MATH 5346

Concepts & Techniques in Problem Solving

TEXTBOOKS:
Teaching Mathematics through Problem Solving Grades 6-12, NCTM, 2003 (ISBN #0-87353-541-3) **&**

Five Practices for Orchestrating Productive Mathematics Discussions, 2nd Edition, NCTM, 2018 (ISBN #978-1680540161).

MATERIALS:

Additional materials will be handed out during class.
3-ring binder to store handouts and articles.
Graphing Calculator (may use Desmos)
Colored pencils and grid paper.

GRADES

Problem Situations/Reflections	25%
Reading Assignments	25%
Class Participation (Attendance/Engagement and Contribution)	15%
Major Project	35%
Total	100%

COURSE GOALS[1] and OBJECTIVES: The goals of this course are

- *to explore* problem solving in mathematics as: a curricular goal, an instructional strategy, the essential core of mathematics, a process for doing mathematics;
- *to develop* a "can do" approach to mathematics problem solving;
- *to understand and describe* mathematics problem solving as more process than product;
- *to become* a mathematics problem solver;
- *To use technology* to solve mathematics problems;
- *to use problem contexts* to create mathematics demonstrations;
- *to use problem solving* to construct new ideas of mathematics for yourself;
- *to engage* in mathematical investigations;
- *to engage* in some independent investigations of mathematics topics from the secondary school curriculum or appropriate for that level;
- *to communicate* mathematics ideas that arise from mathematics investigations; and
- *to* consider ways to *assess* problem solving performance.

This course will focus on solving, or attempting to solve, mathematics problems. The foundation of the course rests upon the idea that one cannot implement problem solving goals and activities in your mathematics instruction without first becoming a problem solver.

CLASS FORMAT: The emphasis is on exploration of various mathematical contexts to learn mathematics, to pose problems and problem extensions, to solve problems, to reflect on the process of problem solving, and to communicate mathematics.

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[1] Modeled after J. Wilson's syllabus for EMAT 6600, see http://jwilson.coe.uga.edu/

The problems will come from many sources and contexts. The primary ground rule is that the problem situations can be investigated with pre-calculus mathematics. We will use problem contexts to pose problems, explore mathematical relationships, and examine the use of resources -- media, technology, references, or colleagues -- to engage in mathematics problem solving. Inquiry, investigation, exploration will be significant descriptors of what we want to accomplish.

I will conduct the course in a seminar-style manner with few lectures. I will normally act as a "moderator" while you (the students) present exercises and justifications to one another. I will answer appropriate questions and steer discussions into productive channels.

This course will be taught with an emphasis on writing, collaborative learning, and oral presentations. Memorization and formulae will not be emphasized in this course.

ELECTRONIC COMMUNICATION STATEMENT:

UT Arlington has adopted MavMail as <u>its official means to communicate with students</u> about important deadlines and events, as well as to transact university-related business regarding financial aid, tuition, grades, graduation, etc. <u>All students are assigned a MavMail account and are responsible for checking the inbox regularly.</u> There is no additional charge to students for using this account, which remains active even after graduation. Information about activating and using MavMail is available at <u>http://www.uta.edu/oit/cs/email/mavmail.php</u>.

DETAILS ABOUT THE COURSE

Grades will be assigned using the following scheme (approximate):	90-100	A
	80-89	B
	70-79	C
	60-69	D
	59 or Below	F

COURSE ASSIGNMENTS:

1. <u>Problem situations/Reflections</u> We will be working on a set of challenging problem situations and you will also generate rich problems for your classroom. You will be required to hand in a neat write-up of your solution procedures, explanations, reflections and extensions. You also will be required to reflect upon the tasks presented in class using a prescribed format (at times, rather than turning in a solution, this is a reflection upon the problem solving strategies, heuristics, etc., used)—these reflections will be no more than 2 pages in length. Typically, you will have two weeks to prepare these assignments and they will be collected approximately every other week (alternate weeks from the readings). You will submit a scanned or computer-generated (pdf) copy of your assignment via Blackboard and bring the hard-copy to class for possible discussions. <u>All scans must be in pdf format</u>. *Note: If you take pictures with your phone and convert those to pdf format, please make sure that your assignment is legible—not angled or covered by shadows.*

2. <u>Reading assignments</u> Reading assignments will be given over the course of the semester. You will write a 2- page reflection on *each* article or book chapter assigned. Note that each *assignment* may contain more than one article/chapter reflection. Typically, you will have two weeks to prepare these assignments and they will be collected approximately every other week (alternate weeks from the problem situations/reflections). You will submit a scanned or computer-generated (pdf) copy of your assignment via Blackboard and bring the hard-copy to class for discussion. <u>All scans must be in pdf format</u>. *Note: If you*

<u>If at any time, you have questions, please do not hesitate to ask.</u>

take pictures with your phone and convert those to pdf format, please make sure that your assignment is legible—not angled or covered by shadows.

For each article/chapter that you read, turn in the following:

- The bibliographic information (list this as the first entry on your reflection)

- 1-2 paragraphs briefly summarizing the major point/s of the book chapter or article. Do not use the abstract as the summary. Full credit will only be given if it is clear that you have understood the article.

- 1-2 paragraphs of your interpretation of the article as it would affect your own teaching with specific references to the article. This could include a critique, a description of what you found most/least useful or an example from your own teaching that relates to the article.

The write-up for each article/chapter should not exceed 2 double-spaced (12pt type) pages.

3. <u>Major Project</u> Design problem solving activities for the classroom that are grounded in the Texas Essential Knowledge and Skills with emphasis on the mathematical process standards that are relevant to the subject/grade-level you choose. You are to organize your project by writing about the rationale for the activity, reflections on the activity (what did you learn as a teacher? How did the students react to the activity? Did the activity elicit positive problem solving behaviors, etc.), revisions that you may make after trying the activity, your 5E Lesson Plan for the activity and samples of student work on the activity. You will receive more information regarding the structure of the project during the 4th week of the semester. You will make a 15-minute power-point presentation of your project and submit the written component of the project on May 6th.

4. <u>Participation</u> Since this course relies heavily on group participation, more than one absence from our weekly class time or excessive late arrivals to or early departures from class will lower your final grade. In addition to regular class attendance, participation in class is essential (e.g. periodically, you will be asked to share your thoughts on the mathematical task or an assigned reading, solution methods, both in your groups and at the board). For each unexcused absence, your participation grade will be lowered by 10 points. For each class meeting in which you have not prepared sufficiently (i.e. do not have your written assignments for sharing), your participation grade will be lowered by 5 points. For each excessive tardy (more than 10 minutes late), 1 point will be deducted for every 15-minute interval missed. Each of you begins the semester with 100 participation points.

Please note that class begins at 5:30. Since this course relies heavily on group participation, more than one absence from our weekly class time or excessive late arrivals to or early departures from class will lower your final grade.

LATE WORK: In general, late work will not be accepted.

HELP OUTSIDE OF CLASS: My office hours are listed on the first page of this syllabus. These are times when I will be available, in my office, to discuss the material/homework/tests. No appointment is necessary for those times. If, however, those times are inconvenient for you, then please make an appointment with me for another time (e.g., e-mail me stating the times you prefer). *Please use the <u>subject heading</u> "<u>**MATH 5345 Student Question**</u>" when sending Dr. Álvarez an e-mail and identify yourself (full name) in the communication.*

If at any time, you have questions, please do not hesitate to ask.

Personal Technology Use: Cellular phones should either be switched off or set to silent mode during all class meetings. Cellular phone use will not be permitted during class; however, at times with permission, cell phones may be used for applications such as a cell-phone-based graphing calculator or online mathematics technology tool. If you must take an important phone call, please leave the classroom. If you have a watch, or other device, that beeps please turn this off during class meetings as it is disruptive for other students. <u>**As class time for this course focuses on interpersonal interactions, students must request permission to use a laptop or tablet during class. This permission may be revoked should the student choose to use the device inappropriately.**</u>

COURSE SCHEDULE[2]:

Date	Topics
January 14	What is Problem Solving? What does it look like? Rain Gauge Task
January 28	Discussion on the Rain Gauge Problem. Problems Just for Fun (Tasks 1-3)
February 4	Discussion on reading assignment 1. Discussion and presentations: Problems Just for Fun (Tasks 1-3):
February 11	Problems Just for Fun (Tasks 4-6)
February 18	Discussion on Reading Assignment 2. Discussion and presentations: Problems Just for Fun (Tasks 4-6)
February 25	Problems Just for Fun (7-9)
March 4	Discussion on reading assignment 3. What is a rich mathematical task? Creating rich mathematical tasks from ordinary exercises.
March 18	Creating rich mathematical tasks. Develop ideas for major project.
March 25	Discussion on reading assignment 4. Project Plan Discussion
April 1	Assessing mathematical problem solving—review student work, use problem solving scoring rubrics to score student work.
April 8	Discussion on reading assignment 5. Assessing mathematical problem solving: Using a problem solving rubric, comparing understandings of the rubric and discussion.
April 15	Using a problem solving assessment rubric.
April 22	Discussion on reading assignment 6. Revisit extended problem solving tasks with technology and from the perspective of vertical connections.
April 29	Discussion on reading assignment 7. "Feed and Water" problem continued. Major Project Poster Discussion.
May 6	Major Project Presentations & Final Project Due

Drop Policy: Students may drop or swap (adding and dropping a class concurrently) classes through self-service in MyMav from the beginning of the registration period through the late registration period. After the

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[2] As the instructor for this course, I reserve the right to adjust this schedule in any way that serves the educational needs of the students enrolled. – Dr. James A. Mendoza Álvarez

<u>*If at any time, you have questions, please do not hesitate to ask.*</u>

late registration period, students must see their academic advisor to drop a class or withdraw. Undeclared students must see an advisor in the University Advising Center. Drops can continue through a point two-thirds of the way through the term or session. It is the student's responsibility to officially withdraw if they do not plan to attend after registering. **Students will not be automatically dropped for non-attendance.** Repayment of certain types of financial aid administered through the University may be required as the result of dropping classes or withdrawing. For more information, contact the Office of Financial Aid and Scholarships (http://wweb.uta.edu/aao/fao/).

Disability Accommodations: UT Arlington is on record as being committed to both the spirit and letter of all federal equal opportunity legislation, including *The Americans with Disabilities Act (ADA), The Americans with Disabilities Amendments Act (ADAAA),* and *Section 504 of the Rehabilitation Act.* All instructors at UT Arlington are required by law to provide "reasonable accommodations" to students with disabilities, so as not to discriminate on the basis of disability. Students are responsible for providing the instructor with official notification in the form of **a letter certified** by the Office for Students with Disabilities (OSD). Only those students who have officially documented a need for an accommodation will have their request honored. Students experiencing a range of conditions (Physical, Learning, Chronic Health, Mental Health, and Sensory) that may cause diminished academic performance or other barriers to learning may seek services and/or accommodations by contacting: **The Office for Students with Disabilities, (OSD)** www.uta.edu/disability or calling 817-272-3364. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at [www.uta.edu/disability.](www.uta.edu/disability)

Student responsibility primarily rests with informing faculty **at the beginning of the semester and in providing authorized documentation through designated administrative channels.**

If you require an accommodation based on disability, I would like to meet with you in the privacy of my office, during the first week of the semester, to make sure you are appropriately accommodated.

Counseling and Psychological Services (CAPS) www.uta.edu/caps/ or calling 817-272-3671 is also available to all students to help increase their understanding of personal issues, address mental and behavioral health problems and make positive changes in their lives.

Non-Discrimination Policy: The University of Texas at Arlington does not discriminate on the basis of race, color, national origin, religion, age, gender, sexual orientation, disabilities, genetic information, and/or veteran status in its educational programs or activities it operates. For more information, visit [uta.edu/eos](uta.edu/eos).

Title IX Policy: The University of Texas at Arlington ("University") is committed to maintaining a learning and working environment that is free from discrimination based on sex in accordance with Title IX of the Higher Education Amendments of 1972 (Title IX), which prohibits discrimination on the basis of sex in educational programs or activities; Title VII of the Civil Rights Act of 1964 (Title VII), which prohibits sex discrimination in employment; and the Campus Sexual Violence Elimination Act (SaVE Act). Sexual misconduct is a form of sex discrimination and will not be tolerated. *For information regarding Title IX, visit* www.uta.edu/titleIX or contact Ms. Michelle Willbanks, Title IX Coordinator at (817) 272-4585 or [titleix@uta.edu.](titleix@uta.edu)

Student Support Services: UT Arlington provides a variety of resources and programs designed to help students develop academic skills, deal with personal situations, and better understand concepts and information related to their courses. Resources include tutoring, major-based learning centers, developmental education, advising and mentoring, personal counseling, and federally funded programs. For individualized referrals, students may visit the reception desk at University College (Ransom Hall), call the

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Maverick Resource Hotline at 817-272-6107, send a message to resources@uta.edu, or view the information at http://www.uta.edu/universitycollege/resources/index.php.

Academic Integrity: Students enrolled in this course are expected to adhere to the UT Arlington Honor Code:

> *I pledge, on my honor, to uphold UT Arlington's tradition of academic integrity, a tradition that values hard work and honest effort in the pursuit of academic excellence.*
>
> *I promise that I will submit only work that I personally create or contribute to group collaborations, and I will appropriately reference any work from other sources. I will follow the highest standards of integrity and uphold the spirit of the Honor Code.*

UT Arlington faculty members may employ the Honor Code in their courses by having students acknowledge the honor code as part of an examination or requiring students to incorporate the honor code into any work submitted. Per UT System Regents' Rule 50101, §2.2, suspected violations of university's standards for academic integrity (including the Honor Code) will be referred to the Office of Student Conduct. Violators will be disciplined in accordance with University policy, which may result in the student's suspension or expulsion from the University. Additional information is available at https://www.uta.edu/conduct/. Faculty are encouraged to discuss plagiarism and share the following library tutorials http://libguides.uta.edu/copyright/plagiarism and http://library.uta.edu/plagiarism/

Campus Carry: Effective August 1, 2016, the Campus Carry law (Senate Bill 11) allows those licensed individuals to carry a concealed handgun in buildings on public university campuses, except in locations the University establishes as prohibited. Under the new law, openly carrying handguns is not allowed on college campuses. For more information, visit http://www.uta.edu/news/info/campus-carry/.

Student Feedback Survey: At the end of each term, students enrolled in face-to-face and online classes categorized as "lecture," "seminar," or "laboratory" are directed to complete an online Student Feedback Survey (SFS). Instructions on how to access the SFS for this course will be sent directly to each student through MavMail approximately 10 days before the end of the term. Each student's feedback via the SFS database is aggregated with that of other students enrolled in the course. Students' anonymity will be protected to the extent that the law allows. UT Arlington's effort to solicit, gather, tabulate, and publish student feedback is required by state law and aggregate results are posted online. Data from SFS is also used for faculty and program evaluations. For more information, visit http://www.uta.edu/sfs.

Final Review Week: A period of five class days prior to the first day of final examinations in the long sessions shall be designated as Final Review Week. The purpose of this week is to allow students sufficient time to prepare for final examinations. During this week, there shall be no scheduled activities such as required field trips or performances; and no instructor shall assign any themes, research problems or exercises of similar scope that have a completion date during or following this week *unless specified in the class syllabus*. During Final Review Week, an instructor shall not give any examinations constituting 10% or more of the final grade, except makeup tests and laboratory examinations. In addition, no instructor shall give any portion of the final examination during Final Review Week. During this week, classes are held as scheduled. In addition, instructors are not required to limit content to topics that have been previously covered; they may introduce new concepts as appropriate.

Emergency Exit Procedures: Should we experience an emergency event that requires us to vacate the building, students should exit the room and move toward the nearest exit which is located at the end of the hall as we exit the classroom and turn right. When exiting the building during an emergency, one should never take an elevator but should use the stairwells. Faculty members and instructional staff will assist

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students in selecting the safest route for evacuation and will make arrangements to assist handicapped individuals.

Important Dates:

First Day of Classes	14 January
MLK Holiday	21 January
Census Date	30 February
Spring Break	11-16 March
Drop Date	29 March, by 4 pm
Last Day of Classes	29 April (this class)
Final Project Presentations and Written Component Due	6 May, 5:30-8 pm

If at any time, you have questions, please do not hesitate to ask.