STUDENT LEARNING ASSESSMENT REPORT, 2018-2019

PROGRAM: Cybersecurity (MS)
SUBMITTED BY: Michelle Liu
DATE: September 1, 2019

Executive Summary: Description of Assessment Process

List *all* of the program's learning outcomes, as of the assessment year's catalog: *(regardless of whether or not they are being assessed this year)*

Learning Outcome	Year of Last Assessment	Assessed This Year *(Y=Yes)*	Year of Next Planned Assessment
1. Identify and solve cybersecurity issues in business and society by managing cybersecurity operations using available tools and techniques	2017-18		2019-20
2. Review and understand the legal, regulatory, policy, and ethical issues related to securing cyberspace and ensuring the privacy of personally identifiable information (PII)	2015-16		2020-21
3. Communicate effectively with others, including technologists and managers in the cybersecurity, IT, and users and managers in the business context	2013-14	Y	2020-21
4. Use specialized knowledge and techniques to obtain skills and, if applicable, certifications in the cybersecurity field	2017-18		2019-20
5. Optimize the effectiveness of cybersecurity in an organization by performing vulnerability assessments, risk mitigation, forensic analysis, auditing, certification and accreditation of information systems	2017-18		2020-21
6. Work effectively as a member or as a leader of a cross-disciplinary team in the cybersecurity field where teamwork is essential to the success of a time-critical project	2015-16	Y	2021-22
7. Develop the knowledge and skills required to pursue life-long learning, in areas relating to cybersecurity and to adapt to an ever-changing, global technological and business environment through information literacy activities relevant to a fast-changing discipline	2015-16	Y	2021-22

Provide a <u>brief</u> description of the assessment process used including how results are shared and discussed and strengths, challenges, and planned improvements to the <u>process</u>, providing evidence of a culture of continuous improvement based on assessment. If there is something that is impeding your ability to implement improvements, please comment on those issues *(generally not more than two paragraphs, may use bullet points)***:**

In 2018-19, the assessment process was effective and cybersecurity faculty responded well to all calls for data (full-time and part-time). The overall outcome assessment strategy and the specific outcome assessment techniques were discussed early in the school year at a department meeting of cybersecurity full-time faculty. Based on these discussions, the chair and the program director met individual adjunct faculty who were involved in providing data for the various assessment techniques. The results from the previous assessment were discussed along with this year's cybersecurity assessment plans. A plan was put in place to focus on the three learning outcomes being assessed in the designated courses. Outcomes and their measurement for the 2017-18 outcomes assessment were discussed and data collection requirements were identified. A graduate student was designated as the data collection point of contact and worked closely with the chair to ensure the faculty provided the necessary data in a timely manner. The major data and documents used to generate this report are stored in the Canvas courses for 2018-19, Box, and MU Plan.

A number of previously identified initiatives were also refined, implemented, and extended as part of our continuous improvement process including the need for reexamine the course sequencing and reducing some prerequisites for the certain elective courses and specialty courses , revising scheduling to meet the additional number of students, the development of specialties in healthcare security, cyberintelligence, and data science.

Closing the Loop: Progress on Planned Improvements from Prior Year

Describe how the program implemented its planned improvements from last year:

Outcome	**Planned Improvement**	**Update** *(Indicate when, where, and how planned improvement was completed. If planned improvement was not completed, please provide explanation.)*
Identify and solve cybersecurity issues in business and society by managing cybersecurity operations using available tools and techniques	We will continue to expose students to best practices in the cybersecurity field and to ensure students can apply their knowledge in the workplace.	The program has continued to evolve with more students and more adjunct faculty, professionals in the field who have real-world experiences. Multiple courses (including IT 530, IT535, IT 537, IT547 and IT670) have increased their use of the day-to-day tools found in the cybersecurity operations environment. The emphasis is on students downloading the tools onto their own laptops or access the cloud-based operational environment with cybersecurity tools integrated so they can practice cybersecurity concepts, frameworks, and theories, inside and outside the classroom. Some students shared with the director and the department chair that they found connections and relevance of the knowledge and concepts covered in the courses and were able to apply what they have learned in their workplace.
Use specialized knowledge and techniques to obtain skills and, if applicable,	AWS architecture certificate;	The mapping is still being finalized and will be issued shortly. In addition, we ran a non-cost 6-week boot camp for students to prepare for the AWS

Outcome	Planned Improvement	Update *(Indicate when, where, and how planned improvement was completed. If planned improvement was not completed, please provide explanation.)*
certifications in the cybersecurity field	Changes in course content will be reviewed when the mapping is complete.	architecture certification in fall 2018. 20 graduates and 10 undergraduate students attended and the evaluation were high. Several students passed the certification exam after the bootcamp.
Optimize the effectiveness of cybersecurity in an organization by performing vulnerability assessments, risk mitigation, forensic analysis, auditing, certification and accreditation of information systems.	More writing assignments are being introduced in earlier courses and additional resource made available to students.	We have increased the writing and oral presentation requirements in courses throughout the curriculum. The additional resources are made available to students in the program. 1) We are also encouraging students to use the Library Resources now given on the Canvas site for each course. 2) Further, for multiple core courses including IT 530, IT 575 and IT 680, all the instructors adopted the Library Guide for Graduate Students module created by our university library and imported to their Canvas sites. 3) Brainfuse is a free, online writing tutoring service tool provided by Canvas as one of the external tools. The instructors made this tool available on Canvas for various courses including IT 680 (Master Thesis Project). The informal, exit surveys (course level) showed that the students (especially the international students) appreciated the availability of such writing tutoring tool. 4) Based on the first one or two writing assignments in each course, the instructors referred the students who need further help or improvement on writing to the CTL writing tutoring service and resource. At the end of each semester, we also surveyed students on their writing and presentation skills in selected courses and determined what extra support to offer next semester.

Provide a response to last year's University Assessment Committee review of the program's learning assessment report:

Comment: According to the Academic Assessment Evaluation Rubric from the committee, last year's report was accepted as submitted. The committee deemed the executive summary, implemented improvements from previous year, outcomes, assessment measures and targets, and analysis of results and implications as acceptable. The only item marked as "Developing" centers on the use of assessment to improve effectiveness. For this item, the comments are:

"Outcome 1: For planned improvements, you indicate that that you will "continue to expose students to best practices"; how will you do that? Expand on this idea. Outcome 2: The planned improvements are just listed and not expanded upon. How will these three changes affect the assessment of outcomes? In the area of planned improvements, you identify "more writing assignments" are being introduced but you don't indicate what these writing assignments are or how they will improve the program."

Response: 1) The committee suggested that for planned improvements, there is a need to think of more specific statements and concrete plan for "exposing students to best practices". Based on the suggestion, more detailed discussions on how cybersecurity tools, frameworks, and practices are incorporated in the courses along with virtual lab settings are provided in this year's assessment report.

2) The second comment also suggested that more details were expected on writing assignments. The committee suggested to include more detailed descriptions on the writing assignments used in those courses. The suggestion is well received and a collection of sample writing assignment requirements for the courses of IT 530 (Computer Security), IT 547 (Security and Privacy of Electronic Documents and Records), IT 575 (Information Security Management) and IT 680 (IT Master Thesis Project) will be gathered and refined at the department level so that each writing assignment would reinforce the critical thinking, problem solving, and writing skills that are highly sought for in the cybersecurity field. The mapping of assignments and the learning objectives and learning outcome assessment will be developed, which in turn enhances the quality of each course individually, and the program as a whole.

Outcomes Assessment 2018-2019

Learning Outcome 1: Communicate effectively with others, including technologists and managers in the cybersecurity, IT, and users and managers in the business context

Outcome Measures *Explain how student learning will be measured and indicate whether it is direct or indirect.*	**Performance Standard** *Define the acceptable level of student performance.*	**Data Collection** *Discuss the process for collecting this data: who conducted the assessment, when, and how?*	**Result** *Did you meet your target? What was the result?*
Direct: Evaluation of communication activities as well as clarity and accuracy of the information and language/writing used in the report. The final group project of IT537, Computer Forensics/Incident Response, was used for this assessment. This group project required each group to prepare for a forensic investigation, analyze an email archive for an electronic discovery investigation and analyze evidence from Mac OS X. Each group also needs to present in class (for a face to	Students rate 75% of the team members as effective or very effective in the communication process on the project in IT537. 8 out of 10 on the rubric (Rubric 1) is considered as effective.	A questionnaire is given as a confidential evaluation by the student of the team as a whole and each member of the team to assess the communication skills of the team members.	There were 27 students in Fall 2017 and 22 students in Spring 2019. (Total 49) 10 individuals rated their team or at least one of their team members as ineffective or only partially effective in their communications in team work leaving 39 with a positive feeling about their team and its members (approximately 80 %). The most common complaint was collaborative writing efforts. Some students left their assignments to the

Outcome Measures *Explain how student learning will be measured and indicate whether it is direct or indirect.*	**Performance Standard** *Define the acceptable level of student performance.*	**Data Collection** *Discuss the process for collecting this data: who conducted the assessment, when, and how?*	**Result** *Did you meet your target? What was the result?*
face section) and via Zoom (for an online section). The emphasis was on communication to a non-technical audience such as a business person.			last minute thus minimizing the group revision process. The standard was met.
Direct: Performance on a report and presentation in a high-level course towards the end of the program	80% of students should get at least 23 out of 30 in the final report and presentation in the IT Master Thesis Project (IT680) course using Rubric 3	The department chair and one other IT professor read the reports and attended the final presentations. Each student was rated using the rubric 3. The students were randomly chosen based on their scheduled time to present.	9 out of 10 student (5 students selected from FA/18 and 5 students selected from SP/19) received 23 or more on the assigned rubric. The standard was met.
Indirect: From the Graduating Student Survey, confidence by the graduating students In their ability to give effective presentations and prepare effective written reports	80% of students should feel good or adequate about their written and oral skills on graduating from the program.	Data was collected from the 2018-19 Graduating Student Survey, conducted by the Office of Planning and Institutional Effectiveness in response to the following questions: • Develop a coherent written argument; • Deliver a coherent oral presentation	13 individuals responded to the survey. 77 % of graduating students felt that they could develop a coherent written argument and the 70% felt that they can deliver a coherent oral presentation. This standard was not met.

Interpretation of Results

Analysis and Implications: *What does this result tell you about the extent to which your students achieved this outcome? What are the strengths and weaknesses that this result highlights, and what are the implications for your curriculum or your program?*

Two of the three measures were met and it was obvious that communication skills improved through the program.

There are many opportunities to practice oral and written communication skills throughout the M.S. Cybersecurity program and this was evidenced by the quality of the written and oral presentations in the IT680 (IT Master's Thesis Project) course. We will continue to enhance the quality of the program by mentoring more master students to present their IT680 work at Marymount Student Research Conferences or in the IT and Cybersecurity professional conference such at the regional or even national level. These would definitely improve student engagement, the program quality, and the school as well as university visibility.

Discuss planned curricular or program improvements <u>for this year based on assessment of outcome:</u>

The program director will work with instructors to instigate a more formal draft and review process for the master thesis project process to enable students to be more prepared in both writing and oral skills. The department will also organize and host at least one department-level workshop focusing on IT/Cybersecurity in which master students will present their thesis work in the 19/FA-20/SP academic year.

Learning Outcome 2: Work effectively as a member or as a leader of a cross-disciplinary team in the cybersecurity field where teamwork is essential to the success of a time-critical project

Outcome Measures *Explain how student learning will be measured and indicate whether it is direct or indirect.*	**Performance Standard** *Define the acceptable level of student performance.*	**Data Collection** *Discuss the process for collecting this data: who conducted the assessment, when, and how?*	**Result** *Did you meet your target? What was the result?*
Direct: Evaluation of communication activities in the cyber operations project of IT535, "Advanced Computer Security" which is a group project with a short deadline.	Students rate 70% of the team members as effective or very effective in the communication process on the cyber operations project in IT535, Advanced Computer Security,	A questionnaire was given as a confidential evaluation by each student to evaluate their team as a whole and each member of the team was asked to assess the communication skills of each of the team members.	There were 13 students in Fall 2018, 19 students in Spring 2019, and 13 students in Summer 2019. Of the 45 total students, 10 individuals rated their team or at least one of their team members as ineffective or only partially effective in their communications in teamwork leaving 35 with a positive feeling about their team and its members (78%). The most common complaint was the timeliness and quality of collaborative writing efforts. The standard was met.
Indirect: From the Graduating Student Survey, students showed confidence	By the end of their program, 80% of students should feel good or adequate about	Data was collected from the 2018-19 Graduating Student	100% of students felt confident in their ability to work as part of a team and

Outcome Measures *Explain how student learning will be measured and indicate whether it is direct or indirect.*	**Performance Standard** *Define the acceptable level of student performance.*	**Data Collection** *Discuss the process for collecting this data: who conducted the assessment, when, and how?*	**Result** *Did you meet your target? What was the result?*
in their ability to work as part of a team and to lead a team	their ability to cope in a team environment in the IT field where work is often fast-paced and deadline driven.	Survey, conducted by the Office of Planning and Institutional Effectiveness. Responses to the question was evaluated: " I'm confident in my ability to work collaboratively with people of diverse backgrounds and experiences."	collaborate with people of diverse backgrounds. This standard was met.
Direct: Performance on a group project in an online course	Teammates rated 80% of their team members as effective or very effective communicators in working on an online team project in IT580, Technology Leadership, in Spring 2019. 8 out of 10 is considered as effective on the rubric (Rubric 2).	A questionnaire was given to assess communication effectiveness as a confidential evaluation by one team member of another (2 or 3 person teams, selected by the instructor).	There were 23 students in IT585 in spring 2019. Of these 16 (70%) of student received 8 or more on the assigned rubric. The standard was NOT met. Getting effective team work in asynchronous online classes remains a challenge.

Interpretation of Results

Analysis and Implications: *What does this result tell you about the extent to which your students achieved this outcome? What are the strengths and weaknesses that this result highlights, and what are the implications for your curriculum or your program?*

Two of the three outcomes were met. The third team work in an online course remains an issue.

Group (team work) is emphasized in both face-to-face and online courses in the program**.** Group work in on-line courses has proven more difficult with students generally not being available for asynchronous sessions.

Discuss planned curricular or program improvements for this year based on assessment of outcome:

We have been investigating online group techniques at the department level. In addition, the director will work with instructors to reexamine and renovate some group-based projects that are assigned in online courses so that the projects are more suitable for online courses.

Learning Outcome 3: Develop the knowledge and skills required to pursue life-long learning, in areas relating to cybersecurity and to adapt to an ever-changing, global technological and business environment through information literacy activities relevant to a fast-changing discipline

Outcome Measures *Explain how student learning will be measured and indicate whether it is direct or indirect.*	**Performance Standard** *Define the acceptable level of student performance.*	**Data Collection** *Discuss the process for collecting this data: who conducted the assessment, when, and how?*	**Result** *Did you meet your target? What was the result?*
Direct: From the IT680, IT Masters Project, ability of students to perform an effective literature review in the cybersecurity field.	70% of students received a 2 or 3 on the rubric evaluation for the literature review (see rubric 3)	The literature review deliverable was reviewed by the program director and a librarian	73% of students received a 2 or 3 on the assessment. The standard for the outcome was met.
Indirect: From the Graduating Student Survey, confidence that the student can "find appropriate sources of information" and "evaluate the quality of information".	The performance standard is that 80% of students rated their ability to find appropriate sources and evaluate the quality of information as good or excellent.	Data was collected from the 2018-19 Graduating Student Survey, conducted by the Office of Institutional Effectiveness Data was reviewed for responses to two questions: "Find appropriate sources of information" and "Evaluate the quality of information (e.g., scholarly articles, newspapers)"	77% of students rated themselves as good or excellent for both of these questions The values for both metrics are slightly lower than the standard (80%), so this outcome was NOT met.
Indirect: From the Graduating Student Survey, confidence that the student can "apply knowledge and skills to new situations"	The performance standard is that 75% of students rated their ability to apply knowledge to new situations".	Data was collected from the 2018-19 Graduating Student Survey, conducted by the Office of Institutional Effectiveness	100% of students rated themselves as good or excellent in this category. Meeting this standard is also significant since IT and Cybersecurity is a fast changing field and new situations are always present.

Interpretation of Results

Analysis and Implications: *What does this result tell you about the extent to which your students achieved this outcome? What are the strengths and weaknesses that this result highlights, and what are the implications for your curriculum or your program?*

Two of the three outcomes were met. One of the indirect measures on students' ability to "Find appropriate sources of information" and "Evaluate the quality of information (e.g., scholarly articles, newspapers)" does not meet the standard.

Cybersecurity is a new and changing field and this is reinforced throughout the program. Most classes require students to discuss cybersecurity-related news and emerging technologies at the beginning of each class and reinforce the needs for the lifelong learning concept. The final master's project specifically addresses the concept of new knowledge and keeping current in the field. However, the dynamic nature of the field also present certain degree of challenge for our students to search and find substantial academic journal resources covering some emergent technologies and their implications such as 5G networks and artificial intelligence. In order to address this challenge, we have been working with our library liaison to compile and provide library resources catering the IT and Cybersecurity majors and incorporate the links in each Canvas course sites.

Discuss planned curricular or program improvements <u>for this year based on assessment of outcome:</u>

Involvement of library services in the various classes is spotty (some students get the presentation 2 or 3 times) and so we are working with the library liaison to improve coverage over the program, focusing on specific assignments in each class.

Appendices *(please only include items that will help reviewers understand your process – for example, test questions, rubrics, survey questions, more detailed description of assessment measures, summary tables of survey results, etc.)*

Rubrics

Rubric 1: Evaluation of Communication in Projects in a Face-to-Face Class

Attribute	Measure	Scoring	Student Score
Review the group discussion posts looking for evidence that the student was engaged in the project activities	Grade as fully engaged, partially engaged, or lacks engagement or was not present	Factor a, values 0, 1, 2	
Review the class participation records on Blackboard to look for evidence of participation by each student in weekly group activities	Mark as team leader, high levels of participation, participates effectively particularly in areas of expertise, some participation, little or no participation	Factor b, values 0, 1, 2, 3	
Review the written communications for readability and ability to be understood by non-technical people	Mark as well developed documentation, satisfactorily developed documentation, or inadequate or missing	Factor c, values 0, 1, or 2	
Review of group project reports and their accuracy and completeness	Accurately reflects the findings of the project that can be understood by a non-technical person, accurately reflects project but is too technical in nature, does not accurately reflect project or not submitted	Factor d, values 0, 1, 2, or 3	
Total score	Calculate score	a+b+c+d with students receiving a score of 0 through 10.	

Rubric 2: Evaluation of Communication in Projects in an On-line Class

Attribute	Measure	Scoring	Student Score
Review the group discussion posts looking for evidence that the student was engaged in the project activities	Grade as fully engaged, partially engaged, or lacks engagement or was not present	Factor a, values 0, 1, 2	
Review the discussion board records on Blackboard to look for evidence of participation by each student in weekly activities, in general and in the team work specifically	Mark as team leader, high levels of participation, participates effectively particularly in areas of expertise, some participation, little or no participation	Factor b, values 0, 1, 2, 3	
Review the written communications for readability and ability to be understood by non-technical people	Mark as well developed documentation, satisfactorily developed documentation, or inadequate or missing	Factor c, values 0, 1, or 2	
Review of group project reports and their accuracy and completeness	Accurately reflects the findings of the project that can be understood by a non-technical person, accurately	Factor d, values 0, 1, 2, or 3	

	reflects project but is too technical in nature, does not accurately reflect project or not submitted		
Total score	Calculate score	a+b+c+d with students receiving a score of 0 through 10.	

Rubric 3: Evaluation of Cybersecurity Final Project

Attribute	Measure	Scoring	Student Score
Review the project proposal to examine the scope of the project as planned	Grade it as complex, medium, or simple	Factor a, values 1, 2 or 3	
Review the literature for the scope of the review, the correct citing of sources, and the relevance of the search to the problem	Mark as fully relevant to a professional project, partly relevant, non-relevant or non-professional, does not meet requirements	Factor b, values 0, 1, 2, 3	
Review the project report and presentation for satisfaction of objectives outlined in the proposal	Mark as well developed themes, satisfactorily developed themes, or inadequate	Factor c, values 0, 1, or 2	
Assess the writing including spelling, grammar, and organization in all deliverables	Mark as adequate, minor issues, or poorly crafted, needs to be rewritten	Factor d, values 1 or 2	
Examine project retrospective for analysis of performance and confidence in their ability	Mark as well analyzed, adequate, or not effectively analyzed	Factor e, values 0,1, or 2	
Review of presentation materials	Adequately conveys contents of report or does not convey essence of report	Factor f, values 0 or 1	
Total score	Calculate score	a(b + c + d + e+f) with students receiving a score of 0 through 30.	