

**Institutional Effectiveness
2022-2023**

Program: Computer Science MS

College and Department: College of Engineering, Department of Computer Science

Contact: Gerald Gannod

Mission:

Our mission is to be widely recognized for enabling students to have a global impact through innovative and quality programs, through research that emphasizes collaborative partnerships, and by enabling the success of a diverse student, faculty, and alumni community.

Attach Curriculum Map (Educational Programs Only): *See Appendix 1.

PG 1: BREADTH AND DEPTH OF KNOWLEDGE

Define Outcome:

PG 1: The student should gain a breadth of knowledge in the discipline and depth in the specific area of his/her specialization.

Assessment Methods:

Graduating GPA - Since our curriculum requires both breadth and depth, we believe a GPA of 3.5 or higher at the time of graduation demonstrates success in these areas. We will track the proportion of students with at least a 3.5 graduating each school year. Our target percentage is at least 70%. We will use this metric to evaluate not only the effectiveness of instruction, but also the quality and background of students accepted into the program, which may result in refinement of the acceptance criteria and process.

Criteria for Success (Thresholds for Assessment Methods):

The student should achieve at least a 3.5 GPA in breadth of knowledge in the discipline and depth in the specific area of his/her specialization.

Results and Analysis:

	<u>2017-18</u>	<u>2018-19</u>	<u>2019-20</u>	<u>2020-21</u>	<u>2021-2022</u>	<u>2022-2023</u>
Number of graduates	7	10	16	12	21	21
% with at least 3.5	71.43%	100%	93.75%	83.33%	86%	90.4

Over the last **six** years, we have been able to reach our targeted percentage of **70%**. For the **2022-2023** academic year, **6** students achieved a 4.0 GPA. In addition, the average breadth GPA was **3.69** and the average depth GPA was **3.87**.

For the **2022-2023** academic year, the results are similar to the rest of the College of Engineering, but with a much larger number of graduates:

Major 3.5	Number of graduates	% with at least
Civil and Environmental Engineering	11	82%
Chemical Engineering	2	50%
Electrical and Computer Engineering	6	83%
Engineering Management	6	67%
Mechanical Engineering	6	50%

Use of Results to Improve Outcomes:

No actions were taken during the planning year designed to impact performance, and no new actions are occurring in the next planning year.

PG 2: GRADUATES WILL MENTOR GRADUATE STUDENTS, UNDERTAKE RESEARCH, AND PUBLISH THEIR WORK

Define Outcome:

PG 2: Graduates of the program, who go into academia, will mentor graduate students, undertake research, and/or publish their work in peer-reviewed journals and conferences.

Assessment Methods:

Provide evidence of former graduate students' mentoring and research

accomplishments: Students who go into academia and do research will produce various forms of accomplishments: mentor students, research, grants, publish papers, etc. To capture this information, information from these student's academic websites will be collected to include the following: number of graduate students mentored; number of external research grants as PI or co-PI; and number of peer-reviewed publications.

Criteria for Success (Thresholds for Assessment Methods):

This is the first time we had started collecting this information. As such, thresholds for each of the following will be set to equal to the number of students that go into academia, which at this time is unknown (because it has never been collected in the past):

- number of graduate students mentored
- number of external research grants as PI or co-PI
- number of peer-reviewed publications

Results and Analysis:

	<u>2017-18</u>	<u>2018-19</u>	<u>2019-20</u>	<u>2020-21</u>	<u>2021-2022</u>	<u>2022-2023</u>
Number of graduates	7	10	16	12	21	21
% with publication or presentation	57.14%	70%	68.75%	66.7%	66.7%	61.9%

The number of students engaged in publications and/or presentations of conference/journal research papers has been fairly consistent over the last **six** years. In addition, many of the students had more than one publication – which is quite an achievement given that it is not required to get an MS degree.

Use of Results to Improve Outcomes:

No actions were taken during the planning year designed to impact performance, and no new actions are occurring in the next planning year.

SLO 1: DEMONSTRATE KNOWLEDGE OF TECHNIQUES, METHODS, AND DISCIPLINES

Define Outcome:

SLO 1: The student should demonstrate knowledge of the techniques, methods, and disciplines of computer science research.

Assessment Methods:

Score on Oral Defense and Thesis/Project Assessment Form –Thesis/Project presentations and reports provide evidence of student research and communication skills. At an M.S. student's defense (thesis and project only), committee and audience members submit an Oral Defense and Thesis/Project Assessment Form. These results are tabulated and stored on the MS Teams server each semester. Each area of evaluation is on a scale of 1 to 4, with 4 being excellent, 3 being good, 2 being an area that could use improvement, and 1 being a weak evaluation.

Criteria for Success (Thresholds for Assessment Methods):

We have set our desired level of attainment at 3.0 (good) for each area.

Results and Analysis:

In order to collect more detailed data related to student learning, an Oral Defense and Thesis/Project Assessment Form was implemented in Spring 2021. A copy of the form can be found in Appendix 2. Results from the **2022-2023** academic year can be found below. **12** students were evaluated.

Area	Average
Mastery of basic principles	3.80
Advanced problems in their chosen specializations	3.72
Oral presentation	3.46
Quality of written English	3.46
Technical writing content	3.32

These scores were significantly better than the previous academic year, albeit the previous academic year had a much smaller sample size (only **3** students were evaluated last year). But, given the stellar publication record of our MS students, it is not surprising that our students are getting better at presenting and writing.

Use of Results to Improve Outcomes:

No actions were taken during the planning year designed to impact performance, and no new actions are occurring in the next planning year.

SLO 2: PROGRESS AND GRADUATE**Define Outcome:**

SLO 2: The student should progress and graduate in a timely fashion.

Assessment Methods:

Time to degree completion - Timely graduation is important for students and for the responsible use of department resources. Students going beyond 2.5 years for their M.S. should be an exception. Note that we use the 2.5-year measure due to the fact that many graduate students defend late in their intended semester of graduation and will miss the defense deadline for graduation. As such, while a student successfully defends their thesis or project in one semester, they are listed as a graduate of the following semester. We will use this metric to determine the process for matriculating students through the program, including the clarification of key milestones and periodic demonstrations of progress.

Criteria for Success (Thresholds for Assessment Methods):

Our desired level of attainment is 80% graduating within 2.5 years. We are NOT including direct-admit PhD students who are also pursuing their M.S. degree because their timeline can be very different.

Results and Analysis:

	<u>2017-18</u>	<u>2018-19</u>	<u>2019-20</u>	<u>2020-21</u>	<u>2021-2022</u>	<u>2022-2023</u>
Number of graduates[1]	7	10	16	11	15	19
% completing degree in 2.5 years or less	57.1%	100%	87.5%	81.8%	88%	100%

Since **2017**, only **10** of the **78** graduates (**12.8%**) were unable to complete the degree in 2.5 years or less, and for 2022-2023, **all** MS-only students (not counting direct-admit-to-PhD who went for their MS along the way) graduated in 2.5 years or less. Again, we were able to meet our percentage expectations for the **sixth** year in a row. We should consider raising our expectations for this goal in **2023-2024**.

Some students have been removed from this SLO because as stated earlier, we are not counting direct-admit-to-PhD students who happen to get their Masters along the way, and thus their timeline is different from typical Masters students.

Use of Results to Improve Outcomes:

No actions were taken during the planning year designed to impact performance, and no new actions are occurring in the next planning year.

Summative Evaluation:

The CSC Department has in place a framework/process for the continual improvement of the MS program to ensure its learning outcomes are met and that the outcomes are themselves updated as necessary to reflect any changes that may occur in vision, mission, or the needs of the profession and research community. Overall, we met every objective for 2022-2023, and have shown improvement in some areas, and there are currently no areas of concern.

Assessment Plan Changes:

Information that is regularly collected for the evaluation of program objectives and learning outcomes was outlined in the previous sections of this report. As responses to the identified results, changes implemented in **2022-2023**, or planned for **2023-2024**, are as follows.

1. Create a Repository of Student Artifacts (SLO 1)

- While theses are submitted and stored by the University, students create many other artifacts that demonstrate what they have learned: reports, publications, presentations, and projects. Starting in spring 2023, we created a repository

where graduate student advisors can store these artifacts. Our hypothesis is that this will provide us with additional data points for evaluating our program.

2. Graduate Student Tracker (All)

- In order to better manage our growing graduate program, in the fall of 2022, we employed a student worker to help us better track the progress and successes of our graduate students. This included e-mail reminders to students and advisors of upcoming deadlines, follow-through on the creation of advisory committees and programs of study, and tracking of exams and defenses. In the future, we need to consider implementing some software (using the previously mentioned repository) to automate these activities.

3. Fast Track Program

- While not currently tied to a specific program goal or student learning outcome, enrollment in our MS program has increased significantly. In order to further increase our enrollments, the department has put additional effort towards increasing the number of qualified Tennessee Tech students enrolled in our MS program. While the Fast-Track program (allowing a student to take courses as an undergraduate for graduate credit) has been in place for several years, starting in spring 2022, we held a seminar on Fast-Track that was attended by 24 students and advisors, one in fall 2022 attended by 22 students and advisors, and one in spring 2023 attended by 29 students – something we will continue to do at least each semester. We also hired a communications coordinator, who will help us improve Fast Track's visibility on social media and departmental websites.

4. Student Future Plans

- While not currently tied to a specific program goal or student learning outcome, one indirect way to evaluate the quality of our students can be through the positions that garner after graduating. In the spring of 2023, at the end of every student's defense, we had them complete a survey regarding where they were going next. In addition, we sent out surveys to previous graduates, and are in the process of storing and analyzing this information for subsequent reports.

Appendix 1: Curriculum Map, Computer Science MS

Course	Title	Student Outcomes	
		SLO1	SLO2
CSC 5100	Operating Systems	X	X
CSC 5200	Computer Networks	X	X
CSC 5220	Data Mining/Machine Learning	X	X
CSC 5240	Artificial Intelligence	X	X
CSC 5260	Advanced Data Science	X	X
CSC 5320	Computer Architecture	X	X
CSC 5400	Analysis of Algorithms	X	X
CSC 5570	IT Security	X	X
CSC 5575	Info Assurance & Cryptography	X	X
CSC 5580	Software Reverse Engineering	X	X
CSC 5585	Software and Systems Security	X	X
CSC 5760	Parallel Programming	X	X
CSC 5770	Distributed & Cloud Computing	X	X
CSC 6220	Data Mining	X	X
CSC 6230	Machine Learning	X	X
CSC 6240	Math/Theory-Machine Learning	X	X
CSC 6260	Advanced Topics in A.I.	X	X
CSC 6400	Advanced Analysis of Algorithms	X	X
CSC 6575	Internet Security	X	X
CSC 6580	Advanced Reverse Engineering	X	X
CSC 6585	Secure Software Development	X	X

Appendix 1: Curriculum Map, Computer Science MS, cont.

CSC 6730	Advanced Networking	X	X
CSC 6740	Parallel/Distributed Algorithm	X	X
CSC 6780	Distributed Computing	X	X
CSC 6910	Computer Science Seminar	X	X
CSC 6980	Masters Project	X	X
CSC 6990	Research & Thesis	X	X