally rather than a particular graduate. This "dodge" failed for two reasons: first, employers didn't go for it and,

second, had any data been generated it might not have been specific to the population of three-years-out alumni that we were trying to evaluate. In the face of legal (and arguably moral) objections to our seeking employer evaluations of our graduates' ability, we dropped the practice. In 2013-14, we were informed that—for similar reasons—ABET no longer asks programs to survey employers.

Program Outcomes

1. What They Are

Program outcomes appear on the CS department web site at http://www.stevens.edu/ses/cs/about/accreditation/bs_cs_prog_out. Beginning in 2011-12, the department switched to using exactly ABET A-K as its program outcomes.

2. How They Are Assessed

We assess our success in establishing program outcomes in three ways:

1. Direct evidence: data gathered in every required course, providing quantitative measurement of success in establishing course outcomes based on student performance on assigned work. Such “course outcome” data is mapped to corresponding program outcomes.
2. Indirect evidence: results from the “senior exit survey” administered in April in the required senior course CS 424 Senior Design II, asking senior graduates-to-be their opinion about the extent to which they think they have achieved each program outcome.
3. Indirect evidence: results from an alumni survey in which graduates are asked one year after graduation their opinion about the degree to which the program established each of its outcomes. Note that this alumni *outcomes* survey is distinct from the alumni *objectives* survey mentioned above. The objectives survey asks three-years-out alumni about objectives. The outcomes survey asks one-year-out alumni about outcomes.

The handling of each form of evidence is discussed in separate sections below.

2.1 Assessment of Direct Evidence: Course Outcome Measurements

Each required course is assigned to a full time CS department faculty member who acts as “coordinator” for the course. The faculty coordinator maps the course outcomes to program outcomes. This mapping is shown at http://web.stevens.edu/csfiles/accreditation/2013-14/BS_programs_outcomes_map.xlsx

Each course instructor (who may or may not be the coordinator) plans the course before the semester and records his/her improvement plan on the Pre-Course Review (PCR) form. The blank PCR form is available at <http://web.stevens.edu/csfiles/accreditation/PCR.doc>. It includes sections for this information:

- Materials from prior offerings of this course (and possibly other courses) reviewed as part of the preparation to teach this course this term.
- Any resulting adjustments in teaching plan based on review of the above materials. That is, what, if any, improvements are suggested by the assessment results from prior courses?
- Assessment plan for this semester: which course outcomes will be assessed, using which instrument(s), and what grading rubric will be used for each instrument?

The purpose of the PCR form is to "close the loop" by feeding into the coming offering lessons learned from previous offerings of the course.

At the conclusion of each course the instructor fills out a Student Performance Assessment Data (SPAD) form. The SPAD form is available inside the Institute's "ACE" assessment system at <https://web.stevens.edu/assess>. The form includes this information for each course outcome:

- The program outcome the course outcome maps to
- Statement of the course outcome
- The instrument used to assess the course outcome
- The number of students assessed
- Average student performance on this instrument, on a 4-point scale
- Average student opinion--on a 4-point scale, derived from the Institute's end-of-semester survey--about how well they are able to accomplish the outcome

At the conclusion of each course the instructor also fills out an Instructor Course Evaluation (ICE) form on which the instructor gives his/her opinion about how the course went, including whether the outcomes are appropriate. The ICE form is also available inside ACE.

PCR, SPAD, and ICE forms for all courses, across all semesters, are collected and made available to instructors at <http://www.stevens.edu/ses/cs/forms>. The page is password protected with access limited to instructors. This privacy measure is taken so that instructors do not hesitate to speak frankly on the ICE form.

The spreadsheet at http://web.stevens.edu/csfiles/accreditation/2013-14/BS_programs_outcomes_map.xlsx serves as the basis of the evaluation of SPAD data. That spreadsheet has an X in a cell to indicate that a certain course has one or more course outcomes that cover a certain program outcome. A portion of the spreadsheet is:

	115	135	146	284	334	347	383
A: Apply - An ability to apply knowledge of computing and mathematics appropriate to the program's student outcomes and to the discipline.	X	X			X		
B: Analyze - An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution.	X						
C: Design - An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs.	X			X		X	
D: Teamwork - An ability to function effectively on teams to accomplish a common goal.			X			X	
E: Responsibility - An understanding of professional, ethical, legal, security and social issues and responsibilities.							
F: Communicate - An ability to communicate effectively with a range of audiences.			X				
G: Impact - An ability to analyze the local and global impact of computing on individuals, organizations, and society.							
H: Professional development - Recognition of the need for and an ability to engage in continuing professional development.							
I: Currency - An ability to use current techniques, skills, and tools necessary for computing practice.	X	X		X		X	X

J: Tradeoffs - An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.				X	X	X				
K: Construction - An ability to apply design and development principles in the construction of software systems of varying complexity.	X		X	X		X		X	X	

An academic year's SPAD evaluation replaces each X with the number that indicates (on a 4-point scale) the average of how students performed on all outcomes in the indicated course that map to the indicated program outcome, like so:

	115	135	146	284	347	383	385	392	423	442	4
A: Apply - An ability to apply knowledge of computing and mathematics appropriate to the program's student outcomes and to the discipline.	2.66	3.4					3.76			3.36	
B: Analyze - An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution.	2.66								3.7		
C: Design - An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs.	4			2.2	3.5		3.47	2.82	3.8	4	
D: Teamwork - An ability to function effectively on teams to accomplish a common goal.					3.95				3.7		
E: Responsibility - An understanding of professional, ethical, legal, security and social issues and responsibilities.											
F: Communicate - An ability to communicate effectively with a range of audiences.			3						3.7		

G: Impact - An ability to analyze the local and global impact of computing on individuals, organizations, and society.										
H: Professional development - Recognition of the need for and an ability to engage in continuing professional development.								3.3		
I: Currency - An ability to use current techniques, skills, and tools necessary for computing practice.	2.55	3.2		3.2	3.26	3.94	3.58	3.83		3.86
J: Tradeoffs - An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.				3.24	3.55			3.58		
K: Construction - An ability to apply design and development principles in the construction of software systems of varying complexity.	3		3.58	3.4	3.42	3.38		3.87		

At the far right end of each row (not shown in the example above because of lack of space), the program outcome’s overall score is computed as the average across all courses that cover that program outcome.

The SPAD evaluation spreadsheet for an academic year is posted at http://www.stevens.edu/ses/cs/about/accreditation/prog_rev_history/bscs Also at this location is a report written by the program director interpreting the data. The program director is responsible for presenting the results to the department curriculum committee once per year in Fall following that summer’s data collection/reduction/analysis activity. The committee’s conclusion about what the data mean and what, if any, actions will be taken to modify the program so as to improve outcome performance are recorded at http://www.stevens.edu/ses/cs/about/accreditation/prog_rev_history/bscs

2.2 Assessment of Indirect Evidence: Senior Exit Survey

All graduating seniors are surveyed toward the end of the Spring “senior design” course, which is required. Seniors are asked to what extent they feel they have achieved the program’s student outcomes. The senior exit survey is summarized as follows:

- Purpose: gather opinions, from last-semester graduates-to-be, about the program's success in achieving its outcomes
- Survey audience: students in the second senior design capstone course, CS 424 Senior Design II. This course is required for all seniors in the Spring semester.
- When administered: every Spring, approximately late April.
- How administered: on a paper form in class and also online via [surveymonkey.com](https://www.surveymonkey.com)
- How delivered to audience: students are required to attend class and class time is set aside for students to respond.
- Data collected: 15 questions are posed. For each of 11 questions that map one-to-one with program outcomes, the student is asked to rate to what degree he/she thinks he/she attained the program outcome. The four remaining questions ask for: employment information, if the student has arranged employment; graduate school information, if the student has arranged graduate school; post-graduation email address; and a free-response question asking for suggestions on how to improve the program.
- Data retention: survey responses for the first 11 questions, which are numbers on a scale of 1 to 5, are tabulated in a spreadsheet. Email addresses are retained in the mailing list associated with that graduating class. Information about employers and grad schools are stored in a database. Responses to the free-response question are transcribed into a text file. All survey results are digitized and kept forever in a database maintained by the CS department.
- Data reduction: for each of the 11 outcomes-based questions, the spreadsheet computes the average score.
- When data analyzed: the following Fall.
- Data analysis: the program director is responsible for presenting the results to the department curriculum committee once per year in Fall following that summer's data collection/reduction/analysis activity. The reduced scores, the committee's conclusion about what the data mean and what, if any, actions will be taken to modify the program so as to improve outcome performance are recorded at http://www.stevens.edu/ses/cs/about/accreditation/prog_rev_history/bscs

2.3 Assessment of Indirect Evidence: Alumni Outcome Survey

An example alumni outcome survey is at <https://www.surveymonkey.com/s/2QS7639>. The survey is summarized as follows:

- Purpose: gather alumni opinions, in the light of experience, about the program's success in achieving its outcomes
- Survey audience: alumni who graduated approximately one year ago
- When administered: every summer, to those who graduated in January or May the year before
- How administered: using [surveymonkey.com](https://www.surveymonkey.com)

- How delivered to audience: most alumni can easily be found on LinkedIn or Facebook.
- Data collected: for each of 11 questions that map one-to-one with program outcomes, the graduate is asked to rate to what extent he/she thinks the program attained the outcome.
- Data retention: survey responses are downloaded from SurveyMonkey and kept forever.
- Data reduction: for each question, SurveyMonkey computes the average score.
- When data analyzed: the following Fall.
- Data analysis: the program director is responsible for presenting the results to the department curriculum committee once per year in Fall following that summer's data collection/reduction/analysis activity. The reduced scores, the committee's conclusion about what the data mean and what, if any, actions will be taken to modify the program so as to improve outcome performance are recorded at http://www.stevens.edu/ses/cs/about/accreditation/prog_rev_history/bcs