Assurance of Student Learning Report 2022-2023	
Ogden College of Science & Engineering	*Department of Mathematics*
730 Middle Grades Mathematics	
Patrick Brown, Program Coordinator	
Is this an online program? ☐ Yes ☒ No	Please make sure the Program Learning Outcomes listed match those in CourseLeaf . Indicate verification here ☐ Yes, they match! (If they don't match, explain on this page under **Assessment Cycle)**

Use this page to list learning outcomes, measurements, and summarize results for your program. Detailed information must be completed in the subsequent pages. Add more Outcomes as needed.			
Program Student Learning Outcome 1: Effectively communicate mathematical ideas in verbal and written forms.			
Instrument 1	**Capstone Project in MATH 490 – Seminar in Middle Grades Mathematics**		
Based on your results, check whether the program met the goal Student Learning Outcome 1.		☒ **Met**	☐ **Not Met**
Program Student Learning Outcome 2: Successfully solve a variety of problems using appropriate mathematical tools.			
Instrument 1	**Final Exam in MATH 411 – Problem Solving for Elementary & Middle School Teachers**		
Based on your results, check whether the program met the goal Student Learning Outcome 2.		☒ **Met**	☐ **Not Met**
Program Student Learning Outcome 3: Propose and formally prove mathematical conjectures.			
Instrument 1	**Final Exam in MATH 403 – Geometry for Middle School Teachers**		
Based on your results, check whether the program met the goal Student Learning Outcome 3.		☒ **Met**	☐ **Not Met**

Assessment Cycle Plan:

During this past year, we have been working on new Student Learning Outcomes. They are now essentially complete, and we are assessing those learning outcomes this cycle, as we discussed in the last cycle. The learning outcomes assessed this cycle do not match the outcomes in CourseLeaf, as we have not had time to update them since finalizing our new goals and metrics this Spring. However, we will be updating our learning outcomes in CourseLeaf as soon as possible in Fall 2023.

The 2023/2024 cycle will assess these new objectives as well.

Program Student Learning Outcome 1				
Program Student Learning Outcome	**Effectively communicate mathematical ideas in verbal and written forms.**			
Measurement Instrument 1	**Capstone Project in MATH 490 – Seminar in Middle Grades Mathematics** **Students work independently with a faculty member on a mathematics research project, culminating in both a final paper and final presentation, in which they are assessed on their ability to effectively communicate mathematics in both verbal and written forms.**			
Criteria for Student Success	*Students will exhibit the ability to effectively communicate mathematics in verbal and written forms via their final oral presentation and written paper in theis senior seminar class. Students will average a "sufficient"or higher across all assessment domains: Writing of Paper, Delivery of Presentation, Quality of Mathematics, Quantity of Mathematics, Mathematical Accuracy, and Mathematical Understanding.*			
Program Success Target for this Measurement	70% of students will average "sufficient" or higher across all domains on the project rubric.		**Percent of Program Achieving Target**	100% of students averaged "sufficient" or higher across all domains on the project rubric.
Methods	All students enrolled in the senior capstone course, MATH 490, during the 2022/2023 academic year were assessed.			
Based on your results, highlight whether the program met the goal Student Learning Outcome 1.			☒ **Met**	☐ **Not Met**

Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)

Results: While we expect that this goal is attainable, we had a particulary strong (but small) class of students this year, with 100% of them exceeding the target.

Conclusions: We've been improving our MATH 490 course for the last few years, including more in-class time to better support students and to help them understand and meet course expectations. We suspect this has helped our success a fair amount. Previously we tried to address this area by including "mini-capstone projects" in some other 400-level courses, but this did not yield the positive impact we thought it would. We do still require students to communicate mathematics in a myriad of ways in those courses, but have moved away from requiring these mini-capstone projects. Going forward, we believe that the best practice is to maintain the rigor we have in the 400-level courses, and to continue to look for ways to support our students once they hit the capstone course.

Plans for Next Assessment Cycle: We have just completed a substantial redesign of our course goals and meterics over the past year. Our plan for next year is to assess these new goals using the opdated instruments and metrics and then evaluate at the in Spring 2024 to determine whether are measuring the things we set out to measure, and whether those things are the right things to be measuring.

Program Student Learning Outcome 2				
Program Student Learning Outcome	**Successfully solve a variety of problems using appropriate mathematical tools.**			
Measurement Instrument 1	**Final Exam in MATH 411 – Problem Solving for Middle Grades Teachers** **Students in this class learn formal and informal problem solving strategies, and apply these strategies, along with mathematical understanding gained in previous coursework, to solve a wide variety of problems. Much like the senior seminar course, this course requires students to draw upon skills and concepts from across the program and apply them in new and creative ways.**			
Criteria for Student Success	*Students will demonstrate their ability to successfully solve a variety of problems using appropriate mathematical tools on the final exam for this problem solving class. The final exam contains problems requiring a wide range of problem-solving strategies and a diverse set mathematical tools. Students will be evaluated on each problem using a 10 point rubric that assesses their ability to understand the problem, choose and implement an appropriate strategy, obtain the correct answer, and explain their thinking.*			
Program Success Target for this Measurement	70% of students will average 7.5/10 or higher on the problem-solving rubric across all problems.	**Percent of Program Achieving Target**	100% of students averaged 7.5/10 or higher on the problem-solving rubric across all problems.	
Methods	All students enrolled in the problem solving course, MATH 411, during the 2022/2023 academic year were assessed.			
Based on your results, highlight whether the program met the goal Student Learning Outcome 2.			☒ **Met**	☐ **Not Met**

Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)

Results: While we expect that this goal is attainable, we had a particulary strong (but small) class of students this year, with 100% of them meeting the target.

Conclusions: We feel that students' development as mathematical problem solvers is one of the most important goals of our program. As such, every one of our courses contains a problem-solving component, which is not unusual for a mathematics program. We work very closely as a program faculty to coordinate our efforts, and I think this work shows in the success of our students. For our students preparing to be teachers, we want to make sure they are well-prepared to develop the next generation of problem solvers, so we will continue to focus on this area.

Plans for Next Assessment Cycle: We have just completed a substantial redesign of our course goals and meterics over the past year. Our plan for next year is to assess these new goals using the opdated instruments and metrics and then evaluate at the in Spring 2024 to determine whether are measuring the things we set out to measure, and whether those things are the right things to be measuring.

Program Student Learning Outcome 3				
Program Student Learning Outcome	**Propose and formally prove mathematical conjectures.**			
Measurement Instrument 1	**Final Exam in MATH 403 – Geometry for Middle Grades Teachers** **As the second geometry course students in the Middle Grades Mathematics program take, MATH 403 is a proof-based course. Students make conjectures and prove theorems throughout the course, culminating in the final exam. This exam assesses students' ability to propose and formally prove mathematical conjectures from across the geometry curriculum, making it an especially appropriate instrument for this learning outcome.**			
Criteria for Student Success	*Students will demonstrate their ability to propose and formally prove mathematical conjectures on the final exam for this proof-based geometry course. Students will be evaluated on each proof-based problem using a 10 point value-rubric that assesses their ability.*			
Program Success Target for this Measurement	70% of students will average 70% of students will average 7.5/10 or higher on the rubric across all proof-based problems.	**Percent of Program Achieving Target**	75% of students averaged 7.5/10 or higher on the proof-solving rubric across all problems.	
Methods	All students enrolled in the problem solving course, MATH 403, during the 2022/2023 academic year were assessed.			
Based on your results, highlight whether the program met the goal Student Learning Outcome 2.			☒ **Met**	☐ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)				

Results: We met this goal, but barely. With such a small number of students, if any more than 1 did not meet, we would not have met as a program.

Conclusions: Students' ability to write proofs is something we continue to struggle with in the Middle Grades Math Program. While these students may never teach a proof-based class themselves, we believe the ability to formally prove theorems and conjectures is an important component in developing and exhibiting mathematical undertsnading. Several years ago, we added a new transition course, MATH 302 – Introduction to Advanced Mathematics, to our program. This allowed us to focus on developing students' ability to write proofs, and to "beef up" our subsequent course work to include more proof-based content. This has been a gradual process, but we believe we're now graduating stronger students. While we may occasionally struggle to meet this standard, we will continue to focus our efforts to include more abstractification and generalization across our upper-division courses.

Plans for Next Assessment Cycle: We have just completed a substantial redesign of our course goals and meterics over the past year. Our plan for next year is to assess these new goals using the opdated instruments and metrics and then evaluate at the in Spring 2024 to determine whether are measuring the things we set out to measure, and whether those things are the right things to be measuring.

CURRICULUM MAP

Program name:	Middle Grades Mathematics
Department:	Mathematics
College:	Science & Engineering
Contact person:	Patrick Brown
Email:	patrick.brown@wku.edu

KEY:

I = Introduced

R = Reinforced/Developed

M = Mastered

A = Assessed

			Learning Outcomes		
			LO1:	**LO2:**	**LO3:**
Course Subject	**Number**	**Course Title**	Effectively communicate mathematical ideas in verbal and written forms.	Successfully solve a variety of problems using appropriate mathematical tools.	Propose and formally prove mathematical conjectures.
MATH	136	Calculus I		I	
MATH	183	Introductory Statistics	I	I	
MATH	205	Number Systems and Number Theory for Teachers	I	I	
MATH	206	Fundamentals of Geometry for Teachers	R	R	
MATH	308	Rational Numbers and Data Analysis for Teachers	R	R	
MATH	302	Introduction to Advanced Mathematics for Middle Grades Teachers	R	R	I
MATH	304	Functions, Applications and Explorations	R	R	R
MATH	403	Geometry for Elementary and Middle School Teachers	M	M	M / A
MATH	411	Problem Solving for Elementary and Middle School Teachers	M	M / A	M
MATH	413	Algebra and Technology for Middle Grades Teachers	M	M	M
MATH	490	Seminar in Middle Grades Mathematics	M / A	M	M

Rubric for Learning Outcome 1:

Seminar in Middle Grades Mathematics — Student Name: _____

Final Paper & Presentation Rubric — Committee Member: _____

The student's final paper and presentation will be evaluated by a committee of mathematics faculty members, including the student's supervising faculty member. The committee shall use the departmental rubric for grading the final products.

For each category, the student will receive a grade of 0 – 4 from each committee member, with half-points allowed.

0 – Inadequate **1 – Deficient** **2 – Sufficient** **3 – Accomplished** **4 – Exemplary**

Category	Score
Writing of Paper Readability, Structure, Formatting, Style, Grammar, Spelling, Citations, References, Writing Conventions, Length (12-20 pgs.), etc.	
Delivery of Presentation Style, Comfort, Audience Engagement, Flexibility, Tone, etc.	
Quality of Mathematics Appropriateness of Topic/Problem, Level of Difficulty, Originality	
Quantity of Mathematics Student exhibits a body of mathematical work appropriate for a 3 credit, 400-level class in the Middle Grades Mathematics Major	
Mathematical Accuracy Appropriate use of mathematical tools, Lack of errors, etc.	
Mathematical Understanding Evidence that student deeply and thoroughly understands the project, and that the project is student's own work	
Comments:	

The final grade will be the average of all of the scores from all graders, less any deductions*. Letter grades will be assigned as follows:

F – [0, 0.5) **D – [0.5, 1.5)** **C – [1.5, 2.5)** **B – [2.5, 3.5)** **A – [3.5, 4.0]**

Rubric for Learning Outcome 2:

MATH 411 – Problem Solving

Each problem will be graded using the following rubric for a total of 10 points per problem.

A. Understand the problem
   0- Completely misinterprets the problem.
   1- Misinterprets part of the problem.
   2- Shows complete understanding of the problem.

B. Choosing a solution strategy
   0- Does not give evidence of using a strategy or uses a totally inappropriate strategy.
   1- Chooses a strategy that could possibly lead to a correct solution or chooses a strategy that will get him or her a partway through the problem but fails to change strategies when appropriate.
   2- Chooses a correct strategy that could lead to a correct solution if used without error.

C. Implementing the strategy
   0- Makes no attempt to solve, uses a totally inappropriate strategy, or uses a correct strategy totally incorrectly.
   1- Implements a partly correct strategy based on interpreting part of the problem correctly or chooses a correct strategy and implements it poorly.
   2- Implements a correct strategy with minor errors or no errors.

D. Getting the Answer
   0- Gets no answer, fails to state the answer, or gets a wrong answer based on an inappropriate solution strategy
   1- Makes copying error or computation error, gets partial answer to a problem with multiple answers, or labels answer incorrectly.
   2- Gets correct answer, states it, and labels it properly.

E. Giving an explanation of your thinking
   0- Makes no explanation or incoherent explanation,
   1- Gives an incomplete explanation, or the explanation is hard to follow.
   2- Gives a clear, coherent, complete explanation.

Rubric for Learning Outcome 3:

MATH 403: Geometry for Elem/Middle Grades Teachers
10-Point Rubric

Rubric for proof-based problems:

10	8	5	2	0
Surpasses Standard (Mastery plus Connections)	Meets Standard (Mastery)	Approaching Standard	Not Yet Approaching Standard	No Attempt
Demonstrates complete understanding. A correct and complete proof is given. Some irrelevant information may be included but does not affect the intended proof.	Demonstrates complete understanding. A correct approach to proving the theorem is attempted. Some statements may be unjustified or improperly justified, but errors are minor and could be fixed given time to polish the proof.	Demonstrates understanding of theorem to be proved, but proof is incomplete or does not prove the intended result. Statements linked into a reasonable (though perhaps misguided) attempt to prove the theorem. The proof may be left incomplete or may depend upon a major unjustified leap.	Attempts the proof but demonstrates little or no understanding.	Product does not address the assignment, is off topic, or was not submitted.