

George Mason University
GMU COMPLETE MATH
Center for Outreach in Math Professional Learning and Educational Technology
COS & CEHD
MATH 600: ALGEBRAIC THINKING and Modeling Mathematical Ideas

Summer/Fall 2015

Professional Development Outreach Course

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I. Course Description: *Modeling Math Ideas across the Learning Progressions*

MATHEMATICAL MODELING, ALGEBRAIC THINKING

This course focuses on developing computational fluency and proportional reasoning across the learning progressions in grades 3-8 through mathematical inquiry. Computational Fluency and Proportional reasoning is examined in the domains of Numbers, Rational Numbers, Functions and Algebra, Data Analysis Probability, Measurement and Geometry with an emphasis on middle grade student learning trajectories.

Meeting dates

DATES:

Part1: Summer institute: August 3-6 (Mon-Thursday) 8:30 am-3:30 pm

Part2: Fall Follow-up: Web assignments due Sept. 17 (TH), Oct. 15 (TH), Collaborative Planning in Teams online coaching

NOV 19 (TH) Learning Study Symposium LOCATION: GMU FAIRFAX Campus

II. Student Outcomes

At the conclusion of this course, students should be able to:

- A. Promote a better understanding of the nature of mathematics, learning progressions and mathematical inquiry
- B. Demonstrate problem-solving strategies in various mathematical content areas and methods for cultivating problems solving, reasoning and communicating skills
- C. Foster an understanding of how children's mathematical thinking develops
- D. Articulate methodologies for teaching mathematics more effectively to children with various abilities in Grades 4-9; Plan effective mathematics instruction for students from diverse populations with a variety of learning needs.
- E. Understand where computational fluency and proportional reasoning can be woven into the elementary and middle grade curriculum.

III. Nature of Course Delivery

The delivery of this course combines methods of seminar, online sessions, active learning, discussion, independent work, student presentation, mathematical problem solving, and writing. The course is designed both in structure and process to engage students in dialogue at the individual, group, and collective levels. Different formats will be used to help build both the capacity of the learning community. Readings and lectures will precede and focus class on-line discussions and interactive forums. This course relies on your willingness to participate in all class and team discussions. You will be asked to complete weekly reading assignments and offer key ideas on how the readings inform professional experience. The syllabus lays out an initial plan for our work and may be revised during the course to meet students' needs and interests. Students are expected to be independent thinkers, intellectually curious, and responsible to each other for the quality of classroom learning. This calls for both purposeful collaborative work as well as deep individual reflection. The course is designed to enhance both of these skill sets. You should expect to spend time in between classes to reading/viewing/listening to assigned materials, conducting research and completing assignments, completing reflections, problem solving and simulations, and participating in substantive on-line discussions.

IV. Readings: Reading packet Resources on Class website

V. Course Requirements and Assignments

The assignments across the semester are intended to improve your strategies as a mathematics teacher and to develop your skills in the interpretation, critique and synthesis of mathematics education research. All assignments are to be completed on time so that class members might benefit from the expertise and contributions of their colleagues.

A. Participation, Problems and Reflections (30%)

Class Participation: Class sessions will consist of a discussion of the readings and related problems. Readings are to be completed before each class session. Students are expected to analyze and reflect on the readings and come to class prepared to participate in the discussion.

Problems will be assigned for each class. Students are expected to complete these problems before class and incorporate their thinking about strategies used to solve the problems in class discussion. Work on problem sets will be shared in class and may be collected and evaluated.

Reflections: Participants will complete weekly reflections on the problems encountered during the course. This writing should include three major parts:

- 1) description of the problem and an example of the participants' thinking about that problem and strategy;
- 2) reflection on changes in the participant's own understanding and thinking with regard to that problem; and
- 3) related implications for teaching and learning in the 4-9 setting.

Reflections are assigned for each face-to-face meeting and will be posted to the course website.

B. Collaborative Lesson Study Plan and Reflection (30%)

During the course, participants will be conducting Lesson Study with the focus on developing spatial proportional reasoning and proportionality in their students. Participants are required to reflect on the teaching experience following the implementation the lesson plan using algebraic habits of mind.

These reflections will be completed on Edthena

- 10% - task & lesson plan written as a collaborative team and presented at the final class meeting.
- 20% - personal reflection on the lesson study process and the individual implementation of the task itself.

Topics for reflection:

- 1) **REVISIONS:** What will you do differently when you teach this lesson with your own students? Why?
- 2) **IMPLEMENT AND REFLECT:** Implement the team's lesson plan with your own students and reflect on how it went in your class.
- 3) **ANALYSIS OF STUDENT LEARNING:** Include at least 3 examples of students work to attach, and comment on student learning

C. Individual Algebraic Lesson with Video Reflection(30%)

Participants will submit one lesson (using provided lesson template) that incorporates algebraic thinking into a lesson within your own curriculum. Included will be an open-ended assessment task with a rubric and necessary blackline masters, activity sheets, and analysis of class performance and sample student work with rubric levels. (Note: this task is in addition to the task designed with the lesson study group.)

D. Final Content Exam (10%)

Students will take a comprehensive exam covering the content studied in the course. The main focus of the exam will be on spatial proportional reasoning and proportionality. Students will be expected to demonstrate their own understanding and reasoning of the content as well as the knowledge and understanding needed by 4-9 students in order to make sense of this content.

HOW LESSON STUDY WILL WORK

Collaborative Planning Activity

The design for this assignment will take place during the face to face sessions. Small groups (Lesson Study Teams) will select a topic for an activity using a specific structure introduced during the second session in the fall. Lesson Study Teams will meet throughout the fall to continue to plan and refine their collaborative lesson. Lesson Study Teams are required to participate in all discussions including face-to-face, synchronous online, and asynchronous online.

Lesson Implementation (Lesson Study Day)

On the Lesson Study Day, one team member “the host” will teach the lesson to his or her group of students. The other members of the Lesson Study Team, as well as the Course Instructors, will be in attendance. The principal and math specialist of the Host School may be invited and encouraged to attend. In the morning, the Lesson Study Team will meet prior to the teaching of the lesson. During the lesson, the other Lesson Study Team members will be assigned a group of students to observe. After the lesson, the Lesson Study Team will meet to “debrief” and discuss what changes they would make.

Written Lesson Study Reflections

Participants are required to reflect on the teaching experience following the Lesson Study Day. These reflections will be written and submitted to the course instructors only. (See B.1. above).

Revised Lesson Plan

Each Lesson Study Team member will revise the collaborative lesson plan for use with their own students. This revised lesson plan will be submitted to the course instructors and shared with all participants.

The host teacher will not re-teach the lesson. Rather, their reflection will incorporate what they *would do differently* next time, and examples of their own students’ work from the Lesson Study Day along with comments on student understanding.

VI. Evaluation Schema

Determination of the Final Grade:

Graduate Grading Scale

A 93%-100%	B+ 87%-89%	C 70%-79%
A- 90%-92%	B 80%-86%	F Below 70%

VII. UNIVERSITY POLICIES

The university has a policy that requests students to turn off pagers and cell phones before class begins.

Formative Assessment:

<http://www.smarterbalanced.org/sample-items-and-performance-tasks/>

<http://www.parcconline.org/K2-assessments>

http://www.ccsstoolbox.com/parcc/PARCCPrototype_main.html

<http://www.education.vic.gov.au/school/teachers/teachingresources/discipline/maths/assessment/Pages/misunderstandings.aspx>

<http://map.mathshell.org/materials/index.php>

<http://www.exemplars.com/resources/formative/index.html>

<http://mathforum.org/mathed/assessment.html>

<http://balancedassessment.concord.org/>

Middle school Contextualized Problems

<http://www.mmmproject.org/data.htm>

Model Eliciting Tasks

<http://crlt.indiana.edu/research/csk.html>

HONOR CODE

To promote a stronger sense of mutual responsibility, respect, trust, and fairness among all members of George Mason University and with the desire for greater academic and personal achievement, George Mason University has set forth a code of honor that includes policies on cheating and attempted cheating, plagiarism, lying and stealing. Detailed information on these policies is available in the GMU Student Handbook, the University Catalog, and on the GMU website (www.gmu.edu).

Individuals with Disabilities Policy

The university is committed to complying with the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990 by providing reasonable accommodations for applicants for admission, students, applicants for employment, employees, and visitors who are disabled. Applicants for admission and students requiring specific accommodations for a disability should contact the Disability Resource Center at 703-993-2474, or the University Equity Office at 703-993-8730.

ATTENDANCE POLICY

Students are expected to attend the class periods of the courses for which they register. Although absence alone is not a reason for lowering a grade, students are not relieved of the obligation to fulfill course assignments, including those that can only be fulfilled in class. Students who fail to participate (because of absences) in a course in which participation is a factor in evaluation, or students who miss an exam without an excuse, may be penalized according to the weighted value of the missed work as stated in the course syllabus (GMU University Catalog, pg. 32).

TASKSTREAM/Blackboard REQUIREMENTS

Every student registered for any MEL course with a required performance-based assessment (will be designated as such in the syllabus) is required to submit this assessment to TaskStream/blackboard (regardless of whether a course is an elective, a onetime course or part of an undergraduate minor). Evaluation of your performance-based assessment will also be provided using TaskStream. Failure to submit the assessment to TaskStream will result in the course instructor reporting the course grade as Incomplete(IN). Unless this grade is changed upon completion of the required TaskStream submission, the IN will convert to an F nine weeks into the following semester.

GMU POLICIES AND RESOURCES FOR STUDENTS

- a. Students must adhere to the guidelines of the George Mason University Honor Code [See <http://oai.gmu.edu/honor-code/>].
- b. Students must follow the university policy for Responsible Use of Computing [See <http://universitypolicy.gmu.edu/1301gen.html>].
- c. Students are responsible for the content of university communications sent to their George Mason University email account and are required to activate their account and check it regularly. All communication from the university, college, school, and program will be sent to students solely through their Mason email account.
- d. The George Mason University Counseling and Psychological Services (CAPS) staff consists of professional counseling and clinical psychologists, social workers, and counselors who offer a wide range of services (e.g., individual and group counseling, workshops and outreach programs) to enhance students' personal experience and academic performance [See <http://caps.gmu.edu/>].
- e. Students with disabilities who seek accommodations in a course must be registered with the George Mason University Office of Disability Services (ODS) and inform their instructor, in writing, at the beginning of the semester [See <http://ods.gmu.edu/>].
- f. Students must follow the university policy stating that all sound emitting devices shall be turned off during class unless otherwise authorized by the instructor.
- g. The George Mason University Writing Center staff provides a variety of resources and services (e.g., tutoring, workshops, writing guides, handbooks) intended to support students as they work to construct and share knowledge through writing [See <http://writingcenter.gmu.edu/>].

PROFESSIONAL DISPOSITIONS

Students are expected to exhibit professional behaviors and dispositions at all times.

CORE VALUES COMMITMENT

The College of Education Human Development is committed to collaboration, ethical leadership, innovation, research-based practice, and social justice. Students are expected to adhere to these principles. <http://cehd.gmu.edu/values/>

For additional information on the College of Education and Human Development, Graduate School of Education, please visit our website [See <http://gse.gmu.edu/>]