

**ASSESSMENT DATA REPORT---UNDERGRADUATE PROGRAMS**

**FOR**

**Computer Science**

**F2020-S2021**

**I. DATA PRESENTATION AND REFLECTION**

The Department of Computer Science outcomes were evaluated using the Senior Capstone Project, CSC4500 (Databases) and CSC3660 (Data Structures). The program analyzes eleven outcomes (a-k) adopted from the ABET learning outcomes for computer science (Table 1). All eleven outcomes were scored using a rubric as follows: Exemplary (4 points), Good (3 points), Developing/Poor (2 points), and Unacceptable (1 point). Students are considered to be meeting learning outcomes if they score in either the Exemplary (4 points) or Good (3 points) category. The benchmark for satisfactory achievement of program goals of 80% of students reaching “Exemplary” or “Good” status for the indicators was achieved. If the means were calculated, then any rubric indicator with a mean score of three or greater would be considered meeting standards for the program. Individual sub-indicators for the outcome were averaged to obtain the score reported.

**Table 1: COMPUTER SCIENCE PROGRAM OUTCOMES**

|  |  |
| --- | --- |
| Program Outcome | ABET Outcome |
| PO1: Identify and analyze computer-based systems, processes or components. Utilize their education to contribute critical and systemic thinking while recognizing ethical responsibilities. | (a) An ability to apply knowledge of computing and mathematics appropriate to the discipline  (i) An ability to use current techniques, skills, and tools necessary for computing practice. |
| PO2: Communicate and collaborate effectively when interacting with other individuals or serving on teams | (d) An ability to function effectively on teams to accomplish a common goal  (f) An ability to communicate effectively with a range of audiences |
| PO3: Evaluate and develop solutions in an organization by integrating computer science practices of programming and theory. | (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  (g) An ability to analyze the local and global impact of computing on individuals, organizations, and society  (k) An ability to apply design and development principles in the construction of software systems of varying complexity. |
| PO4: Understand the importance of, and practice, continuing learning to keep abreast of developments in technology, economics, and society. | (h) Recognition of the need for and an ability to engage in continuing professional development  (e) An understanding of professional, ethical, legal, security and social issues and responsibilities  (j) 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. |

**OUTCOME 1**

|  |  |  |
| --- | --- | --- |
| Computing/Mathematic Knowledge | PO1: Identify and analyze computer based systems, processes or components. Utilize their education to contribute critical and systemic thinking while recognizing ethical responsibilities | (a) An ability to apply knowledge of computing and mathematics appropriate to the discipline  (i) An ability to use current techniques, skills, and tools necessary for computing practice. |

1. **ASSESSMENT DATA FOR OUTCOME 1**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **What data sources were used** | **When collected** | **Indicator** | **Percent of students earning good or exemplary** | **2020-2021** | **2019-2020 Mean (sd)** | **2018-2019 Mean** | **2017-2018**  **Mean** |
| During CSC4500 a database design problem (ERD) will be assigned to each individual that requires them to analyze the problem and build the appropriate tables, triggers, view, and indexes. | F2020 | a | Not Available | Not Available | 3.2 (0.92) | 2.89 | 3.04 |
| CSC4500 project | Fall 2020 | i | Not Available | Not Available | 3.73 (0.45) | n/a | n/a |

1. **Identify STRENGTHS evident in the data**.

The data was not available at the time of this writing

1. **Identify OPPORTUNITIES for improvement of learning outcomes evident in the data.**

This data was not available. We need to insure it will be collected.

**OUTCOME 2**

|  |  |  |
| --- | --- | --- |
| Computing/Mathematic Knowledge | PO2: Communicate and collaborate effectively when interacting with other individuals or serving on teams | (d) An ability to function effectively on teams to accomplish a common goal  (f) An ability to communicate effectively with a range of audiences |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **What data sources were used** | **When were data collected** | **Indicator** | **Percent of students earning good or exemplary** | **2020-2021** | **2019-2020 Mean (sd)** | **2018-2019 Mean** | **2017-2018**  **Mean** |
| CSC4990 capstone project | Spring 2021 | d) Effective Teams  d) Team Organization | 80%  80% | 3.5  3.0 | 3.4 (0.56)  3.4 (0.56) | 2.94 | 3.12 |
| CSC4990 capstone project | Spring 2021 | f) Pres. Delivery  f) Subject knowledge | 100%  80% | 3.7  3.7 | 3.5 (0.5)  3.4 (0.65) | 3.22 | 3.18 |

1. **Identify STRENGTHS evident in the data**.

Overall the CSC4990 data seems to indicate that students meet this benchmark overall. Still this metric is assessed as a group project. We need to seek a way to assess individual learning.

1. **Identify OPPORTUNITIES for improvement of learning outcomes evident in the data.**

This data evaluates a group project and therefore will miss students who do not contribute well to the overall efforts.

**OUTCOME 3**

|  |  |
| --- | --- |
| PO3: Evaluate and develop solutions in an organization by integrating computer science practices of programming and theory. | 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  (g) An ability to analyze the local and global impact of computing on individuals, organizations, and society  (k) An ability to apply design and development principles in the construction of software systems of varying complexity. |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **What data sources were used** | **When were data collected** | **Indicator** | **Percent of students earning good or exemplary** | **2020-2021** | **2019-2020 Mean (sd)** | **2018-2019 Mean** | **2017-2018**  **Mean** |
| CSC4500 project | Fall 2020 | b) | Not Available | Not Available | 3.5 (0.51) | 3.22 | 3.14 |
| CSC4990 capstone project | Spring 2021 | c)design and implement  c) dem. comprehension | 48%  47% | 3.2 | 3.23 (1.36)  N/A | 3.11 | 3.23 |
| CSC4500 project | Fall 2020 | g) | Not Available | Not Available | 3.1 (0.86) | 2.94 | 3.04 |
| CSC4990 capstone project | Spring 2021 | k) | 100 | 3.65 | 3.6 (0.55) | 2.89 | 3.27 |

1. **Identify STRENGTHS evident in the data**.

Overall the CSC4990 data seems to indicate that students meet this benchmark overall. Still this metric is assessed as a group project. We need to seek a way to assess individual learning.

1. **Identify OPPORTUNITIES for improvement of learning outcomes evident in the data.**

This data evaluates a group project and therefore will miss students who do not contribute well to the overall efforts

**OUTCOME 4**

|  |  |
| --- | --- |
| PO4: Understand the importance of, and practice, continuing learning to keep abreast of developments in technology, economics, and society. | (h) Recognition of the need for and an ability to engage in continuing professional development  (e) An understanding of professional, ethical, legal, security and social issues and responsibilities  (j) 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. |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **What data sources were used** | **When were data collected** | **Indicator** | **2020-2021 Mean** | **2019-2020 Mean (sd)** | **2018-2019 Mean** | **2017-2018**  **Mean** |
| CSC4990 | Spring 2021 | h) | 3.5 | 3.22 | 3.17 | 3.23 |
| CSC4990 Ethics Paper | Spring 2021 | e) | 3.4 | 3.6 | 3.00 | 3.18 |
| CSC4500 project | Fall 2019 | j) | Not Available | 3.73 (0.45) | 3.11 | 3.04 |

1. **Identify STRENGTHS evident in the data**.

Overall the CSC4990 data seems to indicate that students meet the ethics portion of the benchmark overall. Overall students we able to identify the need for professional development.

1. **Identify OPPORTUNITIES for improvement of learning outcomes evident in the data.**

A portion of this data is not available the time of this writing.

**II. REFLECTION UPON INDIRECT SOURCES OF DATA CONCERNING STUDENT LEARNING**

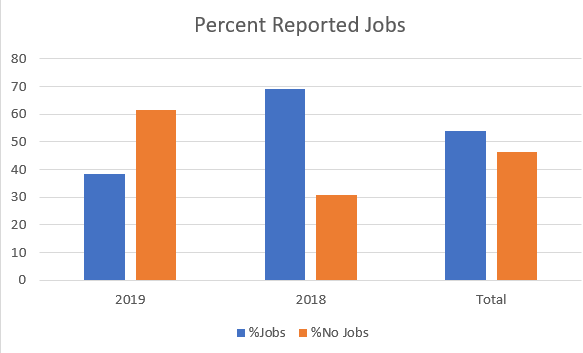
Provide summaries of and discuss any data collected concerning the program that constitute *indirect* measurement of learning outcomes - for instance, student focus groups or satisfaction/exit surveys; faculty focus groups or other qualitative observations; alumni surveys, advisory group input, etc. Discuss notable strengths and opportunities for improvement, suggested by these data.

1. ***CSC1700’s move to Python*** - One major change we made was to move CSC1700 from a Java based course to the Python programming language. We have not gathered direct assessment data on this change. This change will impact the 3 core programming sequence of courses (CSC1700, CSC2660, CSC3660) . At the start of CSC3660 I asked 2 multiple choice questions and a 3 survey questions about basic concepts that should have been clear from CSC2660.
2. A question about recursion that asks how this basic programming concept functions.
3. A question that asks students to identify the 4 pillars of OOP.
4. Three survey questions that asked about their confidence level in working with:
   1. Arrays
   2. Arrays of Objects
   3. Java file I/O

The following results show that overall students did not feel confident using these basic CSC2660 outcomes.

|  |  |
| --- | --- |
| **Item** | **Response** |
| Recursion Question | 22% correct (5/22). |
| OOP Pillars Question | 1% correct (1/22) |
| Student reported confidence in Java Arrays | 25% struggle  75% confident can work with them |
| Student reported confidence in Java Arrays of objects | 45% struggle  55% confident can work with them |
| Student reported confidence in using File I/O | 55% struggle  45% confident can work with file I/O |

1. As a cross check to the assessment data, this last summer I held informal interviews with about 35 CSC graduates from the last 2 years. To conduct these interviews, I utilized the linked-in platform and asked students if they had jobs in Computer Science, how their interview process went and if they had jobs, what technologies they use. As you can see from Figure, at that time about 60% of the graduates from last year did not have jobs by August 2020.



Students reported a variety of issues when trying to find work in the Software Engineering field. Primarily, the Covid-19 pandemic contributed to a slow-down in companies hiring and likely had a large impact on the 2019 data. Still recent graduates reported difficulty in performing well in technical interviews and white-boarding interview problems that require student to solve impromptu coding problems. For example, the following are 2 different responses from 2 different recent graduates.

*“I had a couple of interviews where I flubbed a question on the technical interview and I think that is what disqualified me, and then I've had a couple of interviews where they were looking for specific skills that I did not have.”*

*“Yeah I had a couple of interviews. I was asked technical questions I could not answer well. They never reached out to me again to see what I missed.”*

I also asked past students with jobs what technologies they are currently using. The following figure compares these technologies with those included in the AU CSC curriculum. From this data, I concluded that students gain about 66% of the technologies most in demand. There are several technologies such as React.js, PHP, cloud computing and asp.net that we should consider covering in required courses.

**COMPARISON OF TECHNOLGIES GRADUATES REPORTS WITH OUR CURRULUM**

After analyzing the reported technology data, I realized that most recent graduates reported technologies that either develop applications on the World Wide Web and/or use a database. The above figure shows that approximately 85% of the recent graduates reported using development skills in the web application and database areas. This finding is significant for 2 reasons:

1. a bulk of these skills have been taught in an elective course (CSC3700 - Advanced Web Development) and has not been part core curriculum.
2. CSC4500 (Databases) is one of the underperforming courses in our curriculum.
3. A student can complete the entire AU CSC curriculum and NOT learn a web application development framework.
4. **Strengths**

Students are finding jobs in the CSC field even through the pandemic.

1. **Opportunities for Improvement**

Students need to be better prepared for the rigors of the technical interview and expectations of technology companies. We need to identify key technologies and include them into our program.

**III. EVIDENCE OF ACHIEVEMENT OF UNIVERSITY LEANING OUTCOMES**

Describe how data to establish evidence of University Leaning Outcomes were collected (e.g. which assignments, which classes, which semester(s)). **Create separate tables for AU, GWC, Woodstock, & Online.**

1. **Assessment Data for University Learning Outcomes**

|  |  |  |  |
| --- | --- | --- | --- |
| **ITEM** | N (Number of Students Assessed) | AVERAGE RATING USING UNIVERSITY LEANING OUTCOME RUBRICS 2020/2021 | Prior Year’s Data  2019/2020 |
| **WRITING (Lower level WI course)** |  |  | N/A |
| Focus and Purpose | 36 | 2.51 | N/A |
| Evidence and Support |  | 2.18 | N/A |
| Organization |  | 2.56 | N/A |
| Language |  | 2.83 | N/A |
| **WRITING (Upper level WI course)** | 31 |  |  |
| Focus and Purpose |  | 4.25 | N/A |
| Evidence and Support |  | 4.13 | N/A |
| Organization |  | 4.21 | N/A |
| Language |  | 4.12 | N/A |
| **CRITICAL THINKING (Senior level course)** |  |  |  |
| Explanation of Issues |  | 4.5 | 4.8 |
| Evaluating Evidence, Context, Assumptions |  | 4.5 | 4.4 |
| Conclusions |  | 4.4 | 4.6 |
| **ORAL COMMUNICATION (Senior level course)** |  |  | 4.8 |
| Physical Actions |  | N/a | 4.4 |
| Voice and Delivery |  | 4.45 | 4.4 |
| Language |  | 4.56 | 4.6 |
| Organization and Transitions |  | 4.65 | 5 |

1. **Identify STRENGTHS evident in the data.** (May be a bulleted list.)

The does appear to show growth in students writing abilities. The classes appear to be meeting their outcomes.

1. **Identify OPPORTUNITIES for improvement of learning outcomes evident in the data.** (May be a bulleted list.)

*Note any concerns regarding data quality or validity; plans for addressing these concerns will need to be captured in the Updated Assessment Plan for the coming year.*

Physical actions were not evaluated as this year presentations were prerecorded and over zoom. Computer Science does not explicitly evaluate explanation of issues or evidence citation. Instead, problems have to be analyzed and the correct solution needs to be selected, justified and analytically solved.

**V. EXECUTIVE SUMMARY REGARDING PROGRAM ASSESSMENT DATA**

***THE EXECUTIVE SUMMARY WILL BE INCORPORATED INTO UNIVERSITY REPORTS TO BE SHARED WITH KEY STAKEHOLDERS***

Please share highlights of unique strengths, as well as opportunities for improvement, gleaned from the program assessment data that you intend to explore further in the assessment plan revision stage to follow. Include specific reference to the outcome (state the outcome) and findings presented in the body of the report when creating your summary. Please use this space to communicate positive accomplishments as well as potential areas for continuous improvement, referencing the data that inspired them.

1. **Strengths to Explore (at least one)**

From this data, the computer science program is graduating students who are prepared in many areas. Assessment data indicates students are performing well in basic areas. They are proficient at using current technology to solve problems and are effective communicators and working in teams.

1. **Opportunities for Improvement to Explore (at least one)**
   1. The discrepancies between the indirect evidence of learning and direct evidence needs exploration.
      1. Using our metrics, students may well be learning but not at the levels and depth required by the job market.
      2. Our graduates need to demonstrate a level of competency with technologies that are in demand to do well in the job market. As such, we need to continue to raise expectations for our graduates to master several in-demand technologies before graduation.
      3. Our graduates need better preparation on the technical interview process that many technologies employers use to evaluate candidates.
   2. Assessment metrics that utilize group projects should be explored and possibly replaced with better measurement methods.
   3. The core sequence of CSC1700, CSC2660 and CSC3660 should be explored to ensure they are getting the desired results.
   4. The overall curriculum needs analysis to identify key gaps and determine the best ways to fill them.