MATH 411G Problem Solving for Elementary and Middle Grades Teachers
Fall 2020

Instructor	Office	Phone	Email
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Prerequisites
MATH 206, 302, and 308 with a grade of C or better, or permission of instructor

Required Textbook:
Johnson, K., Herr, T., & Kysh, J. (2018). Crossing the River with Dogs: Problem Solving for
        College Students. (3rd Edition). Hoboken, NJ: John Wiley & Sons.
IMPORTANT: **YOU MUST PURCHASE THE 3RD EDITION**. The 2nd edition is very different and will create difficulties for you trying to complete homework assignments.

Graduate Catalog Description
Integrates concepts developed in algebra, geometry, logic, statistics, probability, and elementary number theory. Students are encouraged to use problem-solving strategies, models, and technologies to solve problems as well as create problems of their own.
Please note If you took Math 411 (or its equivalent at another university) as an undergraduate, you cannot repeat the course for graduate credit. **It is your responsibility to find out if you can count this course towards your degree.**

Course Objectives/Student Learning Outcomes (SLO):
Upon completion of this course, successful students will be able to:
1. employ both inductive and deductive reasoning appropriately
2. choose appropriate strategies to solve problems and recognize when multiple strategies will work to reach a solution
3. recognize and find multiple solutions when appropriate
4. construct visual representations as needed and then analyze those constructs to reach a solution
5. identify patterns and predict other outcomes using the patterns they identified
6. employ logic in solving a problem to arrive at a conclusion
7. analyze and evaluate the mathematical thinking and strategies of others
8. communicate their mathematical thinking orally and in writing to peers, faculty, and others

Course Assignments, Projects, and Evaluation: MATH 411G

Major Course Experiences	Course Objectives/Student Learning Outcomes	SPA Standard(s): **NCTM/CAEP Elementary Math Specialist**	KY Teacher Performance Standards
Math Problem Solving Content Exams □Clinical;	SLO 1-8	Standards: 1a, 2a, 2b, 2c, 2d, 2e, 2f	KTPS Standard 4a & 5
Problem Solving Assignments & Math Discussion Boards □Clinical;	SLO 1-8	Standards: 1a, 2a, 2b, 2c, 2d, 2e, 2f	KTPS Standard 4a, 4b, 5
Math Research Article Bibliography □Clinical;	SLO 8	Standards: 2d, 2e, 2f	KTPS Standard 4a & 5
Math Pedagogical Article Critique □Clinical;	SLO 8	Standards: 1a, 2d, 2e, 2f	KTPS Standard 4a & 5

Standards addressed in this course:

Kentucky Teacher Performance Standards (KTPS):	MATH 411G Alignment: Assignments/Assessments
Standard 4. Content knowledge. The teacher shall: a. Understand the central concepts, tools of inquiry, and structures of the discipline he or she teaches; and b. Create learning experiences that make these aspects of the discipline accessible and meaningful for learners to assure mastery of the content.	Math Problem Solving Content Exam KTPS 4a Problem Solving Assignments & Math Discussion Boards KTPS 4a and 4b Math Research Article Bibliography KTPS 4a Math Pedagogical Article Critique KTPS 4a
Standard 5. Application of content. The teacher shall understand how to connect concepts and use differing perspectives to engage learners in critical thinking, creativity, and collaborative problem solving related to authentic local and global issues.	Math Problem Solving Content Exam Problem Solving Assignments & Math Discussion Boards Math Research Article Bibliography Math Pedagogical Article Critique

NCTM CAEP Standards 2012 Elementary Math Standards	Course Alignment
	MATH 411G

Standard 1: Content Knowledge Effective elementary mathematics specialists demonstrate and apply knowledge of major mathematics concepts, algorithms, procedures, connections, and applications within and among mathematical content domains. Elementary mathematics specialist candidates: • **1a)** Demonstrate and apply knowledge of major mathematics concepts, algorithms, procedures, applications in varied contexts, and connections within and among mathematical domains (Number and Operations, Algebra, Geometry and Measurement, and Statistics and Probability) as outlined in the NCTM CAEP Mathematics Content for Elementary Mathematics Specialist.	Math Problem Solving Content Exam Problem Solving Assignments & Math Discussion Boards Math Pedagogical Article Critique
Standard 2: Mathematical Practices Effective elementary mathematics specialists solve problems, represent mathematical ideas, reason, prove, use mathematical models, attend to precision, identify elements of structure, generalize, engage in mathematical communication, and make connections as essential mathematical practices. They understand that these practices intersect with mathematical content and that understanding relies on the ability to demonstrate these practices within and among mathematical domains and in their teaching and mathematics leadership. In their role as teacher, lead teacher, and/or coach/mentor, elementary mathematics specialist candidates: • **2a)** Use problem solving to develop conceptual understanding, make sense of a wide variety of problems and persevere in solving them, apply and adapt a variety of strategies in solving problems confronted within the field of mathematics and other contexts, and formulate and test conjectures in order to frame generalizations. • **2b)** Reason abstractly, reflectively, and quantitatively with attention to units, constructing viable arguments and proofs, and critiquing the reasoning of others; represent and model generalizations using mathematics; recognize structure and express regularity in patterns of mathematical reasoning; use multiple representations to model and describe mathematics; and utilize appropriate mathematical vocabulary and symbols to communicate mathematical ideas to others. • **2c)** Formulate, represent, analyze, and interpret mathematical models derived from real-world contexts or mathematical problems. • **2d)** Organize mathematical thinking and use the language of mathematics to express ideas precisely, both orally and in writing to multiple audiences. • **2e)** Demonstrate the interconnectedness of mathematical ideas and how they build on one another and recognize and apply mathematical connections among mathematical ideas and across various content areas and real-world contexts. • **2f)** Model how the development of mathematical understanding within and among mathematical domains intersects with the mathematical practices of problem solving, reasoning, communicating, connecting, and representing.	Math Problem Solving Content Exam: Standards 2a, 2b, 2c, 2d, 2e, 2f Problem Solving Assignments & Math Discussion Boards: Standards 2a, 2b, 2c, 2d, 2e, 2f Math Research Article Bibliography: Standards 2d, 2e, 2f Math Pedagogical Article Critique

Required Experiences of EMS WKU Sequence	ELED 411G Assignments
A. depth of knowledge beyond elementary preparation	All assignments
B. learn how to provide professional development in math	
C. deepen understanding of how math procedures work	All assignments
D. promote mathematical reasoning, sense making, problem solving, computational fluency, justification	All assignments
E. how to use different texts and design instruction to meet individual learning needs	
F. learn how to determine what students know and understand, using formative assessments as guide	
G. provide strategies and resources for teaching mathematics, including differentiated instruction	
H. ensure understanding of vertical nature of mathematics K-8	All assignments

Internet Access

You **must** have regular access to the Internet to access email and the course website – BLACKBOARD. This will help ensure that you do not fall behind. My primary form of communication with you will be email and the discussion boards. Please check your email regularly and save class emails for future reference.

Attendance Policy

We will not have a set meeting time when everyone will be online; however, you are expected to be online **frequently** each week to check your WKU email and the discussion board – this is *VITAL*. In a face-to-face class, we would meet in person just shy of 3 hours each week. In addition to this, you are expected to put in additional time outside of class for reading, completing assignments, and studying – this is typically figured as 1-3 hours per credit hour per week. So, in a face-to-face class the spent on a class can range from 6 to 12 hours a week for each class. I will expect you to do the same amount work as if this course was meeting in person – I will not compromise the integrity of the course. Since we are not meeting in person, some students will find that they need to put in additional time to understand the material. Make sure you do not get behind!

Important Dates

Classes Begin	August 24 (Monday)
Labor Day (**university open/classes in session**)	September 7 (Monday)
Election Day (**university closed/no classes)**	November 3 (Tuesday)
Thanksgiving Holiday	November 23 – 27 (Mon – Fri)
Final Exam	**Nov 29 - Dec 3 (Mon – Thurs)**

Assignments & Assessments

The course grade will be computed as follows:

Exams (60%)

There will be 2 – 3 tests throughout the semester that will be announced in advance. There will be a "window of opportunity" to take each test. These "windows of opportunity" will be short, so it will be very important for to you to schedule a time with me as soon as you they are announced. I will post detailed information about this once the first test is scheduled. Each student will schedule her/his testing time with me. There will be no planned make-up tests and missing a test will result in a zero. Only under the most **extenuating** circumstances will a make-up test be considered if the instructor is aware of an issue in **advance**.

On Blackboard is posted an *Expectations and Grading Rubric – Tests* document, which has more information on Tests.

Assignments - 40% (Problem Sets 25% & Write-Ups 15%)

It will be very advantageous for you to read every chapter that we cover in this course. Problems will be assigned on a weekly basis and should be taken seriously. You will find that doing the homework and corresponding with classmates or with the instructor will increase your chances for success on exams. Also keep in mind that this is a problem-solving class – do not expect to sit down and get one assignment done in an hour or two – sometimes you get stuck and need to take a break. **DO NOT wait until the last minute to start an assignment** – instead, budget your time and work when you can.

Do NOT email a problem set or write-up to me unless I request that you do so. **All** assignments should be turned in via the links given the links on Blackboard or dropped off at mu office. Any assignment uploaded on Blackboard for me to grade should be either a **Word document or a PDF file**. It is fine to handwrite your assignments to then scan as a PDF file. However, all uploaded assignments should be turned in as **one file -** do not type your assignments into text boxes. To summarize – any assignment uploaded to Blackboard **MUST** be uploaded as **ONE** document or **ONE** pdf file – **no other file type is acceptable**. Once an assignment has been graded and solutions posted, late assignments will not be accepted for any reason!

For help on how to upload assignments, go to Blackboard help for students. Under Spotlight, click 'Submit your assignments.' Watch tutorial and/or read instructions provided.

On Blackboard are posted an *Expectations and Grading Rubric – Problem Sets and an Expectations and Grading Rubric – Write-Ups* document, which have more information on Problem Sets and Write-Ups. Each assignment consists of two pieces, the problem set

and the write-up. This course will focus extensively on your writing of mathematics. There is also a *General Structure* document posted on Blackboard.

Discussion Boards – Expected
Discussion is a very important part of the learning process. While we cannot replicate in-class discussions in an online class, we can come close. Keeping in mind that this is an online course that utilizes an asynchronous environment, your participation is expected and required. That is, you will not be awarded (given points) for completing the Discussion Boards (DBs). Instead, you will be graded punitively, that is, if you fail to post, you will lose points from your overall grade.
For each DB that is required, you will receive a check mark for completing the discussion on time and as expected (i.e., professional, respectful, a substantial post/response, and appropriate number of posts/responses - See *Calendar*). If you do not meet ALL of these expectations, you will not receive a check mark. I will review students' check marks and their final grade for the course will be lowered as followed (by percentage points):

- Missing 0 checks – final grade is not lowered
- Missing 1 check – lowered by 3% points
- Missing 2 checks – lowered by 6% points
- Missing 3 checks – lowered by 9% points
- Missing 4 checks – lowered by 12% points
- Missing 5 or more checks – lowered by 15% points

If you have any questions about what is expected, please email me ASAP (i.e., BEFORE the due date). For each week's Discussion Board, I will have an entry in the Gradebook; a '1' means you got a check mark and a '0' means you did not get a check mark.

On Blackboard is posted an Expectations and *Grading Rubric – Discussion* Boards document, which has more information on Discussion Boards.

Graduate Component Requirements – Fall 2020

Due Dates: Wednesday, November 4th by 11:59 pm – Pedagogical Article 1
Wednesday, November 11th by 11:59 pm – Pedagogical Article 2
Wednesday, December 2nd by 11:59 pm – Research Article 1

You will read a total of 1 pedagogical and 2 research articles/chapters related to problem solving or teaching middle grades mathematics. Each article is will have its own requirements and due date.

I. **Pedagogical Articles**
Article 1 – "Prove It to Me"
- Read the article and write a brief reaction/critique (@100 words).
- The author mentions that they dispel myths about mathematics during summer camp. What myths do you hold/have you heard about mathematics? What are some strategies to helping students overcome myths about mathematics? Be specific.
- Complete the task in Figure 4. Write exactly what you would say to convince someone that you have constructed the figure with the desired area.
- How do you define equity? What role does it play in mathematics? The author mentions "relational equity." What are your thoughts about relational equity?
- Choose 2 of the websites listed on p. 427 to explore. Compare and contrast the two websites. Which do you prefer? Why?

Article 2 – *"A Model Approach to Problem Solving"*
- Read the article.
- Write a summary of what makes a good problem solver. Based on the article, are you a good problem solver? Explain.

- Write a summary of what a good problem-solving activity looks like. Locate a good problem-solving task (not a problem) where students have to develop something (similar to the task in the article). Explain what makes it a good problem-solving task. Solve the task. Explain how you solved it. Cite your source.
- An item is an exercise (not a problem) if a student knows exactly how to approach it. For example, for a middle grades student, finding the cost of 8 apples at $0.25 each is an exercise, but for a second-grade student, it is a problem. Give another example of an item that would be an exercise for middle grades students but a problem for younger students.
- Write a summary of what a future teacher, such as yourself, should keep in mind as you prepare to bring problem-solving activities to your classroom. What surprises, concerns, or intrigues you about teaching problem solving? Explain.

### II.	Research Articles
Articles – Choose of one of the three articles listed below
- Read the article.
- Write an annotated bibliography for each article (details below) and

Annotated Bibliography
An annotated bibliography can be summative, evaluative, critical, etc. This assignment asks you to produce both summative and evaluative components. This means each annotation will include a short, but careful summary of the original article (100-200 words) and an evaluation of that article and its usefulness to your teaching (100-200 words). Although there are many kinds of annotated bibliographies produced for all fields of academic inquiry, this assignment asks that:
- Each annotation appears in alphabetical order, by last name of author(s), and following each annotation is the summative and evaluative paragraphs (see the last page of this document for an example of the formatting)
- The entries follow the conventions of APA citation (6th edition) (see: https://owl.purdue.edu/owl/research_and_citation/apa_style/apa_formatting_and_style_guide/general_format.html for details)
- The entire document is single spaced (with spaces between each annotation), 12-point Times New Roman, 1-inch margins
- Each annotation has a summative and evaluative component (two paragraphs total)
  - Summative (Summary)
    - Focus on the main ideas
    - Consider the author(s)' premise
  - Evaluative (Critique) *(not all of these are necessary for every critique, these are just examples of how to critique)*
    - Evaluate the authors' ideas
    - Consider the bias/assumptions of the author
    - Consider ideas relevant to the topic but not mentioned by the author(s)
    - Consider the evidence on which the author bases his/her/their claims
    - Consider the appropriateness of the research methodology

Research Article Choices

Carpenter, T. P., Fennema, E., Peterson, P. L., & Carey, D. A. (1988). Teachers' pedagogical content knowledge of students' problem solving in elementary arithmetic. *Journal for Research in Mathematics Education*, *19*(5), 385-401.

Cooney, T. (1985). A beginning teacher's view of problem solving. *Journal for Research in Mathematics Education*, *16*(5), 324-336.

Higgins, K. (1997). The effect of year-long instruction in mathematical problem solving on middle-school students' attitudes, beliefs, and abilities. *The Journal of Experimental Education*, *66*(1), 5-28.

Graduate Credit
As indicated in the WKU Graduate Catalog (http://www.wku.edu/graduate/prospective_students/catalog.php), any student enrolled in a 400-level course for graduate credit is expected to complete additional course requirements. This additional work assigned to graduate students is expected to bring the course to a level of rigor commensurate with a graduate level course. Therefore, any student taking this course for graduate credit will be required to complete additional assignments. Each of these additional assignments **must be satisfactorily completed** before a grade will be awarded in the class; however, they will not be part of the

course grade. The details of these assignments will be posted on Blackboard. **If you fail to satisfactorily complete one or two of these assignments, your final grade will be no higher than a D and failing to satisfactorily complete more than two of these assignments will result in an F in the course.**

Grading Scale:
90 – 100% A   80 – 89% B   70 – 79% C   60 – 69% D   Below 60% F

Gradebook
I use the Blackboard Gradebook. Please note this software is not the best so sometimes interpreting your grade. I will have columns for each test, problem set, write-up, and discussion board expectation. Rather than letting Blackboard calculate your average I will also manually change your current average every time I enter a grade. If you see something that does not make sense, please alert me.

Academic dishonesty will not be tolerated! You are expected to follow **The University Code of Conduct** at all times. Specifically, any form of cheating or plagiarism will be punished. The policy is found in the student handbook at http://www.wku.edu/judicialaffairs/process-for-academic-dishonesty.php.

ADA Statement
"In compliance with university policy, students with disabilities who require academic and/or auxiliary accommodations for this course must contact Student Accessibility Resource Center in Downing Student Union, 1074. The phone number is 270-745-5004. Please DO NOT request accommodations directly from the professor or instructor without a letter of accommodation from the Student Accessibility Resource Center."

Title IX Discrimination/Harassment Statement
Western Kentucky University (WKU) is committed to supporting faculty, sta_ and students by upholding WKU's Title IX Sexual Misconduct/Assault Policy (#0.2070) and Discrimination and Harassment Policy (#0.2040) at

https://wku.edu/eoo/documents/titleix/wkutitleixpolicyandgrievanceprocedure.pdf

https://wku.edu/policies/hr_policies/2040_discrimination_harassment_policy.pdf

Under these policies, discrimination, harassment and/or sexual misconduct based on sex/gender are prohibited. If you experience an incident of sex/gender-based discrimination, harassment and/or sexual misconduct, you are encouraged to report it to the Title IX Coordinator, Andrea Anderson, 270-745-5398 or Title IX Investigators, Michael Crowe, 270-745-5429 or Joshua Hayes, 270-745-5121.

Please note that while you may report an incident of sex/gender-based discrimination, harassment and/or sexual misconduct to a faculty member, WKU faculty are \Responsible Employees" of the University and MUST report what you share to WKU's Title IX Coordinator or Title IX Investigator. If you would like to speak with someone who may be able to afford you confidentiality, you may contact WKU's Counseling and Testing Center at 270-745-3159.

Disclaimer
The instructor reserves the right to change, alter, modify, or tweak anything in this document at any time for any reason.