

**ASSESSMENT DATA ANALYSIS AND UPDATED PLAN**

**FOR**

**Computer Science**

**F2020-S2021**

**I. MISSION & HISTORY**

1. **Describe the history and development of your program.**

The AU Computer Science program is now part of the School of Business and offers a B.S. degree and minor in computer science. It was once a large department that had two tracks, a B.A. and a B.S. degree option. The department went into severe decline, and there were fewer than 15 majors as late as 2011. Current trends in technology had left a program that was significantly lacking skills that graduates need. This decline was evidenced both in the difficulty students were having getting jobs, based on lack of skill set, as well as assessment of our program. Between 2011-2015, major changes were implemented to revive the program. These changes helped to create a focused and relevant identity, and were designed to improve the quality of the program as well as add relevancy to the current field of computer science. Courses were added to enhance the breadth of knowledge our graduates. In addition, some courses were removed where they were inconsistent with current trends and needs, and prerequisites were changed to allow for a more consistent path through the program.

In that last 5 years, the CSC program is experiencing tremendous growth and change. From 2016-2021, the number of majors that has grown on average by 8.5% per year. During this time, the program faced a complete change-over of instructors, 4 different department heads, and 3 different deans. With such leadership churn, course content and outcomes have drifted. For example, when I started at AU in 2015, somehow the course content from CSC2650 and CSC3610 flipped. That is, CSC2650 was called “Data Structures” but taught “Object Oriented Programming” material and CSC3610 was called “Object Oriented Programming” but taught “Data Structures” material. It is likely this change was made when a new book was adopted and instructors just followed the book chapters chronologically but it is still not entirely clear. In addition, in 2017 a Software Engineering Major was added requiring 2 additional courses (CSC3510 – Software Test and CSC4100 - Software Design) and then the major was removed a year later. We never fully reflected on the impact of these changes on how they stretched and then contracted the curriculum. Finally, prior to 2019, students could complete the curriculum and learn only 2 programming languages, no web application development frameworks, and received no exposure to topics such as test driven development, Object Oriented Design patterns, source control tools, code quality, static code analysis tools, and even the pillars of object oriented programming.

Computer Science is an area that changes at the speed of light, and departments must be willing to change with the technology, always seeking to provide opportunities for students that will be respected in industry. The last major revision to the computer science curriculum occurred in 2013, when AU transitioned to the four semester hour model. This change had a significant impact on the department, since most of the courses were three credit hours. While the changes meant more time per course for a deeper understanding of the content, the loss of a course meant that AU CSC graduates have less core coursework than other universities. Some CSC students struggle to find good development jobs in field with that has high demand for candidates. As such, an on-going effort is underway to strengthen the core CSC coursework and electives.

1. **What is the mission statement of the program, and is it visible for students to see (i.e. on your academic website and in written materials)?**

The mission of the Computer Science program at Aurora University is to pursue teaching, research, and service in the computing sciences. The program provides an environment where students can develop a breadth of knowledge across the subject areas of computer science, including their ability to apply computer science theory, abstraction, design, and implementation to solve problems in the discipline. It will also contribute to the development of students as critical thinkers, enabling them to become lifelong learners, to continue to grow in their chosen professions, and to function as productive citizens.

The computer science program goal matrix highlights the educational outcomes, which align with the standards of ABET (Accreditation Board for Engineering and Technology).

1. **How does your mission fit with Aurora University’s institutional mission statement?**

In pursuing our mission, the primary departmental functions are the development, dissemination, and application of knowledge in the area of computer science. We serve students who are our majors and minors, and those from other service areas. In fulfilling this mission, the department creates an environment where the faculty can continue to grow as teachers and scholars, while providing public and professional service.

As students make progress though the computer science curriculum and continue reaching these goals, they see the four core values (integrity, citizenship, continuous learning, and excellence) throughout their instruction. Students majoring in computer science will understand and apply the concepts and techniques that are foundational to contemporary computer science. They will have an appreciation of computer science, its history, and its role in the modern world and learn how to formulate algorithms and create programs. They will demonstrate skills appropriate for careers in business and industry, or for further study at the graduate level.

The mission, together with the program goals, clearly demonstrates that the Computer Science Department is part of an “inclusive community dedicated to the transformative power of learning,” as AU’s mission states.

1. **In what ways is your program essential to the University?**

Computer science based careers continue to be an economic driver for our country and an opportunity for AU to educate students interested in this area. As stated earlier, the computer science program has continued to grow at 8.5% per year for the last 5 years. This increase in enrollment paralleled robust requirement changes for students earning a B.S. in Computer Science. Additionally, the “T” in STEM is often associated with this content area. Therefore, critical to building a solid reputation in STEM includes fostering computer science and demonstrating a university commitment to its success.

1. **What kinds of strategies do you use to engage students, especially at-risk and non-traditional students?**

The Department of Computer Science has implemented several strategies to engage students of diverse backgrounds, and to help those in need of academic assistance.

1. The department encourages high performing students to participate in peer tutoring opportunities.
2. The department has a senior reception in May to honor the graduating students. All students and faculty are invited. Department awards for academic excellence in each major are presented.
3. In order to foster relationships between current and former students, alumni are asked to return to AU to present talks to current students.
4. Students are offered internship opportunities.
5. Students are offered independent study opportunities.
6. A conscious effort is made by faculty to be readily available to assist students with content, as well as with course selection and career objectives. Implementation of the junior mentoring program will further engage students and faculty in conversations beyond college.
7. The Computer Science Club offers problem solving practice sessions allowing students to practice common coding and interview problems.
8. **How would you describe the maturity and visibility of your program?**

The department embraces its responsibility as a STEM constituency, a program with a major and minor, and a provider of service courses. The assessment in all three of these areas is crucial to the evaluation of the department as a whole. Some of our majors are engaged in both the department and AU, are receiving good job offers, and are being accepted into reputable graduate programs. Others struggle to find work in a field with near 100% employment (even through the pandemic). As stated previously, the program has seen tremendous growth and high change in faculty and leadership. Through this time, we have completed several efforts to strengthen the program.

With all the growth and change within CSC more effort is needed to

1. Ensure the core-curriculum continues to produce better outcomes for skills students need. In particular, we need to define and measure the expectations for the first 2 programming courses (CSC1700, CSC2650).
2. Better align the CSC elective offerings with student career prospects. With so few credits required by our curriculum, each elective we offered should be reviewed against how well it contributes to the student’s goals after graduation.
3. Ensure students learn and embrace the expectations of the job-market and develop skills needed to succeed in that market. In particular, many high-tech employers require candidates to complete exams, on-the-spot problem solving and answer deep technical problems during interviews. Our program needs to reflect that reality and better prepare students for these events.
4. Fine tune the program outcome to produce more actionable data for the program. Ideally, our measurement data should indicate:
   1. If students are achieving the program key outcomes and where we need to improve
   2. If our key outcomes are the correct ones
5. Continuously reflect on the concepts, skills, and technology mastery required in the high-tech industry and ensure our program aligns with these needs.

**II. PRIOR YEAR DATA ANALYSIS & PROPOSED PROGRAMIC CHANGES**

**WRITING INITIATIVE**

For your Writing Across the Disciplines (Writing Initiative) data, provide a BRIEF summary and analysis of the data presented in the Assessment Data Report.

During F2020, CSC2300 and CSC4350 Students were evaluated on the following:

1. Writing samples were collected during CSC2300 (Computer Architecture) on Computer Technology’s impact on society.
2. Writing samples were collected via a major paper on during CSC4350 (Software Engineering) on software engineering ethics.
3. **REFLECTION UPON DATA DEMONSTRATING ACHIEVEMENT OF WRITING** – Did your students demonstrate expected growth from the lower level to the upper level writing-intensive courses you assessed? Did students perform equally well on each element of the University rubric for writing? If not, what is your assessment of factors contributing to the differences?

Based on the data collected, students seem to show good growth in all 4 writing criteria.

1. **REFLECTION UPON ACHIEVEMENT OF WRITING OUTCOMES ACROSS PROGRAM LOCATIONS AND INSTRUCTIONAL MODALITIES –** Did students perform equally well on each element of the University rubric for writing across campus locations (Aurora, Woodstock, GWC) and instructional modality (On-Ground, Online)? If not, what is your assessment of factors contributing to the differences?

N/A

1. **PROPOSED PROGRAM/CURRICULAR CHANGES RELATED TO WRITING** - Changes you plan to make to your curriculum, teaching methods, or course assignments to improve this learning outcome, as well as when these changes will be implemented.

The writing assignment in CSC4350 (ethics paper) was a good writing assignment but it caused the course to drift too far from its main outcomes. As a result, students demonstrated deficiencies in other areas critical to the CSC4350 and the overall curriculum. For example, during CSC4990 (Capstone) students had trouble developing requirements and test plans. We should consider changing this writing assignment to something more central to the course.

1. **REFLECTIONS ON EVIDENCE OF EFFICACY OF PRIOR PROGRAM/CURRICULAR CHANGES (N/A for 2020-2021 – will be applicable for 2021-2022)**

N/A

**UNIVERSITY LEARNING OUTCOMES**

For each of the other University Learning Outcomes (Critical Thinking & Oral Communication), provide a BRIEF summary and analysis of the data presented in the Assessment Data Report.

Data for critical thing and oral communication outcomes where collected as follows:

1. Oral communication assessments were done during final project presentations for the Capstone CSC4900 course.
2. Critical thinking is data was gathered via a question on final exam for CSC36600. While the problem requires critical thinking to analyze and solve it, applying the rubric is an awkward fit. Students don’t need to explain their selections, they just need to properly analyze
3. **REFLECTION UPON DATA DEMONSTRATING ACHIEVEMENT OF UNIVERSITY LEARNING OUTCOMES** – Did students perform equally well on each element of the University rubrics? If not, what is your assessment of factors contributing to the differences?

Yes, overall the students performed well on critical thinking and oral communication.

1. **REFLECTION UPON ACHIEVEMENT OF UNIVERSITY LEARNING OUTCOMES ACROSS PROGRAM LOCATIONS AND INSTRUCTIONAL MODALITIES –** Did students perform equally well on each element of the University rubrics across campus locations (Aurora, Woodstock, GWC) and instructional modality (On-Ground, Online)? If not, what is your assessment of factors contributing to the differences?

N/A

1. **PROPOSED PROGRAM/CURRICULAR CHANGES RELATED TO UNIVERSITY LEARNING OUTCOMES** - Changes you plan to make to your curriculum, teaching methods, or course assignments to improve these learning outcomes, as well as when these changes will be implemented.

Overall Students performed well on these learning outcomes. Critical thinking and effective communication are an important part of the university and CSC overall outcomes. Because of the nature of the CSC discipline, critical thinking is well represented throughout the curriculum. Computer Science needs to continue to strengthen verbal outcomes in the required courses. In particular:

1. During CSC4990, we should add more instruction on verbal communication and the expectations of verbal reports.
2. **REFLECTIONS ON EVIDENCE OF EFFICACY OF PRIOR PROGRAM/CURRICULAR CHANGES**

N/A

**GENERAL EDUCATION LEARNING OUTCOMES**

If your program taught any courses eligible to award General Education distribution credit, provide a BRIEF summary and analysis of the data presented in the Assessment Data Report for each distribution category / course combination.

1. **REFLECTION UPON DATA DEMONSTRATING ACHIEVEMENT OF GENERAL EDUCATION LEARNING OUTCOMES** – Did students perform equally well on each element of the University rubrics? If not, what is your assessment of factors contributing to the differences?

N/A

1. **REFLECTION UPON ACHIEVEMENT OF GENERAL EDUCATION LEARNING OUTCOMES ACROSS PROGRAM LOCATIONS AND INSTRUCTIONAL MODALITIES –** Did students perform equally well on each element of the University rubrics across campus locations (Aurora, Woodstock, GWC) and instructional modality (On-Ground, Online)? If not, what is your assessment of factors contributing to the differences?

N/A

1. **PROPOSED PROGRAM/CURRICULAR CHANGES RELATED TO GENERAL EDUCATION LEARNING OUTCOMES** - Changes you plan to make to your curriculum, teaching methods, or course assignments to improve these learning outcomes, as well as when these changes will be implemented.

N/A

1. **REFLECTIONS ON EVIDENCE OF EFFICACY OF PRIOR PROGRAM/CURRICULAR CHANGES (N/A for 2020-2021 – will be applicable for 2021-2022)**

N/A

**PROGRAM LEARNING OUTCOMES**

For each Program Learning Outcome in the Program Assessment Plan, provide a summary and analysis of the data presented in the Assessment Data Report.

\*Please identify one or more learning outcomes as targets for improvement / further development in the coming year and describe your plans for promoting improved achievement of that learning outcome / those learning outcomes in the coming year.

**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. **NARRATIVE SUMMARY FOR OUTCOME 1** – Describe what the data tell you about your students’ achievement of this learning outcome. Did the students’ learning improve from pre-test to post-test / did the student demonstrate achievement of a pre-set benchmark? Did students perform equally well on each element or dimension of this learning outcome? Did students improve relative to performance in previous years? What do you attribute improvements and shortfalls to? Ideally, the cause attributed to performance improvements should be strengthened and sustained, while the cause attributed to performance shortfalls should be the target for change.

The data for this metric was not available at the time of this writing.

1. **REFLECTION UPON ACHIEVEMENT OF OUTCOME 1 ACROSS PROGRAM LOCATIONS AND INSTRUCTIONAL MODALITIES –** Did students perform equally well on each element of the University Learning Outcomes, across campus locations (Aurora, Woodstock, GWC) and instructional modality (On-Ground, Online)? If not, what is your assessment of factors contributing to the differences?

**N/A**

1. **REFLECTION ON THE IMPACT OF PRIOR YEAR CHANGES RELATED TO OUTCOME 1** - If any changes were proposed, did they lead to improvement in student learning outcomes? If improvements were demonstrated, how will you ensure the changes you made are sustained? If no gains were demonstrated, reflect upon the reasons why the changes were not successful and propose an alternative strategy or explain why action is no longer necessary.

N/A

1. **PROPOSED NEW CURRICULAR/PEDAGOGICAL CHANGES RELATED TO OUTCOME 1:**

* Describe the programmatic changes (curriculum, teaching methods, learning materials, and/or assignments) planned for the coming academic year.
* Specify the date/semester that the changes will be implemented.
* Identify the responsible parties.
* Describe how and when this outcome/element will be reassessed to evaluate the efficacy of the changes.

There are no changes based on this metric and lack of data.

1. **PROPOSED CHANGES IN ASSESSMENT RELATED TO OUTCOME 1** - (Do you see any changes needed in the learning outcome or in the ways in which achievement of the outcome is measured based on your use of the previous year’s program assessment plan? What types of changes do you plan to make in response to these observations?)

This PO is actually 2 program outcomes combined into one. We should consider simplifying and defining a more specific PO directed at the outcome we need to achieve. Also, the metric should not be gathered at the group level.

**OUTCOME 2**

|  |  |  |
| --- | --- | --- |
| Collaboration/Communication | 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 |

1. **NARRATIVE SUMMARY FOR OUTCOME 2** – Describe what the data tell you about your students’ achievement of this learning outcome. Did the students’ learning improve from pre-test to post-test / did the student demonstrate achievement of a pre-set benchmark? Did students perform equally well on each element or dimension of this learning outcome? Did students improve relative to performance in previous years? What do you attribute improvements and shortfalls to? Ideally, the cause attributed to performance improvements should be strengthened and sustained, while the cause attributed to performance shortfalls should be the target for change.

The CSC4990 indicates the teams were effective and individuals communicated well. The data appears in line with previous years.

1. **REFLECTION UPON ACHIEVEMENT OF OUTCOME 12 ACROSS PROGRAM LOCATIONS AND INSTRUCTIONAL MODALITIES –** Did students perform equally well on each element of the University Learning Outcomes, across campus locations (Aurora, Woodstock, GWC) and instructional modality (On-Ground, Online)? If not, what is your assessment of factors contributing to the differences?

**N/A**

1. **REFLECTION ON THE IMPACT OF PRIOR YEAR CHANGES RELATED TO OUTCOME 2** - If any changes were proposed, did they lead to improvement in student learning outcomes? If improvements were demonstrated, how will you ensure the changes you made are sustained? If no gains were demonstrated, reflect upon the reasons why the changes were not successful and propose an alternative strategy or explain why action is no longer necessary.

N/A

1. **PROPOSED NEW CURRICULAR/PEDAGOGICAL CHANGES RELATED TO OUTCOME 2:**

* Describe the programmatic changes (curriculum, teaching methods, learning materials, and/or assignments) planned for the coming academic year.
* Specify the date/semester that the changes will be implemented.
* Identify the responsible parties.
* Describe how and when this outcome/element will be reassessed to evaluate the efficacy of the changes.

More instruction should be provided on the effective communication during S2021 Capstone. This material should include examples of effective communication, review of communication techniques and discussion on how presentations will be evaluated. The rubric should be reevaluated to improve its quality. If we continue to measure effective teams, we should consider including material that support this outcome.

1. **PROPOSED CHANGES IN ASSESSMENT RELATED TO OUTCOME 2** - (Do you see any changes needed in the learning outcome or in the ways in which achievement of the outcome is measured based on your use of the previous year’s program assessment plan? What types of changes do you plan to make in response to these observations?)

While the overall data for this PO looks good, this PO is actually 2 program outcomes combined into one. We should consider simplifying and defining a more specific PO directed at the outcome we need to achieve.

**OUTCOME 3**

|  |  |  |
| --- | --- | --- |
| Develop solution | 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. |

**A. NARRATIVE SUMMARY FOR OUTCOME 3** – Describe what the data tell you about your students’ achievement of this learning outcome. Did the students’ learning improve from pre-test to post-test / did the student demonstrate achievement of a pre-set benchmark? Did students perform equally well on each element or dimension of this learning outcome? Did students improve relative to performance in previous years? What do you attribute improvements and shortfalls to? Ideally, the cause attributed to performance improvements should be strengthened and sustained, while the cause attributed to performance shortfalls should be the target for change.

The data collected shows that these metrics are in line with past measurements.

1. **REFLECTION UPON ACHIEVEMENT OF OUTCOME 12 ACROSS PROGRAM LOCATIONS AND INSTRUCTIONAL MODALITIES –** Did students perform equally well on each element of the University Learning Outcomes, across campus locations (Aurora, Woodstock, GWC) and instructional modality (On-Ground, Online)? If not, what is your assessment of factors contributing to the differences?

**N/A**

1. **REFLECTION ON THE IMPACT OF PRIOR YEAR CHANGES RELATED TO OUTCOME**  3 If any changes were proposed, did they lead to improvement in student learning outcomes? If improvements were demonstrated, how will you ensure the changes you made are sustained? If no gains were demonstrated, reflect upon the reasons why the changes were not successful and propose an alternative strategy or explain why action is no longer necessary.

N/A

1. **PROPOSED NEW CURRICULAR/PEDAGOGICAL CHANGES RELATED TO OUTCOME 23:**

* Describe the programmatic changes (curriculum, teaching methods, learning materials, and/or assignments) planned for the coming academic year.
* Specify the date/semester that the changes will be implemented.
* Identify the responsible parties.
* Describe how and when this outcome/element will be reassessed to evaluate the efficacy of the changes.

Based on this data no changes.

1. **PROPOSED CHANGES IN ASSESSMENT RELATED TO OUTCOME 3** - (Do you see any changes needed in the learning outcome or in the ways in which achievement of the outcome is measured based on your use of the previous year’s program assessment plan? What types of changes do you plan to make in response to these observations?)

While the overall data for this PO looks good, this PO is actually 4 program outcomes combined into one. We should consider simplifying and defining a more specific PO directed at the outcome we need to achieve.

**OUTCOME 4**

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| Ethics and continuous learning | 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. |

**A. NARRATIVE SUMMARY FOR OUTCOME 4** – Describe what the data tell you about your students’ achievement of this learning outcome. Did the students’ learning improve from pre-test to post-test / did the student demonstrate achievement of a pre-set benchmark? Did students perform equally well on each element or dimension of this learning outcome? Did students improve relative to performance in previous years? What do you attribute improvements and shortfalls to? Ideally, the cause attributed to performance improvements should be strengthened and sustained, while the cause attributed to performance shortfalls should be the target for change.

The data collected shows that these metrics are in line with past measurements.

1. **REFLECTION UPON ACHIEVEMENT OF OUTCOME 12 ACROSS PROGRAM LOCATIONS AND INSTRUCTIONAL MODALITIES –** Did students perform equally well on each element of the University Learning Outcomes, across campus locations (Aurora, Woodstock, GWC) and instructional modality (On-Ground, Online)? If not, what is your assessment of factors contributing to the differences?

**N/A**

1. **REFLECTION ON THE IMPACT OF PRIOR YEAR CHANGES RELATED TO OUTCOME 4.**  If any changes were proposed, did they lead to improvement in student learning outcomes? If improvements were demonstrated, how will you ensure the changes you made are sustained? If no gains were demonstrated, reflect upon the reasons why the changes were not successful and propose an alternative strategy or explain why action is no longer necessary.

N/A

1. **PROPOSED NEW CURRICULAR/PEDAGOGICAL CHANGES RELATED TO OUTCOME 23:**

* Describe the programmatic changes (curriculum, teaching methods, learning materials, and/or assignments) planned for the coming academic year.
* Specify the date/semester that the changes will be implemented.
* Identify the responsible parties.
* Describe how and when this outcome/element will be reassessed to evaluate the efficacy of the changes.

The data seems to show consistent in student performance. The measurement method was changed though this year with the ethics paper.

1. **PROPOSED CHANGES IN ASSESSMENT RELATED TO OUTCOME 4** - (Do you see any changes needed in the learning outcome or in the ways in which achievement of the outcome is measured based on your use of the previous year’s program assessment plan? What types of changes do you plan to make in response to these observations?)

While the overall data for this PO looks good, this PO is actually 3 program outcomes combined into one. We should consider simplifying and defining a more specific PO directed at the outcome we need to achieve.

**III. ASSESSMENT PLAN FOR LEARNING OUTCOMES – UPDATED AS NEEDED**

**UNIVERSITY LEARNING OUTCOMES**

Aurora University assesses 3 University Outcomes - Effective Communication (represented as both Writing and Oral Communication for undergraduate students and represented as Writing for graduate students) and Critical Thinking – using the University’s Undergraduate / Graduate Assessment Rubrics.

1. Identify and describe the assignment(s) utilized to measure Writing. INCLUDE both the lower-level Writing Across the Disciplines / Writing Initiative class and the upper-level class.

See table below.

1. Identify and describe the assignment(s) utilized to measure Critical Thinking.

See table below.

1. Identify and describe the assignment(s) utilized to measure Oral Communication.

See table below.

1. Indicate when / by whom these assignments are collected and rated using the University Assessment Rubrics.
2. If any variations exist across locations or modalities, please specify.

|  |  |  |  |
| --- | --- | --- | --- |
| Category | Item | Course/Semester | How collected |
| GenEd Writing | Identify and describe the assignment(s) utilized to measure Writing | 1. CSC2200/F2021 2. CSC4350/F2021 | 1. CSC2300 – Students will analyze the impact of computer architecture in 1 area of society.  2. CSC4350 – Students will analyze and write a requirements document for a project |
| GenEd Critical Thinking | Identify and describe the assignment(s) utilized to measure Critical Thinking. | CSC3660/F2021 | A final exam problem will be used for CSC3660 that requires students to:   1. Analyze a problem and identify the correct data structure. Explain why that data structure was selected that clearly explains the rationale for using it. 2. Properly using that data structure to solve a problem that shows the a complete and effective solution |
| GenEd Oral Communication | Identify and describe the assignment(s) utilized to measure Oral Communication. | CSC4990/S2021 | A specific oral report will be required for a specific prompt that prepares students for interviews. For example, “Tell me about yourself”. |

**GENERAL EDUCATION LEARNING OUTCOMES**

1. Identify classes within your program eligible for General Education distribution credit; identify the distribution cluster / learning outcome for each class

N/A

1. Identify and describe the assignment(s) utilized to measure each General Education learning outcome for which your program has a class approved.

N/A

1. If any variations exist across locations or modalities, please specify.

N/A

**PROGRAM LEARNING OUTCOMES**

1. Specify the learning outcomes for your program (state each learning outcome).

Based on this analysis the POs for the CSC program need to be streamlined into the following table shown below.

1. Explain how each one of these outcomes is aligned with your program’s mission.

See table below

1. For each program learning outcome, complete a description or a table that specifies how each learning outcome is assessed. For each learning outcome, include the following information. If any variations in measurement exist across campuses / locations or modalities, please specify.

* The nature of the information gathered to support assessment of the outcome (e.g. written assignment, a speech or presentation, a role play, a performance or product, performance on a competency test, etc.). Indicate if more than one source of information is used.
* From whom the information is gathered (or in what setting, such as a specific class).
* At what time periods the information is gathered (e.g. pre-test and post-test, at the end of each semester, at the end of spring semester, at the end of the academic year in both junior and senior years, etc.).
* By whom the information is gathered and by whom it is assessed. Be certain to capture all program locations and instructional modes.
* How the information is assessed for indicators of achievement of the learning outcome (e.g. a rubric, score on a competency test, an observation checklist, etc.).
* If a rubric, test, checklist, or other instrument/measure is used, attach a copy.
* If there are any instruments you use that assess aspects of your program other than learning outcomes (such as student satisfaction with the program), list those separately and attach.

See table below for assessment methods.

1. How do you, as a School, Department, or Program collectively evaluate the data gathered using these practices and communicate results?

The professor teaching the specific course will be responsible for gathering and summarizing the data.

1. How/when do you make improvements based on your evaluations of the assessments of learning outcomes?

The assessment process will be analyzed and improved upon annually.

1. How do you archive the data collected, analyses of those data, and a record of review of findings and changes made over the course of multiple years?

We will use a CSC shared drive.

NOTE: Assessment data spreadsheets, along with examples of student work artifacts, will be loaded to a Moodle page created by Assessment Directors / Academic Affairs for archiving of assessment-related data.

Based on this analysis, the CSC program outcomes should be streamlined to better direct our program’s focus.

|  |  |  |
| --- | --- | --- |
| **Item** | **How Measured** | **Collection Item** |
| PO1: Create and evaluate applied solutions to computing problems | This outcome should be measured during CSC3660   1. CSC3660 – Students need to demonstrate mastery of a problem that requires them to identify the proper data structure to use, justify its rationale, and solve a programming problem. | 1. Rubric CSC3660 |
| PO2 – Work effectively on a team to solve programming problems | This outcome is best measured during CSC4990. Students need to demonstrate that a team of 2-4 students can:   1. Create an effective development process with source control, task board and sprints 2. Solve a software problem of appropriate size 3. Effective engage all members in significant work | 1. CSC4990 Final project rubric |
| PO3: Create efficient designs and architectures | This outcome is best measured by a database design:   1. During CSC4500, students need to create a data model for a data that includes at least 1 many-to-many, 1 many to one and 2-3 other tables. | 1. CSC4990 database design problem rubric |
| PO4: Mastery of state-of-the-art technologies and tools | During CSC4350, students need to learn a web application framework and demonstrate mastery of that framework with a problem on the final exam. | 1. CSC4350 Final Exam Rubric |

**III. EXECUTIVE SUMMARY REGARDING CONTINUOUS IMPROVEMENT**

1. **Summary of reflection upon data-based changed to promote improved student learning in the previous year.**

Several changes were made in the last years that include the following:

|  |  |
| --- | --- |
| Course | Change / Reflection |
| CSC1700 | The course has moved from Java to Python  We still don’t know the impact of this change. While is does seem to improve student’s ability to transfer, the change is likely to impact outcomes in the later courses (CSC2660 and CSC3660). In addition, we continue to rely on several different instructors to teach this course. Last year there were 4 CSC1700 sections and 4 different instructors and each had a different style of final exam. For example, 1 required a dictionary and file I/O problem, another required a conditional and array problem, still another required a dictionary only problem, and the last 1 required no programming at all.  As such, it may make sense to develop more standardize material and clearer outcomes for this course. |
| CSC2200 | A change was made to require a student project instead of smaller individual assignments.  Including a student project in this course was effective and it provides students opportunities to learn more deeply and showcase their skills. Still the course struggled to make its last outcome topic effectively (using AJAX). The course should be reviewed this summer to streamline it to try to:   1. Better support the project 2. Get to its ultimate outcome (AJAX) or eliminate it. |
| CSC4350 | An additional writing assignment was added (ethics paper). The course was streamlined to learn and apply a specific web application framework to develop a project with it.  The ethics paper took the course too far away from core outcomes. This paper should be replaced with a requirements document. Material added for the web application framework was effective but needs refinement to make better than its initial development. |
| CSC4990 | This course added activities to support readiness to graduate that included:   1. Exercises to review content from entire CSC curriculum 2. A new requirement to learn and master a new technology   The review exercises were good but represent a small percentage of student grades. As such, some students did not put in enough work on them. We need to think through this strategy and determine if there is a better way to encourage the outcome of making students better prepared for technical interviews. |

1. **Summary of anticipated changes, based on review of data, to promote improved student learning in the coming year.**

This report recommends simplifying the CSC program outcomes to the following 4 (instead of effectively 11). The following table shows how each of the 8 CSC required courses contribute to these outcomes. Each course is rated with the following scale:

L - The course does not contribute to the PO

M - The course should provide some contribution to the PO

H - The course should be a major contributor to the PO

The following table shows how each core curriculum course contributes to these POs. Courses that collect assessment data are highlighted in yellow.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course** | **CSC1700** | **CSC2200** | **CSC2300** | **CSC2660** | **CSC3660** | **CSC4350** | **CSC4500** | **CSC4990** |
| PO1 - Create and evaluate applied solutions to computing problems | H | H | L | H | H | H | H | H |
| PO2: Work effectively on a team to solve programming problems | L | L | L | L | L | H | H | H |
| PO3: Create efficient software designs and architectures | M | M | L | M | H | M | H | H |
| PO4: Mastery of state-of-the-art technologies and tools | M | H | L | M | M+ | H | H | H |
| Gen Ed Critical Thinking | H | H | H | H | H+ | H | H | H |
| Gen Ed Writing | L | L | H | L | L | H | L | M |
| Gen Ed Oral Communication | L | L | L | L | L | H | H | H |

Based on our formal and informal data, our program has topic deficits in the following areas:

1. ***Problems Solving*** - Based on exam scores and interviews with recent graduates, about 25-33% of our graduates have trouble solving programming problems required at technical interviews.
2. ***Object Oriented Design Patterns*** – This topic is currently not part of our core curriculum and is taught in the elective CSC4100.
3. ***The 4 pillars of Object Oriented Programming*** (abstraction, inheritance, polymorphism, and encapsulation) – This topic briefly in CSC2600 and currently only taught in-depth in the elective CSC4100.
4. ***Test Driven Development (TDD) –*** This topic is currently part of the elective CSC3510.
5. ***DevOps -*** This topic is currently part of the elective CSC3510.
6. ***Operating Systems -*** This required topic in most curriculums is only taught in our elective CSC3100.
7. ***Programming Language Breadth –*** Our graduates complete our programming knowing Python, JavaScript, Java and SQL. As such, many are likely missing appreciation for other languages in high demand such as C, C++, C# and PHP.
8. ***Portfolio Level Projects –*** Currently only CSC2200 is requires students to complete an individual portfolio level project. CSC2300, CSC4500, CSC4310 and CSC4990 all require group projects. It may make sense to review these projects to ensure they are effective and not allowing some students to pass through the curriculum using the efforts of more active teammates.

Since our core curriculum courses are critical, we should reflect on these courses, and seek to continuously improve ensure they include technologies, concepts, and skills in-demand by the high-tech industry that changes quickly. While it is not clear how many of these efforts we can complete over a short summer, the reflection is provided to analyze the current issues, and provide some direction, and guidance to our annual efforts.

|  |  |
| --- | --- |
| **Course** | **Reflection/Anticipated changes** |
| CSC1700 | With 4 different instructors last year, it may make sense to standardize some of the course. We should at least investigate how other majors are handing introductory level course with several adjunct instructors. It may make sense to measure how effectively this course is contributing to student’s overall problem solving abilities. |
| CSC2200 | Now that this course requires a project, the course material should be reviewed to center it more on core outcomes. This course could continue reworking parts of it to reduce content on HTML/CSS and including more JavaScript code. This change would be made for these rationale:   1. Better support PO#1 by requiring more work on programming fundamentals as applicate to web application development. 2. Better support the project now required in the course.   This is the course description from the AU Catalog.  ***This course is an introduction to web-based software development focusing on clientside web technologies to build dynamic and robust websites. Topics include HTTP protocols, PHP, HTML, CSS, JavaScript and AJAX. Programming is required.***  When compared to other CSC curricula this is a fairly unusual course since it emphasizes only client-side programming and only requiring 1 programming course (CSC1700). This low prerequisite, means the course pace is slower than it should be and it is why it struggles to make its last topic (AJAX). Without this outcome, students may miss a major in-demand technology and architecture.  Thought is needed to analyze if CSC2200 should have additional programming prerequisites and outcomes or if it should be a 3000 level course that teaches both client and server side programming. |
| CSC2300 | With a more focused set of POs, we should review this course to determine if and how it contributes to the curriculum’s POs. The course could be reviewed to determine its overall impact on the curriculum’s POs. As it stands now, its main PO contributions are towards the GenEd requirements and a hardware oriented group project that requires little original Python programming. |
| CSC2660 | The CSC curriculum assessment identified this course as a low performance. The course content, syllabus needs to be reviewed for this course to ensure it is on track and gaining the proper OOP outcome. The course description appears to be out-of-date and emphasizes graphic user interfaces that do not run over the World Wide Web (WWW).  ***This course is a continuation of CSC1700, with a focus on advanced object-oriented programming techniques including event-driven programming and advanced graphical user interfaces. Topics include encapsulation, polymorphism, persistence, inheritance, exceptions, and recursion***.  The current course emphasizes using GUIs with a technology called JavaFX. In the last 4-5 years Oracle has stopped development on JavaFX and unbundled it from the Java programming language. In parallel with that effort, employers are not looking for developer with JavaFX skills. Instead employers are increasingly using the WWW for such interfaces. For example, a search for JavaFX jobs in indeed.com in the Chicago area yielded only 1 job that mentions JavaFx (as a minor need). A search for REST (a major web development architecture) yielded 3,164.  Perhaps as an alternative, the AU Catalog should emphasize the object oriented outcomes of the course since these concepts are clear in the course description but not emphasized.  ***This course is a continuation of CSC1700, with a focus on object-oriented programming techniques. Topics include OO modeling, abstraction, encapsulation, polymorphism, inheritance, design patterns and problem solving using exceptions, and event driven programming.***  As such, the course could still include some GUI programming but the emphasis should be on object oriented programming, OO design and concepts. In particular students should be able to identify and use the 4 pillars of OOP and at least 2 Object Oriented design patterns. |
| CSC3660 | This is a vital core curriculum course, since many common technical interview questions from come it. As such, makes sense to review course material to determine:   1. Can additional outcomes be achieved using additional key technologies (such as integrating Test Driven Development)? 2. Should a project be part of this course? If so, should the project introduce REST architecture or JavaFX? 3. Can the course better emphasize key learnings such as algorithms analysis and graphs? |
| CSC4350 | The CSC4350 new material (regarding web application frameworks) needs to be reviewed and refined. In addition, work is needed to support a change from the Ethics paper to the requirements paper. This change will support recent curriculum changes and refinement and hopefully improve outcomes in student’s ability to secure jobs.  A question should be asked if the new version of CSC4350 is correct. On the positives it:   1. Introduces into our curriculum a web application framework with a specific example of using the REST architectural pattern. This technology has been critically absent from our curriculum. 2. It provides students their first solid project for their portfolio. 3. It covers the entire Software Development Lifecycle (SDLC) including requirements, risk, development, test, deployment and project management.   On the negatives it:   1. Is not able to discuss advanced OO techniques 2. Does not discuss proper use of inheritance and encapsulation 3. It does not have time to go into depth about proper user testing techniques such as Test Driven Development. 4. It strains to cover topics such as code quality, static code analysis and project management.   Here is its catalog course description:  ***This course is an introduction to software engineering concepts and the role of project management, in conjunction with advanced object-oriented programming techniques. The course will provide an in-depth look at architectural design, application modeling, time and risk management, unit and user testing, proper use of inheritance and encapsulation, and discussions on aspects of code quality, design, and efficiency.***  Note that some of this tension was brought when Software Engineering was introduced as an AU major and then removed a year later. This change introduced two additional courses such as CSC4100 (Systems Analysis and Design) and CSC3510 (Software Testing) that replicated a subset of CSC4350. For example, note how the course description of CSC4100 overlaps with CSC4350 in the areas of object oriented design, testing, code quality.  ***Methods and techniques to analyze, design, and develop software applications. Topics include working with project stakeholders, design patterns and modeling, object oriented design, test driven development, clean code development and designing for qualities such as performance, safety, security, reliability, reusability, and maintainability.***  As it stands now, CC3510 and CSC4100 are electives that contain material that are important outcomes for CSC graduates. Students who complete other non-core electives (such as robotics, mobile development, or linux admin) will miss these outcomes and likely have a harder time finding work. We need to sort out this curriculum issue. |
| CSC4500 | The CSC curriculum assessment identified this course as a low performance. In addition, this course will have a new metric. The course content, syllabus needs to be reviewed for this course to ensure it is on track. This course may have strayed from its core outcomes.  Here is its course description:  ***This course will address the design and implementation of relational databases in conjunction with Java-based applications. Emphasis will be on data-modeling techniques, such as ER modeling, database normalization and optimization, relational algebra, SQL, functional dependency, security, stored procedures, and transaction management. Projects will include the design of a complete database with basic application interaction.***  As the course stands now, there are 3 areas of concern:   1. Students learn SQL well enough to be able to demonstrate this knowledge during technical interviews 2. Students learn and are able to demonstrate proper database design (through ER modeling, normalization and optimization). 3. Students gain a proper project to add to their portfolio of work.   More work is needed to analyze this course against these key outcomes and make improvements. |
| CSC4990 | It seems clear that adding the additional requirement to learn and apply a new technology and review key curriculum concepts are important additions to this course. We should consider adding these outcomes to the course description that currently only mentions working in a project:  ***This course involves a team-based design and development of a large-scale application from conception to deployment. The team will function as a complete software development group; beginning with requirements gathering from external users, to modeling and architecting the application, to implementation, and concluding with user acceptance testing. The course is based on the culmination of knowledge and skills of the students, in an effort to simulate a real-world application development scenario***.  Beyond thinking through the course description, additional material is needed to support:   1. Effective teamwork 2. Effective communication 3. Review of key curriculum concepts including a syllabus review to determine if enough emphasis is provided for the review exercises that include oral communication and other CSC concepts and problem solving skills important for student success in job interviews. |