MAE 6313: Problem Solving in School Mathematics

Fall 2024 8-Week Course
August 26, 2024-October 21, 2024
3 Credits, Letter Grade

Course Information

Instructor: Amy Palmer
Office Hours Times: By appointment
Class Days & Time: Online, Asynchronous

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Course Description & Overview

This course analyzes problem solving as an underlying theme in mathematics education focused on K-12 schools. It also emphasizes development of pedagogical content knowledge in mathematics through modeling, inquiry, and problem solving. This course will address questions such as the following: What is problem solving? What strategies and methodologies can one use to solve problems? How do I teach students in a manner that emphasizes problem solving and values student thinking?

Student Learning Outcomes

1. Students will be able to proficiently apply a variety of problem-solving strategies to investigate, solve, justify solutions for complex mathematical problems relevant to K-12 curriculum.

2. Students will observe/participate in, analyze, and plan instruction that engages mathematics students in problem solving and is aligned with the Common Core State Standards for Mathematics (CCSSM), the National Council of Teachers of Mathematics (NCTM) Principles and Standards for School Mathematics, and Florida's B.E.S.T. Standards.

3. Students will use teaching practices that are effective for the mathematics classroom and rooted in problem solving, such as those reflected in the NCTM Effective Mathematics Teaching Practices and Florida B.E.S.T Mathematical Thinking and Reasoning Standards.

4. Students will identify and adapt problems to create rich, relevant mathematical tasks that align to the CCSSM, NCTM Principles and Standards for School Mathematics, and Florida's B.E.S.T. Standards.

5. Students should be able to create classroom environments that encourage inquiry where ALL students' ideas and cultures are valued and where the teacher's role is to facilitate learning rather than deliver instruction.

Course Materials

Table 1

List of Required Course Materials and Optional Resources

Materials	Required or Optional
Select one of the following books based on your grade level. • Huinker, D., & Bill, V. (2017). *Taking action: Implementing effective mathematics teaching practices in K-grade 5*. Reston, VA: National Council of Teachers of Mathematics. • Smith, M. S., Steele, M. D., & Raith, M. L. (2017). *Taking action: Implementing effective mathematics teaching practices in grades 6-8*. Reston, VA: National Council of Teachers of Mathematics. • Boston, M., Dillon, F. L., Smith, M. S., & Miller, S. (2017). *Taking action: Implementing effective mathematics teaching practices in grades 9-12*. Reston, VA: National Council of Teachers of Mathematics.	Required
Articles on the Canvas Website	Required (Free)
Other Resources • Florida's B.E.S.T. Standards Mathematics http://www.fldoe.org/core/fileparse.php/18736/urlt/StandardsMathematics.pdf Link to the Florida Mathematical Thinking and Reasoning Standards as well as the K-12 Mathematics Content Standards (by grade level and content area). • National Council of Teachers of Mathematics (NCTM) www.nctm.org Click on "Lessons and Resources" • The Math Learning Center Apps https://www.mathlearningcenter.org/apps Virtual manipulatives	

Course Structure and Conduct

This course will be online; however, I will attempt to provide opportunities for different forms of engagement and your participation will be highly encouraged. I enthusiastically encourage you to share your experiences, explanations, and knowledge as it is an important part of community building. Ideas from a diverse community typically produce alternative perspectives, which can be used to promote meaningful discussions as you assimilate and accommodate ideas. An often overlooked aspect of building community is to acknowledge resources, which learners, such as yourselves, bring to the community, these include language, past experiences, culture, etc., and I encourage you to utilize these resources as learning tools.

Students will use the university learning management system (LMS) Canvas. Complete information on tasks, including announcements, resources, deadlines, and grading policy, is listed on our Canvas site. Please ensure that your e-mail address is correct within the system and that you check for information regularly. If you are having technical issues visit the UF helpdesk website or call 352-392-4357.

How to participate in the course

Two responsibilities you have related to this course are to *thoughtfully participate* in our *classroom community* and to *critically examine* your and others' ideas and assumptions about teaching and learning. To thoughtfully participate in this class, you should:

- be prepared for each class by having thoughtfully completed all readings and assignments,
- share your ideas and communicate respectfully,
- respect others' opinions *(critique the idea, not the person),*
- be curious about ideas different than your own, and
- keep me informed of any extenuating circumstances in your life that may hinder your ability to succeed in this course.

Let me know how you're doing. Send me an email if you're facing difficulties and we can work it out.

Religious Observances

At the University of Florida, students and faculty work together to allow students the opportunity to observe the holy days of their faith. A student should inform the faculty member of the religious observances of their faith that will conflict with class attendance, with tests or examinations, or with other class activities prior to the class or occurrence of that test or activity. The faculty member is then obligated to accommodate that particular student's religious observances. Because students represent a myriad of cultures and many faiths, the University of Florida is not able to assure that scheduled academic activities do not conflict with the holy days of all religious groups. Accordingly, individual students should make their need for an excused absence known in advance of the scheduled activities.

- The UF Religious Holidays Policy is available at: https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/#religiousholidaystext

Disability Resource Center

Students who experience learning barriers and would like to request academic accommodations should connect with the Disability Resource Center by visiting our Get Started page. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Online Course Evaluation Process

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/.

Course Assessments and Grading

Grading Policy:

Assignments will be posted on Canvas within each module and you will submit your assignments via Canvas. For current UF grading policies for assigning grade points, please see the UF website on university grades and grading policies.

Completeness and Promptness: Only assignments submitted complete and on time will be considered for full credit. Assignments submitted after the due date will receive a grade deduction of 5% per day after the due date. To complete the course, you must complete every assignment.

Assessments for Grade Determination: The descriptions of the activities that follow are intended to be general. The instructor reserves the right to alter the assignment as the class proceeds according to the needs of the group. Specifics, including due dates and relevant rubrics, will be described on the class website in a timely manner.

Final Grade Determination: The purpose of this course, as is all education, is to learn – not just to "work for a grade." While all students should be capable of earning an A in the course, merely completing the work does not constitute A level work. Instead, the final determination of a course grade relies primarily on the **quality** of work presented for the various assignments.

Grading Scale:

A	93-100	C	73-76
A-	90-92	C-	70-72
B+	87-89	D+	67-69
B	83-86	D	63-66
B-	80-82	D-	60-62
C+	77-79	F	< 60

Academic Honesty

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: 'On my honor, I have neither given nor received unauthorized aid in doing this assignment.'" The Conduct Code specifies a number of behaviors that are in violation of this code and the possible sanctions. Click here to read the Conduct Code. If you have any questions or concerns, please consult with me.

Examples of Plagiarism include but are not limited to:

- Using sources verbatim or paraphrasing without giving proper attribution (this can include phrases, sentences, paragraphs and/or pages of work)
- Copying and pasting work from an online or offline source directly and calling it your own
- Using information you find from an online or offline source without giving the author credit
- Replacing words or phrases from another source and inserting your own words or phrases
- Submitting a piece of work you did for one class to another class

Please note: I highly encourage students to collaborate in this course. However, if you do collaborate, be sure that each person submits their own work, in their own words. If you collaborate and submit the exact wording, all parties will receive a zero for the assignment, as this does not provide evidence for what each person can do independently.

Assignments

Problem-Based Lesson Plan OR Professional Development Webinar – 20%
(Addresses Student Learning Outcomes: 2, 3, and 4)
Lesson Plan Option:
Each student is expected to design a problem-based lesson plan that you would use for your own classroom. This may consist of only one problem where the students explore and discuss the problem.

The structure for the lesson plan should be in the Launch, Explore, and Summarize Format discussed in class. You should plan for students to be actively engaged in solving the problem(s) in a manner that emphasizes mathematical concepts rather than procedures. Active learning techniques should be incorporated for students to share their problem solving strategies. You should plan to encourage and allow students to use manipulatives while solving problems, so please indicate which types of manipulatives you would have students use to solve the problems.

Expectation for Written Lesson Plans—is that they will be explicit enough that a substitute could pick up the plan and teach from the plan. If a worksheet (or puzzle or song or…) is used, you are expected to include it. You will need to discuss how you will assess students in a manner similar to the sample lessons provided. In addition to the items at the beginning of the lesson plan, you must identify the Florida B.E.S.T. Standards that your lesson addresses.

You are writing these lessons for **each other** as all lesson plans will be shared through a Google Doc at the end of the course. You will receive full credit for these as long as all components (Florida B.E.S.T. Standards, Launch, Explore, Summarize, Assessment) are addressed.

OR

Webinar Option:
For this assignment, you will imagine that you have been tasked by your principal, advisor, or administrator to support a teacher that is resistant to implementing problem solving in their classroom. They asked that you develop a presentation that is a minimum of 10 minutes (no longer than 15 minutes) to share your learnings and knowledge of Problem Solving and Mathematics Teaching that is based on research, and that you try to convince this teacher to engage in Problem Solving and its benefits to students.

For this assignment, you may work with a partner or by yourself to develop this presentation and then record yourself actually giving this presentation as a webinar. You may reference any of the materials/articles from the course (list of and links to all articles can be accessed through the course syllabus).

What to include in your assignment:

1. A Powerpoint/Google Slide (or other brand) presentation that includes slides such as:
    a. What is Problem Solving?
    b. Strategies and suggestions for supporting this teacher and their students in engaging in problem solving in mathematics classrooms (be sure to present at least 3 to 4 strategies teachers can implement in their classroom).
    c. References to the articles and/or other material you researched to develop your slideshow, be sure to include at least 3 new references not included in the course syllabus.
    d. Other slides and information you see fit.

2. A video recording of you (and your partner, if applicable) presenting your slides to an imaginary audience. Be sure your presentation is at least 10 minutes in length.

3. When you share your strategies and suggestions, be sure to share not only what those strategies are but also what the research says about its effectiveness. If you have implemented some of these strategies in your classroom, feel free to share some of your successes and/or adjustments you have made to support your students. However, the strategies should not solely be based on your experiences, they should be grounded in the research.

There are multiple ways you can record and upload your video. You can record yourself here on Canvas, on Zoom and submit a link to the video recording, you can upload a video to Youtube and submit the link (feel free to keep the video as private), or any other way you may be familiar with. If you need assistance in recording your video, please feel free to reach out to me.

Problem of the Module (POM)– 25%
(Addresses Student Learning Outcome: 1)
Within each module, you will be asked to select and solve a mathematical task and reflect on the task or solution.

Mathematical Task Portfolio – 25%
(Addresses Student Learning Outcomes: 1, 4, and 5)
Throughout the semester, you will find a collection of 10 problems that could be used to springboard a lesson at your grade level (K-12) or with undergraduates/preservice teachers. For each problem, identify: the appropriate grade levels (K-12, college level math course, or preservice teacher course), the methods that can be used to solve the problem (should be able to solve each problem in multiple ways), and then present a solution for the problem in the ways articulated. Please indicate with a citation where the problem came from (e.g., http://figurethis.org/index.html).

Weekly Online Canvas Reading Discussion Posts – 25%
(Addresses Student Learning Outcomes: 2 and 5)

You have responsibilities related to course readings. Each week you will respond to the ideas in the assigned reading. Your response is due by Thursday at 11:59pm and should fulfill the following:

Briefly summarize each reading and then select one excerpt or idea from each that speaks to you In one page (~500 words): (1) Write about what you chose and why, and (2) how you will use what you learned. (3) Any concerns or questions related to the idea. Your response can be journal style.

I ask you to read and respond to each others' posts as they are not long and can make for more powerful communication with your peers. **Your responses to your colleagues will be due by Monday at 11:59pm.**

Participation –5%

Table 2

*Course Schedule with Dates, Topics, Readings, and Assignment Due Dates**

Module	Dates	Topic	Readings (TBD)	Assignments
1	8/26-9/2	Introduction to Problem Solving ● History of Problem Solving ● What does problem solving look like in classrooms?	● Taking Action Chapter 1 ● Lederman, E. (2009). Journey into problem solving: A gift from Polya. *The Physics Teacher*, *47*(2), 94-97. ● Schoenfeld, A. H. (2007). Problem solving in the United States, 1970–2008: Research and theory, practice and politics. *ZDM*, *39*, 537-551.	● Teacher's Problem Solving Belief Pre-Survey ● Introduction Post ● Reading Discussion Post 1 & Feedback ● Problem of the Module (POM) 1
2	9/3-9/9	Establish Mathematics Goals ● Difference between performance & learning goals ● How to write effective math learning goals	● Taking Action Chapter 2 ● Hunt, J., & Stein, M. K. (2020). Constructing goals for student learning through conversation. *Mathematics Teacher: Learning and Teaching PK-12*, *113*(11), 904-909. ○ Hunt & Stein (2020) Appendix ● Mills, V. L. (2014).Mathematical goals: The alpha and omega of effective practices. *NCSM Summer newsletter*, *44*(4), 2-3	● Submit Mathematical Task Portfolio Link ● POM 2 ● Reading Discussion Post 2 & Feedback
3	9/10-9/16	Build Procedural Fluency from Conceptual Understanding	● Taking Action Chapter 4	● Submit 5 Tasks to the Mathematical Task Portfolio & Peer Feedback ● POM 3 ● Reading Discussion Post 3

4	9/17-9/23	Use and Connect Mathematical Representations	• Taking Action Chapter 6	• POM 4 • Reading Discussion Post 4 & Feedback
5	9/24-9/30	Facilitate Meaningful Mathematical Discourse	• Taking Action Chapter 7	• POM 5 • Reading Discussion Post 5 & Feedback
6	10/1-10/7	Elicit and Use Evidence of Student Thinking	• Taking Action Chapter 8 • Jacobs et al. 2010 Professional Noticing	• Submit Final 5 Tasks to the Mathematical Task Portfolio & Peer Feedback • POM 6 • Reading Discussion Post 6
7	10/8-10/14	Problem Solving with Special Education Students		• POM 7 • Reading Discussion Post 7 & Feedback
8	10/15-10/21	Problem Solving with Multilingual Learners	Everyone Reads: • Moschkovich, J. (2002). A situated and sociocultural perspective on bilingual mathematics learners. *Mathematical thinking and learning*, *4*(2-3), 189-212. Elementary Readings: Secondary Readings: • Zahner, W., Calleros, E. D., Wynn, L., & Pelaez, K. (2024). Transforming learning opportunities	• Lesson Plan ***or*** Webinar • Complete Teacher's Belief Post-Survey • Reading Discussion Post 8

			in linguistically diverse secondary classrooms through promoting discussions: results of an intervention. *Mathematical Thinking and Learning*, 1-22.	

*The course topics and readings are tentative and may be adjusted during the semester. If they are, students will be adequately notified whenever changes occur.