Assessment Data Mathematical, Information and Computer Sciences
General Education: Mathematics
2021-22

Learning Outcome: 1e. Quantitative Reasoning: Students will be able to solve problems that are quantitative in nature.

Components of this outcome as defined by the department:
- Students will be able to formulate a mathematical model from a verbal description of a problem.
- Students will be able to solve non-routine problems using logic and quantitative techniques.
- Students will be able to construct solutions to problems using computational techniques.

Outcome Measure: Problems placed on the final exam.
MTH1044 Calculus with Applications
MTH1064 Calculus I
MTH1073 Business Calculus
MTH3003 Problem Solving

Note that all classes use the same learning outcomes even if the problems used to measure those outcomes are different. Because it is a life skill, all classes spend some time on financial mathematics (loans, interest and credit cards) in a manner appropriate for the skill level of the students in the class.

Criteria for Success: Average score of 2.5 or higher for each problem. Note that this data is gathered by taking a random sample of the students in each section of each course.

Scale Used:
0 Unsatisfactory - Completely Incorrect
1 Low Satisfactory - Missed more than one key concept or step
2 Satisfactory - Missed one key concept or step
3 High Satisfactory - Made a minor error
4 Outstanding - Completely correct

Longitudinal Data:

		Students will be able to formulate a mathematical model from a verbal description of a problem.	Students will be able it solve non-routine problems using logic and quantitative techniques.	Students will be able to construct solutions to problems using computational techniques.
MTH144	Spring 2013	3.68	2.66	3.24
MTH144	Spring 2014	2.19	2.80	3.93
MTH144	Spring 2015	2.51	3.23	3.69
MTH144	Spring 2016	3.00	2.38	3.23
MTH144	Spring 2017	2.40	2.35	2.20
MTH144	Spring 2018	3.37	3.26	3.11
MTH144	Spring 2019	2.97	2.21	3.66
MTH1044	*Spring 2020*	2.60	3.18	3.95
MTH1044	*Spring 2021*	2.47	3.06	3.03
MTH1044	Spring 2022	2.16	2.59	3.41
MTH164	Fall 2013	3.35	2.80	3.68
MTH164	Fall 2014	2.95	2.90	2.83
MTH164	Fall 2015	3.47	2.53	3.58
MTH164	Fall 2016	2.32	2.97	2.92
MTH164	Fall 2017	2.80	2.48	2.38
MTH164	Fall 2018	1.85	1.82	3.15
MTH1064	Fall 2019	2.05	3.00	3.29
MTH1064	*Fall 2020*	*2.70*	*3.50*	*3.48*
MTH1064	*Fall 2021*	*2.15*	*3.29*	*3.26*
MTH173	Spring 2016	2.93	3.15	3.18
MTH173	Fall 2016	2.21	2.53	2.68
MTH173	Spring 2017	3.32	2.87	2.84
MTH173	Fall 2017	2.79	2.75	2.55
MTH173	Spring 2018	2.75	2.72	2.39
MTH173	Fall 2018	2.87	2.50	2.73
MTH173	Spring 2019	3.67	3.17	3.11
MTH1073	Fall 2019	3.25	2.60	2.38
MTH1073	*Spring 2020*	*3.05*	*3.30*	*3.68*
MTH1073	*Fall 2020*	*2.48*	*3.00*	*3.60*
MTH1073	*Spring 2021*	*2.00*	*2.54*	*3.57*
MTH1073	*Fall 2021*	*3.43*	*3.00*	*2.57*
MTH1073	Spring 2022	1.98	2.33	3.23
MTH303	Fall 2013	2.95	2.97	2.93
MTH303	Spring 2014	2.85	2.65	2.83
MTH303	Fall 2014	2.81	2.77	3.02
MTH303	Spring 2015	2.56	2.64	2.70
MTH303	Fall 2015	3.24	2.55	2.77
MTH303	Spring 2016	2.37	2.53	2.54
MTH303	Full 2016	3.40	2.96	3.49
MTH303	Spring 2017	2.56	2.84	2.74
MTH303	Summer 2017	2.63	2.30	2.28
MTH303	Fall 2017	2.76	2.50	3.02
MTH303	Spring 2018	2.89	3.17	2.94
MTH303	Fall 2018	2.76	2.65	2.95
MTH303	Spring 2019	2.67	2.70	3.10
MTH3003	Fall 2019	3.19	2.86	3.31
MTH3003	*Spring 2020*	*3.38*	*3.49*	*3.12*
MTH3003	*Fall 2020*	*3.21*	*3.81*	*3.13*
MTH3003	*Spring 2021*	*3.44*	*3.19*	*3.56*
MTH3003	*Fall 2021*	*2.59*	*2.79*	*2.09*
MTH3003	Spring 2022	2.77	2.32	2.50

Italics means taught during the COVID pandemic with non-standard class arrangements.

Conclusions Drawn from Data: Note that in the Spring of 2014 some sections of MTH303 were hybrid. Starting in the Fall of 2014, all sections of MTH303 were hybrid. It is interesting to note that student learning outcome success has persisted through the change in modality. The COVID pandemic had impact on class delivery from the Spring of 2020 through the Fall of 2021. The learning outcomes results remained fairly consistent throughout that period.

Some of the early weaknesses in the data came from two features: poorly phrased problems (MTH144 and MTH164) and a need for a greater emphasis on financial mathematics in MTH144 and MTH164. These are calculus classes and we were expecting students to draw conclusions about how to apply calculus techniques to finance without sufficient practice.

MTH173 was introduced in the 2015-16 academic year, we have now worked through the process of designing questions that are appropriate for that course and that trend can be seen in the results.

Students' greatest weakness remains formulating a problem from a verbal description (word problems). This is particularly evident in the calculus classes (MTH1044, MTH1064 and MTH1073).

Changes to be Made Based on Data: Students seem to have had more than a typical level of difficulty with formulating mathematical models from a verbal description during the pandemic. We hope to have some clearer data about this issue in the coming semesters as classes return to a more typical face-to-face format.

Rubric Used

General Education Mathematics Rubric

	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 solve non-routine problems using logic and quantitative 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 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

Calculus (MTH1044, MTH1064 and MTH1073)
- Interest
- Max/min
- Complex derivative

Problem Solving (MTH3003)
- Compound interest
- Scheduling
- Interest