

Teaching Mathematics through Problem Solving

MATH 693-800 (CRN 29347)

Instructor Information

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Instructor Bio:

Please feel free to refer to me as “Chris” (he/him). Since my first teaching experience in 2008, I have taught mathematics and mathematics education courses at the K-12, Community College, and University Levels. In 2019 I graduated from the University of Missouri with a Ph.D. in Learning, Teaching and Curriculum with a primary emphasis in Mathematics Education, and an outside emphasis in Cognitive Development.

Course Information

Course Description

Knowledge and skills for teaching and learning mathematics through problem solving using multiple representations and orchestrating mathematical discourse to promote mathematical reasoning in student-centered mathematics classrooms. Design, select/adapt, and solve worthwhile mathematical tasks to support teaching through problem solving.

Course Materials

Required Text: *Rough Draft Mathematics: Revising to Learn* by Amanda Jansen (2020)

- Physical/hard copy ISBN: 978-1625312068
- Electronic ISBN: 978-1032682327

Any additional required readings and resources will be provided by your instructor.

Prerequisites

At least one year of teaching experience or permission of the department chairperson.

Course Objectives

In this course students will –

- Design, select, and/or adapt worthwhile mathematics tasks and sequences of examples that support a particular learning goal, including teaching through problem solving.
- Engage in and model effective problem solving and mathematical practices—questioning, representing, communicating, conjecturing, making connections, reasoning and proving—while maintaining a high level of cognitive demand for the learners.
- Construct and evaluate multiple representations of mathematical ideas or processes, establish correspondences between representations, and understand the purpose and value of doing so.
- Use questions to effectively probe mathematical understanding and make productive use of responses.
- Develop learners' abilities to give clear and coherent public mathematical communications in a classroom setting.
- Develop skillful and flexible use of different instructional formats—whole group, small group, partner, and individual—in support of learning goals.
- Analyze and evaluate student ideas and work, and design appropriate responses.

Course Rationale

Problem solving is an important mathematical process, not only as a goal of learning mathematics, but also as a means for learning mathematics (NCTM, 2000). Unfortunately, though, the notion of learning mathematics through problem solving is not often reflected in traditional mathematics classrooms.

Traditional mathematics instruction uses what may be called a show-and-tell approach. First, the teacher introduces a mathematical concept or skill. Then the teacher demonstrates how to solve example problems. Finally, the students practice solving similar problems on their own.

Although this approach is commonly used, it is rarely successful in developing students' mathematical understanding (Van de Walle, 2004). One difficulty with this approach is that it is teacher-centered rather than student-centered. Instead of encouraging students to develop their own ideas, teachers show and tell their ideas, leaving many students with the belief that mathematics is beyond their understanding. Another difficulty with the show-and-tell approach is that students learn to expect teachers to show them the rules and then they resist trying to solve problems for which solution methods have not been provided. Thus, students miss the opportunity to do mathematics.

Communication, representation, and worthwhile mathematical tasks are essential parts of teaching mathematics through problem solving. Through oral and written communication, mathematical ideas become objects of reflection. Worthwhile mathematical tasks are a valuable means of exploring mathematical concepts using multiple representations to help students build knowledge, deepen understanding, sharpen their thinking, and make connections.

Course Modality/Structure

This course will be taught using a variety of methods, including projects, discussions, and/or other formats appropriate to the content and goals of the course. Information will be delivered through an asynchronous online format. Generally speaking, assignments will be due at 11:59 PM EDT/EST on their respective due dates.

Course Assignments and Grading Policies

Course Modules

For this course, you will complete work in five modules, with additional minor assignments during the first and last week of the course. Each module will consist of two discussion boards, one problem set, and one quiz. Due dates are provided in the schedule below.

Course Schedule

Assignment	Due Date
Module 0: Welcome and Introduction	
▶ 0.2 Introduction Discussion – First Post	Thursday 1/8
▶ 0.2 Introduction Discussion – Response Post	Sunday 1/11
Module 1: Issues & Perspectives (IP)	
▶ 1.2 IP Rough Draft Math (Ch. 1-2) Discussion – First Post	Tuesday 1/13
▶ 1.2 IP Rough Draft Math (Ch. 1-2) Discussion – Response Post	Friday 1/16
▶ 1.3 IP Problem Solving Discussion – First Post	Tuesday 1/13
▶ 1.3 IP Problem Solving Discussion – Response Post	Friday 1/16
▶ 1.4 Problem Solving Autobiography	Friday 1/16
Module 2: Rich Tasks (RT)	
▶ 2.2 RT Rough Draft Math (Ch. 3) Discussion – First Post	Tuesday 1/27
▶ 2.2 RT Rough Draft Math (Ch. 3) Discussion – Response Post	Friday 1/30
▶ 2.3 RT Problem Solving Discussion – First Post	Tuesday 2/10

▶ 2.3 RT Problem Solving Discussion – Response Post	Friday 2/13
▶ 2.4 RT Curriculum Analysis	Friday 2/13
Module 3: In the Classroom, Part 1 (IC-1)	
▶ 3.2 IC-1 Rough Draft Math (Ch. 4 & 6) Discussion – First Post	Tuesday 2/24
▶ 3.2 IC-1 Rough Draft Math (Ch. 4 & 6) Discussion – Response Post	Friday 2/27
▶ 3.3 IC-1 Problem Solving Discussion – First Post	Tuesday 3/17
▶ 3.3 IC-1 Problem Solving Discussion – Response Post	Friday 3/20
▶ 3.4 IC-1 Task Sequencing	Friday 3/20
Module 4: In the Classroom, Part 2 (IC-2)	
▶ 4.2 IC-2 Rough Draft Math Discussion (Ch. 5) – First Post	Tuesday 3/31
▶ 4.2 IC-2 Rough Draft Math Discussion (Ch. 5) – Response Post	Friday 4/3
▶ 4.3 IC-2 Problem Solving Discussion – First Post	Tuesday 4/14
▶ 4.3 IC-2 Problem Solving Discussion – Response Post	Friday 4/17
▶ 4.4 IC-2 Task Revisions	Friday 4/17
Module 5: Now What?	
▶ 5.2 Problem Solving Discussion – First Post	Sunday 4/26
▶ 5.2 Problem Solving Discussion – Response Post	Wednesday 4/29
▶ 5.3 Unit Plan	Friday 4/24
End of Semester	
▶ Course Reflection	Wednesday 4/29

Course Assignments:

Each module will consist of two discussion boards and one additional assignment. In general, assignments will be due at 11:59 PM EDT/EST.

- Discussions (20 points each): Course readings and discussions are designed to help you explore key aspects of the content of the course. For each module, you will engage in two discussion boards. One board focuses on issues related to the *Rough Draft Mathematics* readings for each module, and the other focuses on making connections between the other readings and student learning in your classrooms. For each discussion board (unless otherwise noted in the assignment), you will be asked to post an initial response to the prompts and replies to at least three of your peers. There are

separate due dates for initial and response posts, and each will be due at the end of the day on their due date (11:59 PM EDT/EST).

- Problem Solving Autobiography (20 points): In Module 1, you will be asked to reflect on your experiences with problem solving as both a learner and educator. This assignment is meant to prime you for thinking about the various ways in which problem solving can manifest in the classroom and to allow you to revisit your experiences as a student so you can understand what it might be like for your students to experience solving these mathematical problems for the first time. Given that we are asking you to reflect on your personal experiences, we are allowing for flexibility in the format of your submission. You may submit a written document (around 500 words), a video recording (around 5 minutes), or some other format to be agreed upon by you and the instructor before the submission deadline. You will be required to submit an electronic copy of this assignment via Canvas.

For Modules 2-5, you will complete a series of assignments that culminate with a Unit Plan due at the end of Module 5.

- Curriculum Analysis (40 points): This assignment has three primary components: (1) Choose a course you teach and approximate the ratio of true problem solving to total content is in the course; (2) Identify a unit or textbook chapter for that course that you would like to incorporate more problem solving into and analyze the cognitive demand of the current tasks from your curriculum; and (3) Brainstorm types of tasks you might incorporate into the unit to increase the time spent on problem solving.
- Task Sequencing (40 points): Identify a learning goal related to the unit you selected for the Curriculum Analysis, then find and sequence at least 4 high-cognitive demand tasks that can be used to help your students reach the learning goal. You will then write a 500-word summary explaining the decisions you made in this assignment.
- Task Revisions (40 points): Identify another learning goal related to the unit you selected for the Curriculum Analysis, then find at least 4 tasks that are not high-cognitive demand and adapt them so that they are high-cognitive demand tasks that can be used to help your students reach the learning goal.
- Unit Plan (60 points): Revise your plans from the Task Sequencing and Revisions assignments, as appropriate, and create a plan for the unit you selected for the Curriculum Analysis. No specific format for the lesson plan is required, but required components (e.g., at least 8 tasks and at least 4 lessons) are specified in the assignment description.
- Other assignments: You will complete a few minor assignments during the first week of the course and Finals Week that include opportunities to reflect on your experiences related to classroom practices regarding problem solving. These assignments are designed to enhance your experience in the course and should be given appropriate attention.

Course Weights and Grading Scale

Assignments are weighted by points, and corresponding percentages are provided below. The Grading Scale for final course grades also follows.

Assignments	Points
Discussions (x10)	
▶ Rough Draft Math (x4)	80
▶ Big Ideas (x6)	120
Autobiography (x1)	20
Assignments (x4)	180

Course Grade	Point Range
A	360-400
B	320-359
C	280-319
D	240-279
F	0-239

Course Statements and Policies

Feedback Policy

- I always try to respond to email from your official Ball State email address within 24 hours during the work/school week (Monday-Friday) and 48 hours on the weekend. Feel free to second a second email if I miss one of these windows.
- I will read every discussion post but I will not always personally comment on posts.
- I always plan to grade assignments and discussions within 1 week of submission.
- Contact me directly with questions or concerns about your performance in class.

Participation Policy

Your regular participation and timeliness are important to your academic success. In MATH 693, this will take the form of completing all assignments and participating in class discussions via Canvas. As this is an online course, it is up to every student to stay on track and not fall behind. You must be self-motivated and disciplined to meet all due dates. Developing a routine is encouraged. You are expected to submit each assignment by a specified time and date. See above for the Course Schedule and specific due dates, and below for the Late Work Policy.

Late Work Policy

All assignments are due by 11:59 PM EDT/EST on their respective due dates unless otherwise noted. Late work will be accepted at the instructor's discretion. Unless there are extenuating circumstances or prior arrangements have been made, there will be a **10% per day** grade deduction for late assignments. Assignments for grading will not be accepted after 11:59 pm EDT/EST on the final day of Finals Week, Friday, May 1.

Course Withdrawal

The course withdrawal period ends **Thursday, March 19**. Before this date, students can elect to receive a “W” for the course by completing and submitting the proper form. The instructor’s permission is not required. For details, see <https://www.bsu.edu/about/administrativeoffices/registrar/registration-activities/withdraw-from-classes> as well as Degree Requirements and Time Limits in the current Undergraduate Catalog OR Withdrawal Procedures in the current graduate catalog.

Assignment Submission Policy

- Written assignments should be submitted as .pdf documents unless otherwise indicated in the assignment description. If you take pictures of handwritten work, please paste these into a Word document and either *print*, *export*, or *download* your file as a pdf. Alternatively, there are several free tools for scanning your work as a pdf with your phone, and I’m happy to provide suggestions and support as needed.
- Assignments should be submitted using the assignment links in Canvas.

Grading Policy

Appropriate evaluation of your academic performance is an integral part of your learning experience. In the absence of mistake, fraud, bad faith, or incompetence, I will be the key decision-maker on the assignment of grades. For information concerning grade appeals, [consult the Ball State website](#).

University Policies

University Statement

We are committed to ensuring that all members of the community are welcome, through valuing the various experiences and worldviews represented at Ball State and among those we serve. We promote a culture of respect and civil discourse.

Disability Statement

If you need course adaptations or accommodations because of a disability, please contact the instructor of record as soon as possible. Ball State's [Disability Services Office](#) coordinates services for students with disabilities; documentation of a disability needs to be on file in that office before any accommodations can be provided. Disability Services can be contacted at 765-285-5293 or dsd@bsu.edu.

Attendance

This course is offered in an online, asynchronous format. Because of that, class attendance is not graded, and for clerical purposes (e.g. “last date of attendance”), will be determined based on the date of the last assignment submission.

Freedom of Expression

In this course, we are committed to fostering a learning environment that values intellectual diversity, encourages free expression, and promotes open inquiry. As members of the Ball State Community, we treat each person in the Ball State community with civility, courtesy, compassion, and dignity and respect and learn from differences in people, ideas, and opinions. Please review Ball State University's [Statement on Freedom of Expression](#), the resources on Ball State's [Freedom of Expression webpage](#), and [Ball State's Beneficence Pledge](#).

Ball State Academic Ethics

Honesty, trust, and personal responsibility are fundamental attributes of the university community. Academic dishonesty and other forms of academic misconduct threaten the foundation of an institution dedicated to the pursuit of knowledge and will not be tolerated. To maintain its credibility and reputation, and to equitably assign evaluations of scholastic and creative performance, Ball State University is committed to maintaining a climate that upholds and values the highest standards of academic integrity. Visit the complete [Student Academic Ethics Policy](#).

Also see [Ball State's Code of Student Rights and Responsibilities](#).

Plagiarism Policy

Plagiarism is not acceptable, unless otherwise indicated for all assignments, you must work independently by yourself. Sharing of files is not permitted for any reason.

Potential Violations

Examples of academic integrity violations include but are not limited to:

- Working with another person on any assignment other than authorized group projects.
- Sharing or allowing others to access your files, whether done with permission or not.
- Use or possession of a file created by someone else.
- Reusing work from another semester, course, or section.
- Fraudulent submission of work.
- Using unauthorized materials during Exams.
- Impersonating someone else or having them impersonate you.
- Making fraudulent or dishonest statements regarding your work.
- Soliciting others, including AI tools, to complete work for you.
- Posting course files and resources on study or content sharing websites.

Canvas and Student Privacy

Canvas Accessibility

Canvas provides a user experience that is easy, simple, and intuitive. Special attention has been paid to making Canvas screen-readable. The Rich Content Editor encourages users to create accessible content pages (i.e. text formatting is accomplished using styles). Canvas is designed to allow limited customization of colors and schemes to be accessible for all users. The National Federation of the Blind granted Canvas the Gold Level Web Certification in 2010.

Find more information by visiting the [Canvas Voluntary Product Accessibility Template \(VPAT\)](#).

FERPA and Privacy

As a student, your educational records are considered confidential. Under FERPA (Family Educational Rights and Privacy Act), your records are confidential and protected. Under most circumstances, your records will not be released without your written and signed consent. However, some directory information may be released to third parties without your prior consent unless a written request to restrict this is on file. You can learn more about student rights to privacy by reading [Ball State's FERPA and Privacy and Protection](#).

Academic Support Services

The Writing Center

All writers improve with practice and feedback, so as a student in this course, you are encouraged to use the Writing Center (in Robert Bell 295 during weekdays, Bracken Library First Floor West in the evenings, or online during any of our regularly scheduled hours) to get additional feedback on your writing.

The Writing Center offers free planning, feedback, and accountability sessions (in person and online) to all students composing essays, reports, reflections, research projects, web content, lesson plans, slideshows, poster presentations, resumes, and other digital or print texts. To schedule a free appointment to discuss your writing, go to <http://www.bsu.edu/writingcenter>. Online and in-person appointments are available; however, plan ahead because appointments book quickly!

The Basic Needs Hub

If you are having difficulty affording enough food, do not have a safe and reliable place to sleep, and/or experiencing an emergency or crisis, help is available through the [Basic Needs Hub](#). The Basic Needs Hub has information, resources, and provides individualized support to students. To talk with a supportive staff member about your

experience, receive one on one assistance, or learn more about resources, you can submit a [Basic Needs Assistance Form](#).

Subject to Change Statement

This syllabus and schedule are subject to change in the event of extenuating circumstances.

Syllabus updated 1/2/2026