Assessment Report: Mathematics - Teaching Learning Outcomes 2017-2018

Fall 2017 Assessment Results

According to the below description of Mathematics Teaching Program Learning Outcomes and Assessment, 12 students were assessed for Outcomes 5 and 6 in M 428.

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

Description of Signature Assignment

The outcome was assessed using representative items from the statistics midterm for M 428. Students' responses were given a score, according the following rubric from the assessment plan.

	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.

Assessment Items

Question 2 on the statistics midterm addressed the following content standard:

> HSS.IC.B.4 – Use data from a sample survey to estimate a population mean or proportion; develop margin of error through the use of simulation models for random sampling.

Students completed several parts to a problem in which they describe how to obtain a representative sample, generate data using technology, discuss the need for measuring uncertainty, use technology to create a simulation model and generate a sampling distribution and develop a margin error, and discuss the use of simulation for teaching.

Assessment Results

	Unacceptable Level	Acceptable Level	Proficient Level
Number (percentage) of students achieving this level	0	6	6

50% of the students in the course demonstrated an acceptable level in these learning outcomes. Further, 50% demonstrated a proficient level for the outcomes. 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 the use of formulas.

The program meets the threshold as 100% of students were at an acceptable level or proficient level.

Recommendations

Overall, students were able to successfully use emerging technologies to create a simulation model and use concepts to develop a margin of error. The course should continue to emphasize simulation as a foundational tool for the teaching of statistical modeling. More emphasis should be placed on discussing the need for measuring uncertainty around a single estimate by generating a sampling distribution and discussing the differences (and common misconceptions) between a population distribution, sample distribution and sampling distribution.

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Spring 2018 Assessment Results

According to the below description of Mathematics Teaching Program Learning Outcomes and Assessment, six pre-service teachers were assessed for Outcome 1 in M 242. The six students were all of the students in M 242 who are in the Mathematics - Teaching program during Spring 2018.

> 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. Three questions designed to critique others' reasoning and to identify and correct errors in proofs 2. A proof by contradiction 3. A proof by contraposition 4. A proof by induction 5. A direct proof

Assessment Results

All six students were successful at critiquing the reasoning of others and identifying and correcting errors in proofs. Four students were proficient for each of the three problems and the remaining two were proficient for two of the three problems.

Four of the six students were successful at the proof by contraposition. One student correctly began the proof but had difficulty using definitions to correctly complete the proof. One student had difficulty correctly setting up the proof but correctly used definitions to argue their supposition. For proof by contradiction, 3 of the six students were fully or nearly successful (two students had minor errors). The remaining three students correctly began the proof but were incorrect in identifying what they needed to prove.

Three of the six students were successful at the direct proof and an additional two students were successful though their proofs contained small flaws. One student was able to begin the proof but was unable to conclude the proof.

For proof by induction, five of the six students were successful. Three of the five student's proofs contained small errors. One of the six students correctly outlined the proof but was unable to reason through the inductive step.

Four of the six students' overall work was judged to be proficient. One students' work was judged to be acceptable and one students' work was judged to be borderline acceptable. 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 distinguishing proof by contraposition and proof by contradiction. Five of the six students were successful in one of these types of proof but three of these students did not correctly set up the other type of proof.

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Program Learning Outcomes

Students demonstrate the ability to:

1) Reason with and about mathematical statements and construct and validate mathematical arguments (M 242).
2) Solve problems with and reason about functional relationships and algebraic structures (M 328).
3) Apply fundamental ideas of number theory and combinatorics in the exploration, solution, and formulation of problems (M 328).
4) Create, critique, and revise proofs in Euclidean and non-Euclidean geometries (M 329).
5) Model, analyze, and interpret situations using data analysis, statistics, and probability (M 428).
6) Develop, apply and validate mathematical models using current and emerging technologies (M 428).

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.