OHIO NORTHERN UNIVERSITY

2006 ANNUAL REPORT ON THE ASSESSMENT OF STUDENT LEARNING`

Academic Program: Computer Science

Department: ECCS

College: Engineering

Submitted by/Date: John K. Estell / 20 November 2006

The Annual Report on the Assessment of Student Learning consists of three parts.

Part I provides the learning objectives and measures as previously identified.
Part II requests information about assessment activities for the previous academic year.
Part III requests information about programmatic or operational changes occurring or being proposed as a result of assessment activities.

Reports must be submitted by department chairs to the Office of Institutional Research by ***December 1, 2006***. Each annual report will be evaluated by the University Assessment Committee and returned to the department chair and the respective Dean by ***March 1, 2007***.

I. ASSESSMENT PROGRAM COMPONENTS

Instructions: Please review the following and make changes as needed.

A. Learning Objectives

Program Educational Objectives (PEO):

Graduates of the Computer Science program will:

PEO-1: be successful in their chosen career.
PEO-2: engage in career-long learning.
PEO-3: be effective communicators with those inside and outside of computer science.
PEO-4: understand the professional, ethical, and moral responsibilities of computer scientists.
PEO-5: understand the impact that their solutions have on society, both locally and globally.
PEO-6: be motivated to accept challenging assignments and responsibilities.
PEO-7: be productive members of society.
PEO-8: act as mentors and role models to both junior members in the profession and to students of computer science.

Program Outcomes (PO):

By the time of graduation, students majoring in Computer Science at Ohio Northern University will:

PO-1: have a broad understanding of the world around them and the variety of people in it. They will be able to communicate effectively, both orally and in writing, with those both inside and outside of the profession.

PO-2: understand the abundance of languages and language types useful in the discipline and be able to design, build and use a wide variety of structures implemented in those languages.

PO-3: have the ability to function in an environment requiring communications between team members working toward a common goal.

PO-4: be familiar with, and be able to select and use, the tools and devices available to build solutions to problems and have the skills to carry out the design and implementation of the same.

PO-5: know the importance of conscientiously and responsibly creating solutions that clients want and that meet user needs.

B. Measurements

- FCAR
- Senior Project/Capstone Experience
- Exit Interview
- Alumni Surveys
- Employer Surveys
- Placement Rates

II. ASSESSMENT ACTIVITIES FOR 2005-06 (ACADEMIC YEAR)

Instructions: Please complete the following sections.

A. Describe the *measures* used to collect the data?

(Which measures did you use during the past year? Which learning objectives does each measure address? How and when did you administer the measures?)

The measures used for the program educational objectives are senior surveys, alumni surveys, and employer surveys. Senior surveys are administered to all graduating seniors in the Spring quarter. Alumni of the program are surveyed officially both 3 and 10 years after graduation; an informal survey is also sent in the year following graduation primarily to verify the accuracy of the address database. Alumni are provided with a survey instrument to be given to their direct supervisor for the employer survey. These measures are reviewed periodically on a multiyear basis; for this year's evaluation, the data from the senior surveys conducted in the 2003-2004 and 2004-2005 academic years were reviewed by both the faculty and the department's Program Working Groups.

The measures used for the program outcomes are performance vectors culled from Faculty Course Assessment Reports (FCAR), which are submitted whenever a course is offered. The performance vectors are direct measurements of student learning that are administered as course assignments. Details are contained within the FCAR submitted for each course.

B. Present the *results* of the data collection and analysis for each measure listed above.

(Present the data resulting from 2005-06assessment activities. What are the standards and expectations for performance? Did the students meet the standards? What gaps were found between the standards for student learning and the actual results?)

Please refer to the attachments, "Minutes of Computer Science Program Working Group Meeting," and "2005-2006 Data for Computer Science Metrics."

III. PROGRAMMATIC /OPERATIONAL ADJUSTMENTS

Instructions: Please complete the following sections.

A. Describe the *adjustments*, if any, to the program or the program's operations (including budgetary) which are either being proposed or have already been made in order to narrow the gaps identified between learning objectives and actual outcomes.

(What changes in curriculum, instructional strategies, course content, personnel, facilities, equipment, resource allocation, etc. are recommended to address the gaps between expected performance and actual results?)

The adjustments that have been, and are still being, undertaken have more to do with addressing the gaps identified when comparing our curriculum to the proposed ABET Computing Accreditation Commission (CAC) Criterion 3 program outcomes, and other related criteria, than with gaps identified by our data. The following changes have been adopted or proposed:

1. Databases (ECCS 348) is being made a required course in the curriculum.
2. The natural sciences requirement (currently, a student can select any four courses) is being made more stringent due to the proposed Criterion 9.3.c for computer science programs that requires a "substantial laboratory science experience." Beginning in the 2007-08 academic year, CS majors will be required to take one of the following course sequences to satisfy the laboratory experience requirement:

    i. BIOL 121-122-(123 or 124)
    ii. CHEM 171-172-173
    iii. PHYS 211-212-213-234-235-236
    iv. PHYS 231-232-233-234-235-236
    v. PHYS 211-234-252-253-255-256

3. It is proposed that ECCS 370 (User Interface Design) be made into a required course to satisfy necessary coverage of human-computer interaction as specified in the Computing Curriculum. This will be evaluated following the initial offering of the course in winter term.
4. It is proposed that a new course be developed on computer security that focuses on issues related to ABET CAC Criterion 3(g), as our curriculum offers essentially no coverage in this area.

B. Describe the *changes* that need to be made to the assessment plan and practices for the future?

(Have questions been raised about the effectiveness of the assessment plan? If so, what changes are needed? Are different objectives, measures, analysis, etc. needed?)

The CS Assessment Plan has been entirely overhauled; a copy of the new plan is attached. The reason for the change has to do with our desire to become an ABET-accredited program. We plan on applying for accreditation during the 2008-2009 accreditation cycle (which is when the engineering programs are scheduled for being revisited), and it is in that accreditation cycle that

the CAC is scheduled to enact their new Criteria for Accrediting Computing Programs. Accordingly, we are redesigning our entire set of metrics for measuring our program outcomes so that they incorporate the proposed ABET CAC Criterion 3 outcomes. Based on feedback from our CS Program Working Group, changes were made to our program outcomes. Specifically, the previous PO-3 was felt to be too specific for use as a program outcome and it was therefore removed.

Minutes of Computer Science Program Working Group – 27 April 2006 Meeting

Present: Mr. Batcha, Ms. Bessick, Mr. Minneman, Mr. Neumann, Mr. Schilling, Ms. Schoonover, Dr. Chen, Dr. Estell, Dr. Luo.

1. General discussion was held updating PWG members on retention issues in CS, particularly with women.
2. The CS Program Educational Objectives were reviewed. Following points were raised:
    a. PEO-2 (career-long learning): this is especially needed in CS!
    b. PEO-1 (be successful in chosen career) definition of successful? Consensus is that it's up to the individual to determine this.
    c. It was suggested that we add the following question to our First-Year survey: "What shocked/surprised you the most when you got out into the real world?"
    d. PEO-3 (effective communicators): how does one measure effective communicating skills?
    e. PEO-8 (act as mentors/roll models): do we do this in the curriculum? (No.) How can we then incorporate this into the curriculum? Are there ways that ACM members and/or juniors and seniors can mentor our freshmen and sophomores? Perhaps a 1-hour course could be offered. Could pair up students between junior-level and freshmen-level courses – e.g. juniors write Javadoc specification sheets for a class that is then implemented by freshmen. Need to get lab TAs involved more.
3. The CS Program Outcomes were reviewed. Following points were raised:
    a. PO-1 (effective communication): pet peeve is hearing people speak with "like," "you know," "so," etc., at meetings; students need to learn how to speak clearly. How do we do this in an academic setting?
    b. One PWG member has worked with lots of international development – is it possible to incorporate dealing with different languages and/or dialects? How do we convey to students that they will eventually have to deal with foreign languages and/or customs? Dr. Chen remarked that he does try to provide exposure to other languages.
    c. It was suggested that it would be beneficial if students would develop a "business sense," perhaps by taking appropriate courses and/or working business concepts into the curriculum. It was remarked by one of the members that most of her class took business courses voluntarily, and they helped out a lot in the real world.
    d. It was noted that the cost analysis portion of the senior design projects pretty much was an exercise in creative writing.
    e. PO-2 (understand languages): OK.
    f. PO-3 (theory of computing): might need revision, as this PO is very specific in its wording when compared to the other outcomes. It was remarked that there is a difference between a computer scientist and a computer programmer; we need to make that distinction, but in a more general format such that it is not tied to a specific concept and/or a specific course.
    g. PO-4 (familiarity with programming tools): OK.
    h. PO-5 (solutions that clients want): considered as being very important, but should make change from "users can use" to "meeting user needs." It was noted that Lexis has psychologists that come in to assist in dealing with this issue; it is very important, especially with web-based applications and GUIs.
    i. PO-6 (ethical issues): should include more in the curriculum on the testing of solutions, which seems to be lacking in programs across the nation. It might help if there was a "Design of Experiments" class that could be used, or incorporate elements of such a course into strategic locations of our curriculum.

Respectfully submitted,
John K. Estell

2005-2006 Computer Science Program Assessment Data

Computer Science Program Outcomes

PO-1: Computer science graduates will have a broad understanding of the world around them and the variety of people in it. They will be able to communicate effectively orally and in writing.

Outcome 1.1: Each graduate will have broad exposure to topics in the arts, social sciences, and history.
Assessment: none.

Evaluation: none.

Outcome 1.2: Each graduate will have successfully demonstrated competence in reading comprehension and in writing.
Assessment: none.

Evaluation: none.

Outcome 1.3: Each graduate will have exposure to topics in the physical sciences.
Assessment:

Evaluation: none.

PO-2: Graduates of the program will understand the abundance of languages and language types useful in the discipline and be able to design, build and use a wide variety of structures implemented in those languages.

Outcome 2.1: Each graduate will have experience with mathematics as a language and be able to build mathematical models of real world entities.
Assessment: FCAR for ECCS 164, 165, 166, 268, 269.

Course	E	A	M	U
164	30	9	8	4
165	8	6	3	1
166	8	6	5	3
268	14	4	5	1
269	12	4	1	0

Evaluation: students seem to understand the concept by the end of the sophomore year.

Outcome 2.2: Each graduate will understand the theory of languages and how that theory generates some of the core ideas of the discipline of computer science.
Assessment: FCAR for ECCS 448, 466

Course	E	A	M	U
466	6	3	3	0
448	3	4	1	3

Evaluation: students did better by the time they got to 466, where they see more implementation of the theory than in 448.

Outcome 2.3: Each graduate will see the relationship between the theory of computing and the practice of computing in concrete ways.

Assessment: FCAR for ECCS 164, 268, 348, 466, 468

Course	E	A	M	U
164	30	9	8	5
268	9	11	3	1
348	2	3	3	6
466	6	3	3	0
468	23	2	1	2

Evaluation: student performance is acceptable.

Outcome 2.4: Each graduate will learn multiple programming languages and multiple operating systems and demonstrate competence in their use.

Assessment: FCAR for ECCS 164, 166, 264, 268, 330, 466

Course	E	A	M	U
164	30	9	8	4
166	1	8	6	9
264	3	5	2	0
268	24	0	0	0
330	6	2	0	1
466	6	3	3	0

Evaluation: ECCS 166 (Programming 3) is when students are introduced to a second language; some students have difficulty making the adjustment to a new language. By the junior year, this seems not to be a problem.

Outcome 2.5: Each graduate will be able to create mathematical structures (commonly called classes) using a variety of languages.

Assessment: FCAR for ECCS 165, 166, 348.

Course	E	A	M	U
165	8	6	5	3
166	20	6	3	1
348	2	3	2	1

Evaluation: student performance is acceptable.

Outcome 2.6: Each graduate will recognize the Fundamental Theorem of Control Structures and know its implications in programming language design.

Assessment: FCAR for ECCS 330

Course	E	A	M	U
330	9	0	0	0

Evaluation: student performance is acceptable.

PO-3: Graduates of the program will understand the theory of computing and know the processes and algorithms appropriate for the discipline so they will be able to make judgments regarding the fitness of automated solutions to various problems and to use generally accepted methods to produce those solutions.

Outcome 3.1: Each graduate will be able to describe a Turing machine.
Assessment: FCAR for ECCS 448

Course	E	A	M	U
448	7	4	0	0

Evaluation: no action needed.

Outcome 3.2: Each graduate will understand the implications of the main theorems in the theory of computing.
Assessment: FCAR for ECCS 448

Course	E	A	M	U
448	7	4	0	0

Evaluation: no action needed.

Outcome 3.3: Each graduate will be able to build and use the fundamental data structures.
Assessment: FCAR for ECCS 166, 268, 269, 466

Course	E	A	M	U
166	4	4	8	9
268	15	4	5	1
269	5	9	3	0
466	6	3	3	0

Evaluation: 166 gives students their first taste of structures, will need to spend more time on the concept. By end of data structures sequence students get the concept, however.

Outcome 3.4: Each graduate will understand the object-oriented paradigm.
Assessment: FCAR for ECCS 165, 166, 464

Course	E	A	M	U
165	8	6	5	3
166	2	7	5	11
464	10	8	7	1

Evaluation: More work needs to be done to drive the concepts home in the freshman courses.

Outcome 3.5: Each graduate will know the fundamental algorithms that are used in computer science.
Assessment: FCAR for ECCS 268, 269

Course	E	A	M	U
268	9	11	3	1
269	13	4	0	0

Evaluation: satisfactory performance.

PO-4: Graduates will be familiar with and be able to select and use the tools and devices available to build solutions to problems and have the skills to carry out the design and implementation of the same.

Outcome 4.1: Each graduate will have experience with an integrated development environment.
Assessment: FCAR in ECCS 164, 166, 360

Course	E	A	M	U
164	30	9	8	4
166	24	1	0	0
360	7	0	0	0

Evaluation: no action needed.

Outcome 4.2: Each graduate will have experience with a collection of software development components and their relationships to each other (in the context of a command line environment).
Assessment: FCAR in ECCS 268, 466

Course	E	A	M	U
466	6	3	3	0
268	24	0	0	0

Evaluation: no action needed.

Outcome 4.3: Each graduate will have participated in an integral way in the design and implementation of a hardware and/or software system.
Assessment: FCAR in ECCS 228, 406

Course	E	A	M	U
228	7	0	0	1

Evaluation: will need to separate CS student performance in 406 from that of ECE students to get this data.

PO-5: Graduates of the program will know the importance of creating solutions that clients want and that users can use.

Outcome 5.1: Each graduate will have experience with writing code to both written and oral specifications.
Assessment: FCAR in ECCS 165, 166, 466, 468

Course	E	A	M	U
165	10	7	5	4
166	20	5	3	0
468	28	0	0	0
466	6	3	3	0

Evaluation: no action needed.

Outcome 5.2: Each graduate will have experience with testing interfaces and with non-technical people who test the interfaces built by the graduate.
Assessment: FCAR in ECCS 464.

No data was collected for this outcome.

PO-6: Graduates of the program will be aware of ethical issues involved in producing solutions to problems. In particular, they will be aware of the sensitive nature of processes and data that must be revealed to them during design, implementation and testing of problem solutions and they will be prepared to follow the ethical standards of the computing profession throughout their careers.

Outcome 6.1: Each graduate of the program will have been exposed to discussion and evaluation about the ethical issues related to proprietary data, systems and processes. Some graduates may get additional exposure through senior design projects.

Assessment: FCAR in ECCS 366

Course	E	A	M	U
366	2	23	0	0

Evaluation: no action needed.

Outcome 6.2: Each graduate of the program will be exposed to the various ethical standards of the computing profession through speakers and classroom discussions.

Assessment: FCAR in ECCS 164, 165, 366

Course	E	A	M	U
164	50	0	0	1
165	27	0	0	0
366	2	23	0	0

Evaluation: no action needed.

2006-07 Computer Science Assessment Plan
Last Revised: 9 November 2006

Computer Science Program Outcomes and their Relationship to

ABET CAC Criterion 3(a)-(i)

By the time of graduation, students majoring in Computer Science at Ohio Northern University will:

PO-1: have a broad understanding of the world around them and the variety of people in it. They will be able to communicate effectively, both orally and in writing, with those both inside and outside of the profession.

3(e): an understanding of professional, ethical, and social responsibilities.

Metric 1-e-1: FCAR reports from the following courses will demonstrate an understanding of the professional, ethical, and/or social responsibilities involved in dealings with the public in general: ECCS 165, ECCS 228, ECCS 366, ECCS 370, ECCS 464.

3(f): an ability to communicate effectively.

Metric 1-f-1: FCAR reports from the following courses will demonstrate an ability to effectively communicate with those inside the computing profession: ECCS 228, ECCS 348, ECCS 366, ECCS 448, ECCS 464.

Metric 1-f-2: FCAR reports from the following courses will demonstrate an ability to effectively communicate with those outside the computing profession: ECCS 370, ECCS 404, ECCS 406.

3(g): an ability to analyze the impact of computing on individuals, organizations, and society, including ethical, legal, security and global policy issues.

Metric 1-g-1: FCAR reports from the following courses will demonstrate an ability to analyze the impact of computing on individuals, organizations, and society: ECCS 404.

PO-2: understand the abundance of languages and language types useful in the discipline and be able to design, build and use a wide variety of structures implemented in those languages.

3(a): an ability to apply knowledge of computing and mathematics appropriate to the discipline.

Metric 2-a-1: FCAR reports from the following courses will demonstrate an understanding of computer languages, language types, and structures: ECCS 164, ECCS 165, ECCS 228, ECCS 268, ECCS 330, ECCS 448, ECCS 466.

3(c): an ability to design, implement and evaluate a computer-based system, process, component or program to meet desired needs.

Metric 2-c-1: FCAR reports from the following courses will demonstrate an ability to design, implement and/or evaluate a computer-based process or program to meet desired needs: ECCS 164, ECCS 165, ECCS 166, ECCS 228, ECCS 268, ECCS 348, ECCS 464, ECCS 466.

PO-3: have the ability to function in an environment requiring communications between team members working toward a common goal.

3(d): an ability to function effectively on teams to accomplish a common goal.

Metric 3-d-1: The FCAR reports for the senior design sequence (ECCS 404-405-406) will document that students understand the concepts of, and as necessary are able to apply principles of, constructive conflict management to interactions with others.

Metric 3-d-2: The FCAR reports for the senior design sequence (ECCS 404-405-406) will document the students' use of peer-to-peer evaluation to provide specific and constructive feedback to other team members.

Metric 3-d-3: The FCAR reports for the following courses will document the results of student participation in team projects where members have separate skills and responsibilities: ECCS 164, ECCS 165, ECCS 348, ECCS 464, ECCS 466.

Metric 3-d-4: The FCAR report for ECCS 404 will indicate that all students have participated in creating a team charter.

3(f): an ability to communicate effectively.

Metric 3-f-1: Students will work together to demonstrate effective communication of information, concepts and ideas in writing as documented in:

- Senior Design project written proposal evaluation in ECCS 404, and
- Senior Design final written report evaluation in ECCS 406.

Metric 3-f-2: Students will work together to demonstrate effective oral communication of information, concepts and ideas as documented by:

- Senior Design project proposal oral presentation in ECCS 404, and
- Oral components of Senior Design poster session and the Senior Design final oral presentation in ECCS 406.

Metric 3-f-3: Students will work together to graphically communicate information, concepts and ideas in an effective manner as documented by the Senior Design poster board evaluation and the graphical components of Senior Design written proposal, final report and oral presentations in ECCS 406.

PO-4: be familiar with, and be able to select and use, the tools and devices available to build solutions to problems and have the skills to carry out the design and implementation of the same.

3(a): an ability to apply knowledge of computing and mathematics appropriate to the discipline.

Metric 4-a-1: FCAR reports from the following courses will demonstrate familiarity with appropriate solution-building tools: ECCS 165, ECCS 166, ECCS 228, ECCS 268.

3(b): an ability to analyze a problem and identify and define the computing requirements appropriate to its solution.

Metric 4-b-1: FCAR reports from the following courses will demonstrate an ability to analyze a problem and to identify and define appropriate requirements for its solution: ECCS 228, ECCS 268, ECCS 269, ECCS 370, ECCS 404, ECCS 464, ECCS 466.

3(c): an ability to design, implement and evaluate a computer-based system, process, component or program to meet desired needs.

Metric 4-c-1: FCAR reports from the following courses will demonstrate an ability to design, implement and evaluate a computer-based system or program to meet desired needs: ECCS 228, ECCS 268, ECCS 269, ECCS 370, ECCS 464, ECCS 466.

3(h): recognition of the need for and an ability to engage in continuing professional development.

Metric 4-h-1: FCAR reports from the following courses will demonstrate student engagement in continuing professional development: ECCS 166, ECCS 268, ECCS 366, ECCS 466.

Metric 4-h-2: All CS faculty members will serve as role models by demonstrably engaging in continuing professional development and reporting on such activities to their students in appropriate forums.

Metric 4-h-3: The student ACM chapter will arrange each term for at least one professional development seminar to be presented on campus, and/or at least one field trip to an external professional development event.

Metric 4-h-4: The CS faculty will offer all CS freshman full reimbursement of their first-year dues if they join ACM while enrolled in GE 100.

3(i): an ability to use current techniques, skills, and tools necessary for computing practice.

Metric 4-i-1: FCAR reports from the following courses will demonstrate an ability to use current techniques, skills, and tools necessary for computing practice: ECCS 165, ECCS 166, ECCS 228, ECCS 348, ECCS 370, ECCS 405, ECCS 464, ECCS 466.

PO-5: know the importance of conscientiously and responsibly creating solutions that clients want and that meet user needs.

3(e): an understanding of professional, ethical, and social responsibilities.

Metric 5-e-1: FCAR reports from the following courses will demonstrate an understanding of the importance of the professional, ethical, and/or social responsibilities involved when working with clients and/or users: ECCS 228, ECCS 366, ECCS 370, ECCS 404, ECCS 406, ECCS 464.

3(g): an ability to analyze the impact of computing on individuals, organizations, and society, including ethical, legal, security and global policy issues.

Metric 5-g-1: FCAR reports from the following courses will demonstrate an ability to analyze the impact of computing on clients, including ethical, legal, security and global policy issues, as a result of meeting user needs: ECCS 404.

CS Program Outcomes to Criterion 3(a)-(i) Relationship Matrix

	3(a)	3(b)	3(c)	3(d)	3(e)	3(f)	3(g)	3(h)	3(i)
PO-1					X	X	X		
PO-2	X		X						
PO-3				X		X			
PO-4	X	X	X					X	X
PO-5					X		X		