Assessment Data Mathematical, Information and Computer Sciences
Foundational Education: Mathematics (TUG)
2023-24

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.
MTH1033 Precalculus (added as GE in 2024)
MTH1044 Calculus with Applications
MTH1053 Mathematical Analysis for Business and Economics (added as GE in 2024)
MTH1064 Calculus I
MTH1073 Business Calculus
MTH2013 Fundamentals of Elementary Mathematics I (added as GE in 2024)
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:

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

Conclusions Drawn from Data: The data shows some weaknesses during the Covid pandemic and we have seen some student weakness in freshman classes (particularly MTH1044, MTH1064 and MTH1073) after the end of the pandemic. There seem to be some holes in students' knowledge.

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.

The MTH1064 class in the Fall of 2023 had some particular challenges in students mastering the material in the course. We suspect that this is because this if the class of students who were freshman in high school when the pandemic began and some of them appear to have some foundational weakness in their knowledge of mathematics.

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.

MTH1033, MTH1053 and MTH2013 were introduced as general education classes in the 2024-25 academic year. We are still working through refining the assessment problems.

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 continue to work on this issue and have seen some post-pandemic improvement.

Based on the experience we had with MTH1064 in the fall of 2023, we have changed the labs in MTH1064 and MTH1074 to be more like traditional recitation sessions that will focus on problem solving to try to address some of the weaknesses in the students' high school preparation. We saw improvement in the fall 2024 student scores so it looks like this approach is working.

In addition, we have changed the tool that we are using for the university-wide math placement

In addition, we have changed the tool that we are using for the university-wide math placement exam. This new tool allows students to do some online remediation before retaking the exam. We are hoping that this opportunity for review will help students to enter classes more prepared for the demands of college-level mathematics courses.

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