

Mathematics and Data Science Assessment Report

2021-22

Learning Outcomes for Mathematics:

1. Students will be able to demonstrate facility with analytical and algebraic concepts.
2. Students will be able to write proofs.
3. Students will be able to apply their mathematical knowledge and critical thinking to solve problems.
4. Students will be able to use technology to solve problems.
5. Students will be able to speak about their work with precision, clarity and organization.
6. Students will be able to write about their work with precision, clarity and organization.
7. Students will be able to identify, locate, evaluate, and effectively and responsibly use and cite information for the task at hand.
8. Students will collaborate effectively in teams.
9. Students will be able to understand and create arguments supported by quantitative evidence.
10. Students will understand the professional, ethical and social issues and responsibilities with the implementation and use of technology.

Assessment Data Mathematical, Information and Computer Sciences

Learning Outcome: Students will be able to demonstrate facility with analytical and algebraic concepts.

Outcome Measure: Annual: ETS Major Field Test in Mathematics: Algebra and Calculus subscores (This has been discontinued). The new measure will be a signature assignment in MTH2074 Multivariate Calculus.

Criteria for Success: The department subscore will be at the 50th percentile or higher. The new criteria for the MTH2074 will be 80% of the students above 2.5 on the relevant rubric.

Aligned with DQP Learning Areas (circle one or more):

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

Longitudinal Data: This is the most recent 10 years of data:

Algebra:

Year	Percentile
2010-11	90
2011-12	85
2012-13	72
2013-14	49
2014-15	*
2015-16	42
2016-17	8
2017-18	*
2018-19	32
2019-20	N/A

Calculus:

Year	Percentile
2010-11	70
2011-12	99
2012-13	38
2013-14	72
2014-15	*
2015-16	16
2016-17	13
2017-18	*
2018-19	57
2019-20	N/A

*Insufficient students for score to be calculated.

Note the ETS changed the Mathematics test in 2012-13.

Conclusions Drawn from Data: Before the change in the exam in 2013, the students were meeting our expectations, since the exam changed they have not. The review of the exam indicates that it no longer meets our needs. We are in the process of developing a signature assignment to embed in MTH2074 Multivariate Calculus to assess this outcome.

Changes to be Made Based on Data: We made curricular adjustments around 2008-09 to reduce the amount of abstract algebra (two semesters to one) in order to create space for additional course work. We did increase the amount of linear algebra that we are requiring each student to take, so that may have balanced the reduction in abstract algebra.

The drop in the scores that corresponds to the change in the ETS test has us concerned. Based on a review that was part of our program review, we have determined that this test is not serving us well. Starting in 2022-23 our data will be gathered from a signature assignment in MTH2074.

Rubric Used: None. The scores are computed by ETS. MTH2074 rubric is under development.

Assessment Data Mathematical, Information and Computer Sciences

Learning Outcome: Students will be able to write proofs.

Outcome Measure: Annual - MTH3012 Signature Assignment.
Alternating Years - MTH4024 and MTH4044 Signature Assignment.

Criteria for Success: 80% of the students to score a 2.5 or higher (on a scale of 1-4) in each of the four areas:

- Statement of the problem
- Logic
- Symbolism
- Justification

Aligned with DQP Learning Areas (circle one or more):

1. **Specialized Knowledge**
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

Longitudinal Data:

	MTH3012 Percentage of Class at 2.5 or Higher									
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Statement of Problem	100%	100%	100%	100%	89%	100%	100%	100%	100%	100%
Logic	100%	100%	100%	100%	89%	100%	100%	100%	100%	100%
Symbolism	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Justification	100%	83%	88%	100%	78%	100%	100%	100%	67%	50%

	MTH4024 Percentage at 2.5 or higher				
	Fall 2013	Fall 2015	Fall 2017	Fall 2019	Fall 2021
Statement of Problem	92%	100%	90%	83%	100%
Logic	92%	89%	90%	83%	100%
Symbolism	100%	100%	90%	100%	100%
Justification	77%	67%	60%	100%	100%

	MTH4044 Percentage at 2.5 or higher				
	Fall 2012	Fall 2014	Fall 2016	Fall 2018	Fall 2020
Statement of Problem	92%	100%	83%	100%	67%
Logic	92%	100%	0%	100%	100%
Symbolism	100%	100%	67%	100%	100%
Justification	77%	100%	67%	100%	100%

Conclusions Drawn from Data: The place where the students continue to struggle the most is in the area of justification in their proofs. These classes are small so the difference between meeting, or not meeting the benchmark may be the performance of single student (this was true in MTH3012 for the last few years). The 2016-17 data in MTH4044 is somewhat surprising – the low scores are primarily due to the particular problem chosen and the instructions given.

Changes to be Made Based on Data: We continue to emphasize the need for strong justification of every step in a proof and to more clearly reinforce that in assignments in all proof writing classes. Since making those changes, we seem to be seeing fewer weak justifications in proofs in the later classes (MTH4024 and MTH4044).

Proof Writing Rubric (MTH3012, MTH4024, MTH4044)

	Unsatisfactory	Low Satisfactory	High Satisfactory	Outstanding
Statement of the Problem	Can not determine what is given and what needs to be proved	Misses one part of the hypothesis or the conclusion	Makes one minor error in identifying the hypothesis or the conclusion	Understands what is given and what is to be proved
Logic	Proof has major flaws that make it invalid	Proof misses more than one major element	Proof has the main flow of the logic correct but misses one major element	Statements flow logically from one to another
Symbolism	There are many errors in the use of symbolic notation	There are more than two errors in symbolic notation	There are two or fewer minor errors in symbolic notation (e.g. missing parentheses)	All symbols are used correctly
Justification	There are several errors in the justification	There is one major mistake in the justification or more than two minor errors	There are two or fewer minor errors in the justification for the steps	Every logical step has the appropriate reason (theorem, definition, lemma, etc.)

Assessment Data Mathematical, Information and Computer Sciences

Learning Outcome: Students will be able to apply their mathematical knowledge and critical thinking to solve problems.

Outcome Measure: ETS Major Field Test in Mathematics: Applied subscore (Annual). We are changing this measure to a signature assignment embedded in MTH2033 Linear Algebra (Annual).

ETS Proficiency Profile – Reading/Critical Thinking (Annual). We are planning on eliminating this measure.

Criteria for Success: ETS MFT: The department subscore will be at the 50th percentile or higher.

ETS Proficiency Profile: 85% of the students will be marginal or proficient at Level 2 Reading/Critical Thinking.

MTH2033 Linear Algebra: 80% of the students will be at a 2.5 or higher on the rubric.

Aligned with DQP Learning Areas (circle one or more):

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

Longitudinal Data: This is the data from the most recent 10 years.

Year	Percentile
2010-11	70
2011-12	96
2012-13	60
2013-14	39
2014-15	*
2015-16	55
2016-17	55
2017-18	*
2018-19	32

* Insufficient students for score to be calculated.

ETS changed the Mathematics test in 2012-13. The department discontinued use in 2019-20.

ETS Proficiency Profile	Percentage of Students Marginal or Proficient									
	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
ETS Proficiency Profile Level 2 Mathematics	100%	100%	100%	100%	92%	82%	95%	93%	81%	90%

*This data is for the entire department, not just mathematics.

Conclusions Drawn from Data: MFT: There have been significant variations in our outcomes over the years, however our sample size is relatively small. We were concerned about the drop in the scores with the exam change in 2017-18?, however they seem to have recovered. However, based on our analysis of the content of the exam, we will be discontinuing its use.

Proficiency Profile: The students are meeting our criteria with the expected variation based on sample size.

Changes to be Made Based on Data: MFT: We have increased the amount of applied mathematics problems in our coursework, so the ETS results are somewhat puzzling. Based on some analysis that we did as part of our program review, we have concluded that the MFT is not meeting our needs because it is measuring some disciplines that are not included in our curriculum and the variation in scores is coming from the rotation of various disciplines in and out of the test annually. The department stopped using the MFT exam.

We are in the process of aligning this learning outcome with a signature assignment in MTH2033 Linear Algebra.

Proficiency Profile: The students are generally meeting our expectations but this tool is focused on critical reading and we would prefer to measure students ability in critical thinking using an assessment that focuses on the use of critical thinking in mathematics.

Rubric Used: None. The scores are computed by ETS. The rubric that will be used in MTH2033 is under development.

Assessment Data Mathematical, Information and Computer Sciences

Learning Outcome: Students will be comfortable using technology to solve problems.

Outcome Measure: Annual: MTH3083 Signature Assignment and CSC2054 Signature Assignment (through 2014-15), CSC2052 Signature Assignment (starting in 2021-22).

Criteria for Success: MTH3083: 80% of the students should have an average score of at least 2.5 in each of the major areas.

Fall 2014 and before: CSC2054: 80% of the students should have an average score of at least 2 in each of the major areas.

Fall 2015 – Fall 2021: Mathematics majors are now taking CSC2052 (the first half of CSC2054) and are not being assessed at the end of CSC2054.

Fall 2021: Mathematics majors will be assessed in CSC2052.

Aligned with DQP Learning Areas (circle one or more):

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

Longitudinal Data:

	MTH3083 Percentage of students at 2.5 or higher									
	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
Students will be able to use technology to solve problems	100%	skipped	100%	78%	100%	100%	100%	100%		
Computational Correctness									100%	60%
Graphical Tool									86%	100%
Interpretation									86%	60%

Note that the assignment and rubric were changed in 2019-20.

	Percentage of Class at 2 or Higher		
	2013	2014	2021
Compilation	92%	75%	Transition
Runtime Correctness	85%	100%	
Problem Solving	100%	75%	

Conclusions Drawn from Data: MTH3083: Students have been able to satisfactorily analyze data using technology. The 2021-22 data is below our benchmark, but if one more student had gotten a higher score, then the benchmark would have been met.

CSC2052: There was a universal issue with the assignment in CSC2052 in Fall 2021. We are currently analyzing the situation.

Changes to be Made Based on Data: MTH3083: The signature assignment was updated to better measure students' facility with the current technology that we are using in the course. That change can be seen in the data.

CSC2052: The department is still working to analyze the change in the assessment in CSC2052. This significant drop may be more about the new problem than the performance of the students.

MTH3083 Signature Assignment Rubric (Spring 2021)

	Unsatisfactory (1)	Low Satisfactory (2)	High Satisfactory (3)	Outstanding (4)
Computation correctness	More than one major error including completely incorrect.	Made a major error	Made a minor error	Completely correct
Use of graphical tool	Graph is not connected to the data	Poor choice of graph and not well-labeled	One of: Correct choice of graph Graph well-labeled	Graph is correct and is well-labeled
Interpretation	Explanation is not connected to the information	Explanation is partially correct and partially clear	Explanation is correct but not clear	Explanation is clear and correct

Criterion: 80% of students will score at or above 2.5.

CSC2052 Signature Assignment

	Unsatisfactory (1)	Satisfactory (2)	Good (3)	Excellent (4)
Runtime Correctness	<ul style="list-style-type: none"> Less than 60% correct 	<ul style="list-style-type: none"> Between 60% – 79% correctness 	<ul style="list-style-type: none"> 80% - 89% correct 	<ul style="list-style-type: none"> 90% – 100% correct
Problem Solving	<ul style="list-style-type: none"> Analysis of program source code indicates that program is NOT close to working, and could NOT easily be modified to work given additional time. 	<ul style="list-style-type: none"> Analysis of program source code indicates that the student partially understands the problem solution or understands the solution but could not efficiently translate the solution to C++ code. 	<ul style="list-style-type: none"> Analysis of program source code indicates that program is close to working, and could be modified to work given additional time. 	<ul style="list-style-type: none"> All tasks execute correctly indicating that the code is both correct and robust (can catch user input errors).

Criterion: 80% of students will average 2 in Runtime Correctness and Problem Solving.

Assessment Data Mathematical, Information and Computer Sciences

Learning Outcome: Students will be able to speak about their work with precision, clarity and organization (Oral Communication).

Outcome Measure: Annual: Each student will be required to give an oral presentation on a topic in their field as a part of their participation in the Senior Seminar. The audience for this talk will include department faculty, fellow students and possibly some alumni. The students will be given the evaluation criteria in advance of their presentation and will be rated by the faculty using a rubric with a scale of 4 (outstanding) to 1 (unsatisfactory) in the following areas:

- Command of background material
- Organization
- Oral presentation skills (added as part of the new rubric in the spring of 2010)
- Use of presentation tools
- Ability to field questions from the audience

Criteria for Success: 80% of the students should have an average score of at least 2.5 in each of the major areas in the department rubric.

Aligned with DQP Learning Areas (circle one or more):

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

Longitudinal Data:

Oral Presentation	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
Background	100%	92%	100%	95%	100%	100%	95%	100%	100%	95%
Organization	100%	100%	100%	100%	92%	94%	100%	100%	94%	100%
Oral Presentation Skills	100%	92%	100%	95%	100%	100%	95%	100%	100%	100%
Presentation Tools	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Ability to Field Questions	100%	100%	89%	100%	100%	100%	94%	94%	100%	100%

Conclusions Drawn from Data: In general, the students have been performing reasonably well in the area of giving oral presentations. We attribute this to the fact that we intentionally have students presenting technical material in front of others starting in their freshman year.

Changes to be Made Based on Data: Over time we have increased our standards and expanded the rubric to increase clarity for students and to push them to speak at a professional level. We have been incorporating more oral presentations into classes and saw an improvement once we began doing that (before 2010). While we have been making a conversion to the AAC&U Value Rubric, it seems that this data is not being used institutionally and our focus has been on our department's rubric.

Oral Presentation Rubric Update (4/12/17)

Criteria	Outstanding	High Satisfactory	Low Satisfactory	Unsatisfactory
Command of background material	<input type="checkbox"/> Clearly knows material and key facts by memory <input type="checkbox"/> Expands on PPT slides <input type="checkbox"/> Content appropriate for audience	<input type="checkbox"/> Clearly knows key facts with a few memory slips <input type="checkbox"/> Some expansion on PPT slides <input type="checkbox"/> Partial audience adaptation of content	<input type="checkbox"/> Reads some information; knows some facts from memory <input type="checkbox"/> No expansion on PPT slide content <input type="checkbox"/> Little audience adaptation of content	<input type="checkbox"/> Reads sentences from slides <input type="checkbox"/> Dependent on notes <input type="checkbox"/> Lacks audience adaptation of content
Organization	<input type="checkbox"/> Clear and concise outline <input type="checkbox"/> Relevant graphics and key text items on slides <input type="checkbox"/> Presentation is between 10-15 minutes	<input type="checkbox"/> Clear outline <input type="checkbox"/> Too much information on slides (not concise) <input type="checkbox"/> Presentation 1 minute outside of the range (10-15 minutes)	<input type="checkbox"/> Some sense of outline <input type="checkbox"/> Too much detailed information on slides <input type="checkbox"/> Presentation 2 minutes outside of the range (10-15 minutes)	<input type="checkbox"/> No clear outline <input type="checkbox"/> Slides are in paragraphs; too much detailed information on one slide <input type="checkbox"/> Presentation 3 minutes outside of the range (10-15 minutes)
Oral presentation skills	<input type="checkbox"/> Clearly has practiced several times; smooth transitions Engages audience in content multiple times and engagement is well connected to talk (questions, examples, etc.) <input type="checkbox"/> Free of disfluencies (ah, uhm) <input type="checkbox"/> Is clearly heard in the room and uses inflection for emphasis <input type="checkbox"/> Engages audience through eye contact <input type="checkbox"/> Engages audience through gestures	<input type="checkbox"/> Has practiced but transitions are not smooth <input type="checkbox"/> Engages audience at least twice in content (questions, examples, etc.) <input type="checkbox"/> A few disfluencies (ah, umh, er) <input type="checkbox"/> Can be understood most of the time and uses some inflection <input type="checkbox"/> Some engagement of audience through eye contact <input type="checkbox"/> Some engagement of audience through gestures	<input type="checkbox"/> Has practiced presentation but cannot verbally make transitions between slides <input type="checkbox"/> Audience engagement at least once with content (questions, examples, etc.) <input type="checkbox"/> Many disfluencies (ah, umh, er) <input type="checkbox"/> Can sometimes be understood and uses little inflection <input type="checkbox"/> Infrequent eye contact <input type="checkbox"/> Distracting gestures or mannerisms	<input type="checkbox"/> Clearly did not practice presentation; Does not anticipate content of next slide <input type="checkbox"/> No audience involvement <input type="checkbox"/> Disfluencies (ah, umh, er) detract from presentation <input type="checkbox"/> Can not be heard and/or speaks in a monotone <input type="checkbox"/> Little audience awareness or eye contact <input type="checkbox"/> Frequent distracting gestures or mannerisms
Use of presentation tools	<input type="checkbox"/> PPT background is matched to content, legible font, seamless transitions <input type="checkbox"/> Graphics imbedded and matched to topic, necessary hyperlinks work	<input type="checkbox"/> Appropriate PPT slide backgrounds, transitions & font <input type="checkbox"/> Most graphics imbedded and matched to topic, most necessary hyperlinks work	<input type="checkbox"/> Distracting PPT slide backgrounds and transitions, font hard to read <input type="checkbox"/> Some inappropriate graphics or use of PPT embellishments, necessary hyperlinks don't work	<input type="checkbox"/> No attention given to PPT slide backgrounds and transitions, font illegible <input type="checkbox"/> Distracting use of embellishments, graphics not connected to topic
Ability to field questions	<input type="checkbox"/> Able to answer questions clearly and without hesitation and prepared material to answer anticipated questions	<input type="checkbox"/> Can answer all questions with some hesitation	<input type="checkbox"/> Able to answer half of the questions with hesitation	<input type="checkbox"/> Unable to answer any questions

Assessment Data Mathematical, Information and Computer Sciences

Learning Outcome: Students will be able to write about their work with precision, clarity and organization (Written Communication).

Outcome Measure: Annual: Each student will be required to write a paper on a topic in their field as a part of their participation in the Senior Seminar. The audience for this talk will include department faculty, fellow students and possibly some alumni. The students will be given the evaluation criteria in advance of their presentation and will be rated by the faculty using a rubric with a scale of 4 (outstanding) to 1 (unsatisfactory) in the following areas:

- Bibliography and other supporting documentation
- Organization
- Grammar and spelling
- Depth of information
- Clarity of writing

Note that the department has a mapping between its rubric and the AAC&U Written Communication Value Rubric.

Annual: ETS Proficiency Profile.

Criteria for Success: 80% of the students should have an average score of at least 2.5 in each of the major areas in the department rubric. This translates to 80% of the students being above a 3.5 in the AAC&U rubric.

ETS: 85% of our students will be marginal or proficient on the Level 2 Writing test.

Our translation from our data to the AAC&U is included. Our department continues to provide the students with our departmental rubric because it has been developed over many years and works effectively with our majors.

Aligned with DQP Learning Areas (circle one or more):

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

Longitudinal Data:

Written Report	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
Bibliography and Support	100%	100%	100%	89%	100%	76%	89%	81%	88%	58%
Organization	100%	100%	100%	100%	92%	94%	100%	100%	100%	100%
Grammar and Spelling	100%	92%	89%	84%	100%	88%	94%	94%	94%	89%
Depth of Information	91%	77%	78%	89%	85%	76%	83%	94%	94%	95%
Clarity of Writing	91%	77%	78%	89%	85%	88%	94%	88%	100%	89%

	Percentage at Marginal or Proficient									
Written ETS	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
ETS Proficiency Profile Writing Level 2	60%	85%	100%	89%	85%	76%	84%	93%	88%	66%

Conclusions Drawn from Data: In general, the students have been performing reasonably well in writing technical reports. We still have some weaknesses in the quality of their writing and the use of their source material. The sample size for ETS in the first year was extremely small so we are not particularly concerned about the fact that the score was below the benchmark. The balance of the ETS scores are at or near benchmark (due to small sample sizes, the difference can often be a single person).

Changes to be Made Based on Data: Over time we have increased our standards and expanded the rubric to increase clarity for students and to push them to write at a professional level. The current rubric has been in use for the last 11 years. We have instituted more formal faculty reviews of their draft papers and are trying to give more specific feedback, particularly about the use of references and that seems to be helping with the quality of the papers.

We do not believe that the ETS exam, which measures the mechanics of grammar, is the best assessment of student writing and will be moving away from it to focus on the results from our department rubric which measures writing in the discipline.

MICS Written Presentation Rubric

Criteria	Outstanding	High Satisfactory	Low Satisfactory	Unsatisfactory
Bibliography and supporting documents	<input type="checkbox"/> Multiple references from distinct reputable sources <input type="checkbox"/> References cited in the body of the document	<input type="checkbox"/> Most references from distinct reputable sources <input type="checkbox"/> Some citation of references in the body of the document	<input type="checkbox"/> Some references from reputable sources <input type="checkbox"/> Limited citation of references in the body of the document	<input type="checkbox"/> No bibliography or all references from untrusted sites on the internet <input type="checkbox"/> No citation of references in the body of the document
Organization	<input type="checkbox"/> Conveys a central theme with all ideas connected, arrangement of ideas clearly related to topic <input type="checkbox"/> Clear introduction, body (with sections), and conclusion includes summary and closure <input type="checkbox"/> Includes both an abstract and table of contents	<input type="checkbox"/> Conveys a central idea or topic with some ideas connected to the topic <input type="checkbox"/> Includes introduction, body and conclusion <input type="checkbox"/> Includes abstract and table of contents (one partial and one complete)	<input type="checkbox"/> Attempts to focus on an idea or topic with many ideas not connected to the topic <input type="checkbox"/> Introduction, body, conclusion detectable but not clear <input type="checkbox"/> Includes partial abstract and partial table of contents	<input type="checkbox"/> Has little or no focus on central idea or topic <input type="checkbox"/> Introduction, body or conclusion absent <input type="checkbox"/> No abstract or table of contents
Grammar and spelling	<input type="checkbox"/> No use of the first-person tense <input type="checkbox"/> No grammatical or spelling errors	<input type="checkbox"/> Few uses of the first-person tense <input type="checkbox"/> Few grammatical and spelling errors	<input type="checkbox"/> Several uses of the first-person tense <input type="checkbox"/> Some grammatical and spelling errors	<input type="checkbox"/> Written in the first-person tense <input type="checkbox"/> Many grammatical and spelling errors
Depth of information	<input type="checkbox"/> Appropriately synthesizes information from multiple distinct sources <input type="checkbox"/> Draws conclusions and personal insights from synthesis <input type="checkbox"/> Has the minimum number of pages including penalty pages; subject coverage is excellent	<input type="checkbox"/> Synthesis of information from at least three distinct sources <input type="checkbox"/> At least two personal insights or conclusions stated <input type="checkbox"/> Has the minimum number of pages including penalty pages; subject coverage is good	<input type="checkbox"/> Synthesis of information from at least two distinct sources <input type="checkbox"/> At least one personal insight or conclusion stated <input type="checkbox"/> Has the minimum number of pages including penalty pages; subject coverage is adequate	<input type="checkbox"/> Summary reporting of information without synthesis <input type="checkbox"/> No personal insights <input type="checkbox"/> Does not have the minimum number of pages including penalty pages
Clarity of writing	<input type="checkbox"/> Sentences flow <input type="checkbox"/> Smooth transitions between paragraphs <input type="checkbox"/> Any and all terms and acronyms are defined <input type="checkbox"/> Provides evidence to support points	<input type="checkbox"/> Good sentence structure <input type="checkbox"/> Adequate transitions between paragraphs <input type="checkbox"/> Most terms and acronyms are defined <input type="checkbox"/> Lacks support for some points	<input type="checkbox"/> Occasional poor sentence structure <input type="checkbox"/> Transitions between paragraphs unclear <input type="checkbox"/> Some terms and acronyms are defined <input type="checkbox"/> Provides minimal support for points	<input type="checkbox"/> Frequent poor sentence structure <input type="checkbox"/> Lacked transitions between paragraphs <input type="checkbox"/> Many terms and acronyms are undefined <input type="checkbox"/> Ideas not supported

Assessment Data Mathematical, Information and Computer Sciences

Learning Outcome: Students will be able to identify, locate, evaluate, and effectively and responsibly use and cite information for the task at hand (Information Literacy).

Outcome Measure: Annual: Each student will be required to write a paper on a topic in their field as a part of their participation in the Senior Seminar. The audience for this talk will include department faculty, fellow students and possibly some alumni. The students will be given the evaluation criteria in advance and their paper will be rated by the faculty using a rubric with a scale of 4 (outstanding) to 1 (unsatisfactory) in the following areas:

- References: Multiple references from distinct reputable sources
- Citation: References cited in the body of the document
- Synthesis: Appropriately synthesizes information from multiple distinct sources

Criteria for Success: 80% of the students should have an average score of at least 2.5 in each of the major areas.

Aligned with DQP Learning Areas (circle one or more):

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

Longitudinal Data:

Information Literacy	Percentage of Students at 2.5 or Higher						
	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
References	95%	100%	71%	89%	81%	94%	74%
Citation	84%	92%	76%	89%	81%	88%	74%
Synthesis	84%	85%	82%	78%	81%	94%	95%

Conclusions Drawn from Data: The students are generally meeting our expectations. This is still one of the areas with which the students have the most challenges since they have some challenges with citation of information particularly if it was taken from the internet.

Changes to be Made Based on Data: We found that we needed to be very specific about our expectations for the use and citation of information in papers. As we have improved the rubric, the students have improved. We continue to work with students in giving them clear feedback about the need to do a better job with references in technical papers.

Rubric: Next Page.

MICS Information Literacy Presentation Rubric

Criteria	Outstanding	High Satisfactory	Low Satisfactory	Unsatisfactory
Bibliography and supporting documents	<input type="checkbox"/> Multiple references from distinct reputable sources <input type="checkbox"/> References cited in the body of the document	<input type="checkbox"/> Most references from distinct reputable sources <input type="checkbox"/> Some citation of references in the body of the document	<input type="checkbox"/> Some references from reputable sources <input type="checkbox"/> Limited citation of references in the body of the document	<input type="checkbox"/> No bibliography or all references from untrusted sites on the internet <input type="checkbox"/> No citation of references in the body of the document
Organization	<input type="checkbox"/> Conveys a central theme with all ideas connected, arrangement of ideas clearly related to topic <input type="checkbox"/> Clear introduction, body (with sections), and conclusion includes summary and closure <input type="checkbox"/> Includes both an abstract and table of contents	<input type="checkbox"/> Conveys a central idea or topic with some ideas connected to the topic <input type="checkbox"/> Includes introduction, body and conclusion <input type="checkbox"/> Includes abstract and table of contents (one partial and one complete)	<input type="checkbox"/> Attempts to focus on an idea or topic with many ideas not connected to the topic <input type="checkbox"/> Introduction, body, conclusion detectable but not clear <input type="checkbox"/> Includes partial abstract and partial table of contents	<input type="checkbox"/> Has little or no focus on central idea or topic <input type="checkbox"/> Introduction, body or conclusion absent <input type="checkbox"/> No abstract or table of contents
Grammar and spelling	<input type="checkbox"/> No use of the first-person tense <input type="checkbox"/> No grammatical or spelling errors	<input type="checkbox"/> Few uses of the first-person tense <input type="checkbox"/> Few grammatical and spelling errors	<input type="checkbox"/> Several uses of the first-person tense <input type="checkbox"/> Some grammatical and spelling errors	<input type="checkbox"/> Written in the first-person tense <input type="checkbox"/> Many grammatical and spelling errors
Depth of information	<input type="checkbox"/> Appropriately synthesizes information from multiple distinct sources <input type="checkbox"/> Draws conclusions and personal insights from synthesis <input type="checkbox"/> Has the minimum number of pages including penalty pages; subject coverage is excellent	<input type="checkbox"/> Synthesis of information from at least three distinct sources <input type="checkbox"/> At least two personal insights or conclusions stated <input type="checkbox"/> Has the minimum number of pages including penalty pages; subject coverage is good	<input type="checkbox"/> Synthesis of information from at least two distinct sources <input type="checkbox"/> At least one personal insight or conclusion stated <input type="checkbox"/> Has the minimum number of pages including penalty pages; subject coverage is adequate	<input type="checkbox"/> Summary reporting of information without synthesis <input type="checkbox"/> No personal insights <input type="checkbox"/> Does not have the minimum number of pages including penalty pages
Clarity of writing	<input type="checkbox"/> Sentences flow <input type="checkbox"/> Smooth transitions between paragraphs <input type="checkbox"/> Any and all terms and acronyms are defined <input type="checkbox"/> Provides evidence to support points	<input type="checkbox"/> Good sentence structure <input type="checkbox"/> Adequate transitions between paragraphs <input type="checkbox"/> Most terms and acronyms are defined <input type="checkbox"/> Lacks support for some points	<input type="checkbox"/> Occasional poor sentence structure <input type="checkbox"/> Transitions between paragraphs unclear <input type="checkbox"/> Some terms and acronyms are defined <input type="checkbox"/> Provides minimal support for points	<input type="checkbox"/> Frequent poor sentence structure <input type="checkbox"/> Lacked transitions between paragraphs <input type="checkbox"/> Many terms and acronyms are undefined <input type="checkbox"/> Ideas not supported

Assessment Data Mathematical, Information and Computer Sciences

Learning Outcome: Students will collaborate effectively in teams.

Outcome Measure: Alternating year: CSC324 Signature Assignment – evaluation of group while working on a project (before 2015-16) and ISS3042 Project Management – evaluation of group while working on a project (2016-17 and beyond).

Alternating year: MTH3052 Signature Assignment – evaluation of group while working on a project.

Criteria for Success: 80% of the students should have an average score of at least 2.5 in each of the major areas.

Aligned with DQP Learning Areas (circle one or more):

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

Longitudinal Data:

	Percent of students with average at least 2.5				
	Fall 2012 CSC324	Fall 2014 CSC324	Fall 2016 ISS342*	Fall 2018 ISS342	Fall 2020 ISS3042
Contributes to team meetings	86%	80%	90%	100%	100%
Encourages team members	93%	84%	N/A	100%	100%
Contributes individually outside of team meetings	93%	88%	86%	100%	100%
Attitude	100%	96%	N/A	100%	100%
Fosters constructive team climate	100%	92%	N/A	100%	100%
Responds to conflict	100%	100%	90%	100%	100%

*Note that the full group work rubric will be used in future years.

	MTH352 Percent of students with average at least 2.5				
	Spring 2013	Spring 2015	Spring 2017	Spring 2019	Spring 2021
Contributes to team meetings	91%	86%	100%	100%	100%
Encourages team members	91%	93%	100%	100%	100%
Contributes individually outside of team meetings	82%	93%	100%	100%	100%
Attitude	100%	100%	100%	100%	100%
Fosters constructive team climate	91%	100%	100%	100%	100%
Responds to conflict	91%	100%	100%	100%	100%

Conclusions Drawn from Data: The students are performing well as member of teams.

Changes to be Made Based on Data: Continue to make use of group activities throughout the curriculum.

MICS Teamwork Rubric

Definition

Teamwork is behaviors under the control of individual team members (effort they put into team tasks, their manner of interacting with others on team, and the quantity and quality of contributions they make to team discussions.)

Evaluators are encouraged to assign a zero to any work sample or collection of work that does not meet unsatisfactory (cell one) level performance.

The purpose of this is to evaluate individual team members. Although no team member will ever see your evaluation of them, please take it seriously.

Directions:

- **Do not put your own name anywhere on this form, the evaluations are to be anonymous.**
- **Please write the name of the person you are evaluating here**_____
- **Please fill out one copy of this form for every person who was on your team, including one for yourself.**
- **For each row, place a checkmark in the box that best describes your teammate's performance.**

	Outstanding	High Satisfactory	Low Satisfactory	Unsatisfactory
Contributes to team meetings	<input type="checkbox"/> Helps the team move forward by articulating the merits of alternative ideas or proposals.	<input type="checkbox"/> Offers new suggestions to advance the work of the group.	<input type="checkbox"/> Shares ideas but does not advance the work of the group.	<input type="checkbox"/> Sits quietly in team meetings and does not contribute.
Encourages members of the team	<input type="checkbox"/> Actively seeks to find opportunities to encourage all members of the team.	<input type="checkbox"/> Offers encouragement to all members of the team.	<input type="checkbox"/> Offers words of encouragement to friends.	<input type="checkbox"/> Does not offer word of encouragement to anyone.
Individual contributions outside of team meetings	<input type="checkbox"/> Completes all assigned tasks by deadline; work accomplished is thorough. Proactively helps other team members complete their assigned tasks.	<input type="checkbox"/> Completes all assigned tasks by deadline; work accomplished is thorough.	<input type="checkbox"/> Completes all assigned tasks by deadline.	<input type="checkbox"/> Does not complete all assigned tasks by deadline.
Attitude	<input type="checkbox"/> Demonstrates (comments, facial expressions, etc.) a negative attitude rarely and helps others to become more positive.	<input type="checkbox"/> Demonstrates (comments, facial expressions, etc.) a negative attitude rarely .	<input type="checkbox"/> Demonstrates (comments, facial expressions, etc.) a negative attitude less often than a positive attitude.	<input type="checkbox"/> Demonstrates (comments, facial expressions, etc.) a negative attitude more often than a positive attitude.

Fosters constructive team climate	<input type="checkbox"/> Supports a constructive team climate by doing <u>all of the following</u> : <ul style="list-style-type: none"> • Treats team members respectfully by being polite and constructive in communication. • Uses positive vocal or written tone, facial expressions, and/or body language to convey a positive attitude about the team and its work. • Motivates teammates by expressing confidence about the importance of the task and the team's ability to accomplish it. 	<input type="checkbox"/> Supports a constructive team climate by doing <u>any two of the following</u> : <ul style="list-style-type: none"> • Treats team members respectfully by being polite and constructive in communication. • Uses positive vocal or written tone, facial expressions, and/or body language to convey a positive attitude about the team and its work. • Motivates teammates by expressing confidence about the importance of the task and the team's ability to accomplish it. 	<input type="checkbox"/> Supports a constructive team climate by doing <u>any one of the following</u> : <ul style="list-style-type: none"> • Treats team members respectfully by being polite and constructive in communication. • Uses positive vocal or written tone, facial expressions, and/or body language to convey a positive attitude about the team and its work. • Motivates teammates by expressing confidence about the importance of the task and the team's ability to accomplish it. 	<input type="checkbox"/> Supports a constructive team climate by doing <u>none of the following</u> : <ul style="list-style-type: none"> • Treats team members respectfully by being polite and constructive in communication. • Uses positive vocal or written tone, facial expressions, and/or body language to convey a positive attitude about the team and its work. • Motivates teammates by expressing confidence about the importance of the task and the team's ability to accomplish it.
Responds to conflict	<input type="checkbox"/> Identifies and acknowledges conflict and acknowledges that relationships can be damaged. Seeks to restore relationships.	<input type="checkbox"/> Identifies and acknowledges conflict and acknowledges that relationships can be damaged.	<input type="checkbox"/> Identifies and acknowledges conflict but will not acknowledge that relationships can be damaged.	<input type="checkbox"/> Will not acknowledge that conflict has occurred or that relationships can be damaged.

Assessment Data Mathematical, Information and Computer Sciences

Learning Outcome: Students will be able to understand and create arguments supported by quantitative evidence, and they can clearly communicate those arguments in a variety of formats (Quantitative Reasoning).

Outcome Measure: Before 2022: Annual: Each student will participate in the ETS Proficiency Profile exam. After Spring 2022: Annual: MTH3083 Mathematical Probability and Statistics Signature Assignment (Math and Data Science Majors). Alternating Year: ISS4014 Database and Web Signature Assignment (CS and IS Majors).

Criteria for Success: 90% of the students will be Marginal or Proficient at Level 2. Note that we dropped the criteria of success so that it is possible for the department to pass even if a single student misses the criteria.

Aligned with DQP Learning Areas (circle one or more):

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

Longitudinal Data:

ETS Proficiency Profile	Percentage of Students Marginal or Proficient									
	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
ETS Proficiency Profile Level 2 Mathematics	100%	100%	100%	100%	92%	82%	95%	93%	81%	90%

Conclusions Drawn from Data: Students are in general meeting our criteria. The variation often comes down to a single student because of small sample sizes. The Spring of 2021 was during COVID and students were exhausted by the time that they took the ETS exam, so this may explain the lower score for that year.

Changes to be Made Based on Data: We do not believe that the ETS exam is accurately measuring student quantitative ability in the department disciplines. Starting the 2022-23 academic year we will be measuring quantitative reasoning in the following classes:
Computer Science and Information Systems: ISS4014 Data Base Systems and Web Integration
Mathematics and Data Science: MTH3083 Mathematical Probability and Statistics

Rubrics: ETS Proficiency Profile (no rubric involved). New rubrics for signature assignments under development.

Assessment Data Mathematical, Information and Computer Sciences

Learning Outcome: Students will understand the professional, ethical and social issues and responsibilities with the implementation and use of technology.

Outcome Measure: Signature assignment in MTH3083 Mathematical Probability and Statistics.

Criteria for Success: 80% of the students should have an average score of at least 2.5 in each of the major areas.

Aligned with DQP Learning Areas (circle one or more):

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

Longitudinal Data:

	MTH3083 Percentage of students at 2.5 or higher
	2021-22
Explain the problem with the graph	60%
Explain how to make the graph truthful	60%

Conclusions Drawn from Data: This is the first time that we have conducted this assessment. The students who were present in class for the ethics module on representation of data did well on this question on the final. Those who were not in class did not do well. This is the first year of giving this assessment so we will be watching what happens over time.

Changes to be Made Based on Data: We are in the process of constructing a set of modules that will be embedded in several MICS classes and the intent that students will have multiple exposures to ethics-related issues and case studies. Our hope is that this scaffolding will ultimately support well-developed ethical responses in the classes where we gather assessment data.

MTH3083 Ethics Rubric

	Unsatisfactory (1)	Low Satisfactory (2)	High Satisfactory (3)	Outstanding (4)
Explain the Problem with the Graph	Indicates that there is no problem with the graph.	Identifies a problem that does not exist.	Identifies the error.	Correctly and clearly identifies the key error.
Explain How to Make the Graph Truthful	Explanation is not connected to the information	Explanation is partially correct and partially clear	Explanation is one of clear or correct	Explanation is both clear and correct