Mathematics and Data Science Assessment Report

2022-23

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**:** A signature assignment in MTH2074 Multivariate Calculus.

Previous: ETS Major Field Test in Mathematics: Algebra and Calculus subscores (This has been discontinued).

Criteria for Success: 80% of the students will score above 2.5 on the relevant rubric.

Previous: The department subscore will be at the 50th percentile or higher.

Aligned with DQP Learning Areas (circle one or more):
1. <mark>Specialized Knowledge</mark>
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 at 2.5 or Higher
	Fall 2022
Students will be able to solve problems using the algebraic properties of vectors	73%
Students will be able to solve multivariable calculus problems using analytical techniques	67%
Students will be able to solve multivariable calculus problems involving algebraic, geometric and analytical techniques	100%

Previous: ETS MFT 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
2020-21	N/A
2021-22	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
2020-21	N/A
2021-22	N/A

*Insufficient students for score to be calculated.
Note the ETS changed the Mathematics test in 2012-13.

Conclusions Drawn from Data: ETS: 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. The department has developed a signature assignment for MTH2074 Multivariate Calculus and pilot tested it in the 2022-23 academic year. The students didn't not meet our benchmark in this pilot test year.

Changes to be Made Based on Data: The most significant change that the department has made is to switch assessment methods. We will need to monitor data for a few more years before drawing any conclusions.

Rubric Used:
ETS: None. The scores are computed by ETS.

The MTH2074 rubric is given below.

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MTH2074 Rubric

	Unsatisfactory (0)	Low Satisfactory (1)	Satisfactory (2)	High Satisfactory (3)	Outstanding (4)
Students will be able to solve problems using the algebraic properties of vectors	Completely incorrect	Missed more than one key step or concept	Missed one key step or concept	Made a minor error	Completely correct
Students will be able to solve multivariable calculus problems using analytical techniques	Completely incorrect	Missed more than one key step or concept	Missed one key step or concept	Made a minor error	Completely correct
Students will be able to solve multivariable calculus problems involving algebraic, geometric and analytical techniques	Completely incorrect	Missed more than one key step or concept	Missed one key step or concept	Made a minor error	Completely correct

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									
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Statement of Problem	100%	100%	100%	89%	100%	100%	100%	100%	100%	100%
Logic	100%	100%	100%	89%	100%	100%	100%	100%	100%	83%
Symbolism	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Justification	83%	88%	100%	78%	100%	100%	100%	67%	50%	83%

	MTH4024 Pecentage 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 Pecentage at 2.5 or higher					
	Fall 2012	Fall 2014	Fall 2016	Fall 2018	Fall 2020	Fall 2022
Statement of Problem	92%	100%	83%	100%	67%	60%
Logic	92%	100%	0%	100%	100%	40%
Symbolism	100%	100%	67%	100%	100%	80%
Justification	77%	100%	67%	100%	100%	60%

Conclusions Drawn from Data: The students are generally meeting our benchmarks. Some of the variation comes from small sample sizes. The Fall 2022 MTH4044 question used for assessment was not well posed and that may have been part of the reason that students were not as successful as is typical.

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: Signature assignment in MTH2033 Linear Algebra (Annual)

> *Previous:*
> *ETS Major Field Test in Mathematics: Applied subscore (Annual).*
> *ETS Proficiency Profile – Reading/Critical Thinking (Annual).*

Criteria for Success: 80% of the students will be at a 2.5 or higher on the rubric.

> *Previous:*
> *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*

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:

	Percentage of Students at 2.5 or Higher
	2022-23
Computing Eigenvalues	71%
Understanding Mutually Orthogonal	71%

> *Previous: ETS MFT*

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
2019-20	N/A

2020-21	N/A
2021-22	N/A

* Insufficient students for score to be calculated.
ETS changed the Mathematics test in 2012-13. The department discontinued use in 2019-20.

	Percentage of Students Marginal or Proficient								
ETS Proficiency Profile	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
ETS Proficiency Profile Level 2 Critical Thinking	92%	100%	84%	92%	76%	79%	80%	88%	79%

Conclusions Drawn from Data: The students consistently met our expectations using the ETS PP. We became concerned about the consistency of the questions in the ETS MFT and resulted in the department discontinuing the use of that measure. In spring of 2023 we pilot tested the new assessment in MTH2033. The students nearly met our benchmark; if one more student had been successful, we would have crossed the threshold.

Changes to be Made Based on Data: None at this time. We will continue to monitor the use of our new assessment.

Rubric Used:
See the next page.

MTH2033 Signature Assignment Rubric

Students will be able to apply their mathematical knowledge and critical thinking to solve problems (CC:CT)

	Unsatisfactory (1)	Low Satisfactory (2)	High Satisfactory (3)	Outstanding (4)
Computing Eigenvectors	More than one major error including completely incorrect.	Made a major error	Made a minor error	Completely correct
Understanding mutually orthogonal	More than one major error including completely incorrect.	Made a major error	Made a minor error	Completely correct

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 and beyond: 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									
	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
Students will be able to use technology to solve	skipped	100%	78%	100%	100%	100%	100%			
Computational Correctness								100%	60%	80%
Graphical Tool								86%	100%	80%
Interpretation								86%	60%	60%

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

	Percentage of Class at 2 or Higher				
	2013-14	2014-15	Transition	2021-22	2022-23
Runtime Correctness	85%	100%		19%	61%
Problem Solving	100%	75%		69%	96%

Conclusions Drawn from Data: MTH3083: Students have been able to satisfactorily analyze data using technology. The last two years have been slightly below our benchmark but if one or two more students had scored slightly higher the benchmark would have been met. We have had some inconsistency in the assessment and we need to address that.

CSC2052: There was a universal issue with the assignment in CSC2052 in Fall 2021. We made changes and the Fall 2022 assessment came closer to the benchmark. Students continue to struggle with runtime correctness which is the most difficult part of the coding process.

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. We have had some inconsistency in the assessment question in the last three years and we need to regularize the question used.

CSC2052: The department is still working to analyze the change in the assessment in CSC2052. We saw improvement this year and are still adjusting the assignment to be sure that we are measuring that we want to measure.

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	• Less than 60% correct	• Between 60% – 79% correctness	• 80% - 89% correct	• 90% – 100% correct
Problem Solving	• Analysis of program source code indicates that program is NOT close to working, and could NOT easily be modified to work given additional time.	• 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.	• Analysis of program source code indicates that program is close to working, and could be modified to work given additional time.	• 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	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
Background	92%	100%	95%	100%	100%	95%	100%	100%	95%	100%
Organization	100%	100%	100%	92%	94%	100%	100%	94%	100%	94%
Oral Presentation Skills	92%	100%	95%	100%	100%	95%	100%	100%	100%	100%
Presentation Tools	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Ability to Field Questions	100%	89%	100%	100%	100%	94%	94%	100%	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.

Oral Presentation Rubric Update (4/12/17)

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

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.

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	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
Bibliography and Support	100%	100%	89%	100%	76%	89%	81%	88%	58%	81%
Organization	100%	100%	100%	92%	94%	100%	100%	100%	100%	88%
Grammar and Spelling	92%	89%	84%	100%	88%	94%	94%	94%	89%	88%
Depth of Information	77%	78%	89%	85%	76%	83%	94%	94%	95%	94%
Clarity of Writing	77%	78%	89%	85%	88%	94%	88%	100%	89%	94%

Conclusions Drawn from Data: In general, the students have been performing reasonably well in writing technical reports.

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.

MICS Written Presentation Rubric (12/31/22)

Criteria	Outstanding	High Satisfactory	Low Satisfactory	Unsatisfactory
Bibliography and supporting documents	☐ Multiple references from distinct reputable sources	☐ Most references from distinct reputable sources	☐ Some references from reputable sources	☐ No bibliography or all references from untrusted sites on the internet
	☐ References cited in the body of the document	☐ Some citation of references in the body of the document	☐ Limited citation of references in the body of the document	☐ No citation of references in the body of the document
Organization	☐ Conveys a central theme with all ideas connected, arrangement of ideas clearly related to topic	☐ Conveys a central idea or topic with some ideas connected to the topic	☐ Attempts to focus on an idea or topic with many ideas not connected to the topic	☐ Has little or no focus on central idea or topic
	☐ Clear introduction, body (with sections), and conclusion includes summary and closure	☐ Includes introduction, body and conclusion	☐ Introduction, body, conclusion detectable but not clear	☐ Introduction, body or conclusion absent
	☐ Includes both an abstract and table of contents	☐ Includes abstract and table of contents (one partial and one complete)	☐ Includes partial abstract and partial table of contents	☐ No abstract or table of contents
Grammar and spelling	☐ No use of first-person tense	☐ Few uses of the first-person tense	☐ Several uses of the first-person tense	☐ Written in first-person tense
	☐ No grammatical or spelling errors	☐ Few grammatical and spelling errors	☐ Some grammatical and spelling errors	☐ Many grammatical and spelling errors
Depth of information	☐ Highly accurate and substantive content	☐ Content is accurate, though key concepts are missing	☐ Content is flawed, and/or a significant number of key concepts are missing	☐ Content is significantly flawed and/or content is trivial
	☐ Appropriately synthesizes information from multiple distinct sources	☐ Synthesis of information from at least three distinct sources	☐ Synthesis of information from at least two distinct sources	☐ Summary reporting of information without synthesis
	☐ Draws conclusions and personal insights from synthesis	☐ At least two personal insights or conclusions stated	☐ At least one personal insight or conclusion stated	☐ No personal insights
	☐ Has the minimum number of pages including penalty pages; subject coverage is excellent	☐ Has the minimum number of pages including penalty pages; subject coverage is good	☐ Has the minimum number of pages including penalty pages; subject coverage is adequate	☐ Does not have the minimum number of pages including penalty pages
Clarity of writing	☐ Sentences flow	☐ Good sentence structure	☐ Occasional poor sentence structure	☐ Frequent poor sentence structure
	☐ Smooth transitions between paragraphs	☐ Adequate transitions between paragraphs	☐ Transitions between paragraphs unclear	☐ Lacked transitions between paragraphs
	☐ Any and all terms and acronyms are defined	☐ Most terms and acronyms are defined	☐ Some terms and acronyms are defined	☐ Many terms and acronyms are undefined
	☐ Provides evidence to support points	☐ Lacks support for some points	☐ Provides minimal support for points	☐ 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	2022-23
References	95%	100%	71%	89%	81%	94%	74%	81%
Citation	84%	92%	76%	89%	81%	88%	74%	75%
Synthesis	84%	85%	82%	78%	81%	94%	95%	81%

Conclusions Drawn from Data: The students are generally meeting our expectations. This is still one of the areas with which the students have some challenges particularly with citation.

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. 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 Written Presentation Rubric (12/31/22)

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

Assessment Data Mathematical, Information and Computer Sciences

Learning Outcome: Students will collaborate effectively in teams.

Outcome Measure: 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:

	MTH3052 Percent of students with average at least 2.5					
	Spring 2013	Spring 2015	Spring 2017	Spring 2019	Spring 2021	Spring 2023
Contributes to team meetings	91%	86%	100%	100%	100%	100%
Encourages team members	91%	93%	100%	100%	100%	100%
Contributes individually outside of team meetings	82%	93%	100%	100%	100%	100%
Attitude	100%	100%	100%	100%	100%	100%
Fosters constructive team climate	91%	100%	100%	100%	100%	100%
Responds to conflict	91%	100%	100%	100%	100%	100%

Conclusions Drawn from Data: The students are performing well as members 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	☐ Helps the team move forward by articulating the merits of alternative ideas or proposals.	☐ Offers new suggestions to advance the work of the group.	☐ Shares ideas but does not advance the work of the group.	☐ Sits quietly in team meetings and does not contribute.
Encourages members of the team	☐ Actively seeks to find opportunities to encourage all members of the team.	☐ Offers encouragement to all members of the team.	☐ Offers words of encouragement to friends.	☐ Does not offer word of encouragement to anyone.
Individual contributions outside of team meetings	☐ Completes all assigned tasks by deadline; work accomplished is thorough. Proactively helps other team members complete their assigned tasks.	☐ Completes all assigned tasks by deadline; work accomplished is thorough.	☐ Completes all assigned tasks by deadline.	☐ Does not complete all assigned tasks by deadline.
Attitude	☐ Demonstrates (comments, facial expressions, etc.) a negative attitude **rarely** and helps others to become more positive.	☐ Demonstrates (comments, facial expressions, etc.) a negative attitude **rarely**.	☐ Demonstrates (comments, facial expressions, etc.) a negative attitude **less** often than a positive attitude.	☐ Demonstrates (comments, facial expressions, etc.) a negative attitude **more** often than a positive attitude.

Fosters constructive team climate	☐ Supports a constructive team climate by doing **all** of the following: • 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.	☐ Supports a constructive team climate by doing any **two** of the following: • 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.	☐ Supports a constructive team climate by doing any **one** of the following: • 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.	☐ Supports a constructive team climate by doing **none** of the following: • 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	☐ Identifies and acknowledges conflict and acknowledges that relationships can be damaged. Seeks to restore relationships.	☐ Identifies and acknowledges conflict and acknowledges that relationships can be damaged.	☐ Identifies and acknowledges conflict but will not acknowledge that relationships can be damaged.	☐ 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: 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).

Previous: Annual: Each student will participate in the ETS Proficiency Profile exam.

Criteria for Success: 80% of the students will score a 2.5 or higher on the rubric for MTH3083 and ISS4014

Previous: 90% of the students will be Marginal or Proficient at Level 2.

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:

ISS4014: First administration in spring 2024

MTH3083:

	MTH3083 Percentage of students at 2.5 or higher
	2022-23
Students will be able to formulate a mathematical model from a verbal description of a problem.	100%
Students will be able to construct solutions to problems using computational techniques.	100%
Students will be able to interpret visual data.	20%

Previous:

	Percentage of Students Marginal or Proficient									
ETS Proficiency Profile	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. In spring of 2023 we pilot tested the new assessment in MTH3083 and the results were mixed. We need to examine how the visual interpretation question was asked.

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 (first administration will be in the spring of 2024) and for Mathematics and Data Science: MTH3083 Mathematical Probability and Statistics (first administration Spring 2023).

Rubrics:

ETS Proficiency Profile (no rubric involved)
ISS4014: Rubric under development
MTH3083: Rubric below

	Unsatisfactory (0)	Low Satisfactory (1)	Satisfactory (2)	High Satisfactory (3)	Outstanding (4)
Students will be able to formulate a mathematical model from a verbal description of a problem.	Completely incorrect	Missed more than one key step or concept	Missed one key step or concept	Made a minor error	Completely correct
Students will be able to construct solutions to problems using computational techniques.	Completely incorrect	Missed more than one key step or concept	Missed one key step or concept	Made a minor error	Completely correct
Students will be able to interpret visual data.	Completely incorrect	Missed more than one key step or concept	Missed one key step or concept	Made a minor error	Completely correct

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	2022-23
Explain the problem with the graph	60%	100%
Explain how to make the graph truthful	60%	100%

Conclusions Drawn from Data: We are seeing improvement in scores as we are including ethics modules in many classes in the curriculum. In 2022-23 the students met our benchmark. 2021-22 was 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 continue to construct a set of modules that are or 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