

# **Assessment Report: Mathematics Teaching Learning Outcomes 2015-16**

## **Fall 2015 Assessment Results**

According to the below description of Mathematics Teaching Program Learning Outcomes and Assessment, 8 students were assessed for Outcomes 5 and 6 in M 428.

- 1) Outcome 5: Model, analyze, and interpret situations using data analysis, statistics, and probability.
- 2) Outcome 6: Develop, apply and validate mathematical models using current and emerging technologies.

### **Description of Signature Assignment**

Address the following standard: Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling. Students complete a project in which they simulate the choice (from a population of all cars on that highway) of 10 at random (assuming normal distribution of mean 51 and SD 15). Create a histogram, summarize variability, and develop a margin of error. Include a discussion of the use of simulation.

### **Assessment Results**

Three students displayed a substantial range of appropriate modeling strategies in the statistical content focus that would enable success in the teaching profession. Their use of technology for simulation and explanation was sufficient to indicate their ability to apply and validate mathematical models, and they were deemed “proficient.” Five students displayed an adequate range of modeling strategies and technology use and were deemed “adequate.” The distinction between the “proficient” and the “adequate” students was in the depth of explanation of variability and margin of error as a concept that can be defined through a simulation process rather than through a “rule of thumb.”

The program meets the threshold, since 100% of students were at the acceptable or higher level.

### **Recommendations**

The course should continue to emphasize simulation as a foundational tool for the teaching of statistical modeling. More in-depth attention to the use of simulation should be included in future offerings of the course.

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## **Spring 2016 Assessment Results**

According to the below description of Mathematics Teaching Program Learning Outcomes and Assessment, 27 students were assessed for Outcome 1 in M 242.

- 1) Outcome 1: Reason with and about mathematical statements and construct and validate mathematical arguments.

### **Description of Signature Assignment**

The final exam contained (among other problems) 1. A proof by contradiction 2. A proof by contraposition 3. A proof by induction 4. A direct proof.

### **Assessment Results**

25 of the 27 students were successful at the direct proof of a result from number theory. The two who were unsuccessful had partial but incomplete understanding of the proof content and technique. 26 of the 27 students were successful at the proof by induction. The one who was unsuccessful made an error common of unsophisticated proof attempts in assuming the statement to be proved. 25 of 27 students were successful at the proof by contrapositive. The two who were unsuccessful did not properly construct the contrapositive statement.

4 of the 27 students were successful at the proof by contradiction. A further 18 students were able to correctly begin the proof, but had difficulty using the definition of an irrational number to complete the proof. Only 5 students were unable to begin the proof. It is our assessment that the difficulty was not with the proof technique, but arose because most proofs in the course focused on definitions and theorems about integers, but the question on the signature assignment used a question that relied on knowledge of rational and irrational numbers. In that regard, the signature assignment question could be improved to align more with the content of the course.

Every student reached an acceptable level of reasoning on at least one proof type. 15 students' overall work was judged to be proficient. 11 students' work was judged to be acceptable. 1 students' work was judged unacceptable.

This assessment is of all students in M 242; not all students are enrolled in the mathematics teaching program. The student whose work was unacceptable is not in the mathematics teaching program.

The program meets the threshold, since 100% of mathematics teaching program students are at the acceptable level and 50% of students were at the proficient level.

### **Recommendations**

In further offerings of the course, more emphasis should be placed on writing proofs that come from topics in the real numbers. The course provides sufficient attention to topics in number theory.

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## Program Learning Outcomes

Students should demonstrate the ability to:

- 1) Reason with and about mathematical statements and construct and validate mathematical arguments.
- 2) Solve problems with and reason about functional relationships and algebraic structures.
- 3) Apply fundamental ideas of number theory and combinatorics in the exploration, solution, and formulation of problems.
- 4) Create, critique, and revise proofs in Euclidean and non-Euclidean geometries.
- 5) Model, analyze, and interpret situations using data analysis, statistics, and probability.
- 6) Develop, apply and validate mathematical models using current and emerging technologies.

## Curriculum Map and Assessment Schedule

	Outcomes						Assessment Schedule
	1	2	3	4	5	6	
M 242, Methods of Proof	X						Even spring semesters
M 328, Higher Mathematics for Secondary Teachers		X	X				Even fall semesters
M 329, Modern Geometry				X			Odd spring semesters
M 428, Mathematical Modeling for Teachers					X	X	Odd fall semesters

## Rubric

The selection of the assignment that will serve as the signature assignment is left up to the discretion of the course instructor for that semester.

	Unacceptable	Acceptable	Proficient
Student's signature assignment for the learning objective being assessed:	Displays limited range of appropriate reasoning, problem solving, or modeling strategies in the mathematical content focus that would enable success in the teaching profession.	Displays an adequate range of appropriate reasoning, problem solving, or modeling strategies in the mathematical content focus that would enable success in the teaching profession.	Displays a substantial range of appropriate reasoning, problem solving, or modeling strategies in the mathematical content focus that would enable success in the teaching profession.

## Threshold

For the students completing the program in mathematics teaching, our goal is that 100% of students will be at an acceptable level or better, and 50% will be at a proficient level, for each of the learning outcomes.