MATH 600 6M1: Mathematical Modeling
Summer/ Fall 2018: Professional Development Outreach Course

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Instructors:

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**COURSE DESCRIPTION**

In this course you will be immersed in learning about mathematical modeling from both a student and a teacher perspective. You will acquire knowledge of what mathematical modeling is and investigate what it looks like in the elementary school classroom. You will experience the cycle of posing problems, making assumptions, determining variables, finding solutions, analyzing your results, and refining and revising your answer. You will co-design research lessons on mathematical modeling through Lesson Study and explore how to effectively engage your students in mathematical modeling while keeping mathematics at the forefront and maintaining a focus on student thinking and learning. At the completion of the course, your work will be disseminated at a class symposium.

**OUTCOMES**

Participants in this course will:

A. Design mathematical modeling tasks that promote mathematical inquiry by cultivating problems solving, reasoning and communicating skills
B. Foster an understanding of how children's mathematical thinking and modeling competencies develop

C. Articulate methodologies for teaching mathematics more effectively to children with various abilities in Grades K-6; Plan effective mathematics instruction for students from diverse populations with a variety of learning needs

**MEETING DATES**

Summer

George Mason University, Monday, July 16 - Friday, July 20, 8:30AM – 3:30 PM

Fall

Tuesdays, September 11, September 18, September 25, 2018, 5:00 - 7:45 PM

**NATURE OF COURSE DELIVERY**

The delivery of this course combines methods of seminar, online sessions, active learning, discussion, independent work, student presentations, 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 the capacity of the learning community. Readings and face-to-face meetings will precede and focus classroom implementation and assignments.

**REQUIRED TEXTS AND READINGS**

Consortium for Mathematics and Its Applications [COMAP,Inc.], & Society for Industrial and Applied Mathematics [SIAM]. (2016). *GAIMME: Guidelines for assessment & instruction in mathematical modeling education*. (S. A. Garfunkel & M. Montgomery, Eds.). Retrieved from http://www.siam.org/reports/gaimme-full_color_for_online_viewing.pdf

English, L. D., Fox, J. L., & Watters, J. J. (2005). Problem Posing and Solving with Mathematical Modeling. *Teaching Children Mathematics*, *12*(3), 156.

Imm, K., Lorber, M. (2013). The footprint problem. *Mathematics Teaching in the Middle School, 19(1),* 46-54.

Levy, R. (2015). 5 Reasons to teach mathematical modeling. *American Scientist.*

National Council of Teachers of Mathematics. (2014). *Principles to Actions.* Reston, VA: NCTM.

Suh J., Seshaiyer, P. (2017). Modeling mathematical ideas. Lanham MD: Rowman & Littlefield

Tran, D., Dougherty, B. (2014). Authenticity of mathematical modeling. *The Mathematics Teacher, 107(9),* 672-678.

Usiskin, Z. (2015). Mathematical modeling and pure mathematics. *Mathematics Teaching in the Middle School, 20(8),* 476-482.

Wickstrom, M., Carr, R., Lackey, D. (2017). Exploring Yellowstone National Park with mathematical modeling. *Mathematics Teaching in the Middle School, 22(8),* 462-470.

Wickstrom, Aytes. (2018). Elementary modeling- Connecting counting with sharing. *Teaching Children Mathematics,* 24(5), 300-307.

## COURSE ASSIGNMENTS AND EXPECTATIONS

The assignments across the course are intended to improve your strategies as a mathematics teacher and to develop your skills in fostering mathematical modeling competencies in students. All assignments are to be completed on time and submitted on Blackboard. Assignment guidelines will be provided on Blackboard.

| Assignment | Percentage |
|---|---|
| Participation and Preparation | 20% |
| Reflections | 10% |
| Collaborative Task Creation | 20% |
| Symposium Presentation | 20% |
| GoReact Video Creation and Reflections | 30% |

### Participation and Preparation (20%)

Class sessions will consist of opportunities for mathematical problem solving, collaboration, and discussion. Students are expected to be actively engaged in all class activities. Assigned readings are to be completed before each class session and will be integral to each day's work. Students are expected to analyze and reflect on the readings and come to class prepared to participate in the discussion and mathematical modeling tasks.

### Due Dates

Students are expected to complete homework problems before class, bring work to class, and upload their work to the course Blackboard site.

### Assignment Descriptions

*Reflections (10%)*

Each day, for both the summer and fall sessions, you will submit a personal reflection on Blackboard. Question prompts will be given and you will be expected to respond as indicated. You are invited to include photos when applicable (e.g. student work examples). Reflections during the summer will be based on the class readings. For the fall sessions, you will reflect on the enactment of an assigned mathematical modeling activity.

*Collaborative Task Creation (20%)*
During the course, you will form planning groups. The groups will be responsible for designing a task using the mini-mathematical modeling (MMM) planning template. Individuals may tweak the group MMM planning template as needed for their grade level needs. Time will be provided during the class sessions for group planning. The groups should plan to meet, either in person or virtually as needed, outside of class. Each participant will be responsible for uploading their MMM template on Blackboard.

*Symposium Presentation (20%)*
After the collaborative task is implemented, each individual will independently reflect on the MM lesson they implemented. Each individual will present their task using the course PowerPoint template at the symposium on the final day of class. The completed individual presentation will be submitted on Blackboard.

*GoReact Video Creation and Reflections (30%)*
You will record two videos with GoReact. The first will be a "notice and wonder" activity. The second video will be of your mathematical modeling task implementation. You will comment on your own video and on one other group member's video.

**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% |

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

*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).

1. GMU Policies and Resources for students

   *Policies*

   a. Students must adhere to the guidelines of the Mason Honor Code (see http://oai.gmu.edu/the-mason-honor-code/).
   b. Students must follow the university policy for Responsible Use of Computing (see http://universitypolicy.gmu.edu/policies/responsible-use-of-computing/).
   c. Students are responsible for the content of university communications sent to their Mason 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. Students with disabilities who seek accommodations in a course must be registered with George Mason University Disability Services. Approved accommodations will begin at the time the written letter from Disability Services is received by the instructor (see http://ods.gmu.edu/).
   e. 5. Students must silence all sound emitting devices during class unless otherwise authorized by the instructor.

   *Campus Resources*

   f. Support for submission of assignments to Tk20 should be directed to tk20help@gmu.edu or https://cehd.gmu.edu/aero/tk20. Questions or concerns regarding use of Blackboard should be directed to http://coursessupport.gmu.edu/.
   g. For information on student support resources on campus, see https://ctfe.gmu.edu/teaching/student-support-resources-on-campus

2. For additional information on the College of Education and Human Development, please visit our website http://cehd.gmu.edu/.

*PROFESSIONAL DISPOSITIONS*

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

*CORE VALUES COMMITMENT*

The College of Education and 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/ ]

**COURSE OVERVIEW & READINGS**

The dates are subject to change dependent on the progress of the course. We will not move due dates for major assignments to an earlier date, only a later date if necessary.

| Date | Focus | Readings | Assignment |
|---|---|---|---|
| Prior to July 16 | | | Entrance Surveys (2) |
| July 16 | What is Mathematical Modeling (MM)? | 1. Five Reasons for MM;<br>2. GAIMME report, Chapter 1 | Reading Reflection |
| July 17 | Mathematical Problem Posing | 1. GAIMME report chapter 2<br>2. Footprint Problem | Reading Reflection |
| July 18 | Making Assumptions, Defining Variables | 1. Modeling mathematical ideas Chapter 3<br>2. Exploring Yellowstone Park with MM | Reading Reflection |
| July 19 | Revising, Reporting, and Revisiting | 1. Elementary modeling - Connecting counting with sharing<br>2. Principles to Actions, introduction, pages 35-41 | Reading Reflection |
| July 20 | Practical Implementation | | |
| September 11 | | 1. English et al, Problem Posing and Solving (optional) | 1. GoReact Video Creation and Reflection (*Notice and Wonder*) upload personal video and comments |
| September 18 | | 1. Principles to Actions pages 29-35 (optional) | 1. Comment on another team member's *Notice and Wonder* video<br>2. Individual collaborative task template upload |
| September 21 (no class) | | | 1. Mini Modeling Task Video Creation and Reflection (personal video upload and own |

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|---|---|---|---|
| | | | comments) |
| September 25 Symposium | Celebrating each others' successes! | | 1. Comment on another team member's Mini Modeling Task video<br>2. Individual Task Presentation PPT |

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