Assessment Data Mathematical, Information and Computer Sciences
Foundational Education: Mathematics
2020-21

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
MTH164	Fall 2012	3.50	3.28	3.80
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*
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*
MTH303	Spring 2012	2.69	2.95	2.71
MTH303	Fall 2012	3.22	2.70	2.48
MTH303	Spring 2013	3.54	2.89	2.74
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***

Bold means taught in hybrid format. Italics means taught during the COVID pandemic.

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. Spring 2020, Fall 2020 and Spring 2021 were during the COVID pandemic and the students were taught in synchronous online modality or hybrid modality. The learning outcomes results remained consistent even with that change.

Some of the early weakness 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 had 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 is formulating a problem from a verbal description (word problems).

Changes to be Made Based on Data: We have increased emphasis on practical financial mathematics in all FE courses. Increasing the time spent on solving problems and engaging in computations in groups in class seems to have helped with the outcomes.

Place some additional emphasis on word problems in all FE classes – particularly the step of translating the words into an equation before engaging in a solution.

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