Problem Solving for Elementary and Middle Grades Teachers
MATH 411/411G – Fall 2021

Instructor: Dr. Dan Clark
Office: COHH 3115
E-mail: daniel.clark@wku.edu
E-mail is by far the best way to reach me. If you email me by 12pm on a weekday, I'll respond by 5pm that same day. If you email after that, it may be the next weekday. Exceptions to this policy will be communicated to you in advance of their occurrence.

Course Hours: Online – At your leisure – but be careful!
Office Hours: By appointment. I'm available at ***a lot*** of times. Just email we and we'll find something that works!

Prerequisites: MATH 206, 302, and 308 all with a grade of C or better, or permission of instructor.

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. **You must get the third edition!**

Graduate and Undergraduate Catalog Course Description: This course 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 (SLOs):
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 411/411G

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	SLO 1-8	Standards: 1a, 2a, 2b, 2c, 2d, 2e, 2f	KTPS Standard 4a & 5
Problem Solving Assignments & Math Discussion Boards	SLO 1-8	Standards: 1a, 2a, 2b, 2c, 2d, 2e, 2f	KTPS Standard 4a, 4b, 5

Standards addressed in this course:

Kentucky Teacher Performance Standards (KTPS):	MATH 411/411G 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
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

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

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.	

AMTE Elementary Mathematics Specialist Standards Alignment:

From AMTE Standard I. Content knowledge for teaching mathematics:

Deep Understanding of Mathematics (Standard Ia):

Algebra and Functions:

3. Modeling of problems, both mathematical and ―real world,‖ using algebraic equations and inequalities.

Data Analysis and Probability:

1. The nature and uses of data: What kinds of questions require data for their answers, and what kinds of data are required? How are relevant data sets created and organized? Designing an investigation, including specification of how the data collected support analysis responsive to the question(s) under investigation.

Further specialized mathematics knowledge for teaching (Standard I b):

2. Create opportunities for learners to develop the Standards for Mathematical Practice (National AMTE EMS Standards 7 Governors Association Center for Best Practices & Council of Chief State School Officers, 2010) and to critically evaluate learners' selection and use of these practices:.
    a. Make sense of problems and persevere in solving them;
    b. Reason abstractly and quantitatively;
    c. Construct viable arguments and critique the reasoning of others;
    d. Model with mathematics;
    e. Use appropriate tools strategically;
    f. Attend to precision;
    g. Look for and make use of structure; and,
    h. Look for and express regularity in repeated reasoning

From AMTE Standard II. Pedagogical knowledge for teaching mathematics:

Learners and learning (Standard II a):

4. Create social learning contexts that engage learners in discussions and mathematical explorations among peers to motivate and extend learning opportunities.

Teaching (Standard II b):

2. Support students' learning of appropriate technical language associated with mathematics, attending to both mathematical integrity and usability by learners.
6. Model effective problem solving and mathematical practices—questioning, representing, communicating, conjecturing, making connections, reasoning and proving, self-monitoring and cultivate the development of such practices in learners.
8. Analyze and evaluate student ideas and work, and design appropriate responses.

Required Experiences of EMS WKU Sequence	ELED 411/411G 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 your WKU email and the course website – Blackboard (BB). This will help ensure that you do not fall behind. My primary forms of communication with you will be your WKU email and the discussion boards. Please check your email regularly and save class emails for future reference.

Attendance: 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 that can range from 6 to 12 hours a week for one 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! As you read the rest of the course documents and become familiar with the structure of the course, I encourage you to put deadlines and times where you will work on this class in your calendar, just like you would for class meetings in a face-to-face class.

Assessment and Grading: Your grade in the course will be based on the following assessments:

- **Exams (65%):** There will be 2 tests throughout the semester that will be announced in advance. Tests will be handwritten and taken at a testing center (of your choice) near where you live/work. Just know that some testing centers have a fee that you may be required to pay. There will be a "window of opportunity" to take each test. These "windows of opportunity" will be short (usually about a week), so it will be very important for to you to schedule your test as soon as you they are announced. I will send a detailed email about this once the first test is scheduled. Each student will schedule their testing time with the appropriate testing center and then take the test at the scheduled time and place. You will receive **one** email from the DL Testing Center that will instruct you on how to register for your tests – please **do not delete** this email, as they only send it out once. The only exceptions for testing outside of the DL Testing Centers will be for students who have written permission from the Student Accessibility Resource Center. 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**. Not scheduling a test in advance is not a reason to test outside of the testing window.

- **Assignments (30%):** 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 homework assignment to me unless I request that you do so. **ALL** assignments should be turned in via the links on Blackboard (BB). Any assignment uploaded on BB for me to grade should be in one of the following formats: 1) a scanned PDF that was from a handwritten homework assignment (please write very neatly), or 2) an uploaded PDF that was originally a typed word processing (you must use the Math Equation Editor when appropriate). All uploaded assignments should be turned in as **one file**. To summarize – any assignment uploaded to BB **MUST** be **ONE** PDF file – no other file type is acceptable. Once solutions are posted, late assignments will not be accepted for any reason! You will find a detailed Grading Rubric and a General Structure document posted on BB.

- **Discussion Boards – Participation – Professionalism (5%):** 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.**

  All homework questions and comments about the reading should be posted on the discussion board (DB) located on BB so that the entire class can benefit from both the question and the discussion relating to the process and solution. You are expected to post comments and/or questions that relate to classmates' questions – just as you would participate in conversations during group work in a classroom. Of course, this "conversation" is not immediate, so it is in your best interest not to wait until the last minute to work on your assignments. You should plan to spend time on the computer monitoring these discussions several times throughout the week. Please **do not** email homework questions to the instructor. If you do, I will ask you to post that question to the DB. The rationale for this policy is that I want all students to benefit from all questions/comments, just as students would in a face-to-face class. The only exceptions to this rule are questions of a personal nature – those should always be communicated privately.

  Online discussions are a way for you to be "present" in class, like attendance in a face-to-face class. For each week during the course, two students will be assigned to individually and independently respond to all questions on the discussion board for that week. If it is your week and you respond to all the questions by the deadline to respond, you will receive all the points. If you do not respond to all the questions that week, you will receive points proportional to the amount of questions to which you responded. If no questions are posted your week, you will get all the points. Of course, anyone may participate in the discussion and answer questions posted by classmates even if it is not their assigned week to respond for a grade.

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 an additional assignment. This additional assignment **must be satisfactorily completed** before a grade will be awarded in the class; however, it will not be part of the course grade. The details of these assignments will be posted on Blackboard. **If you fail to satisfactorily complete this assignment you will earn an F in the course.**

Determination of Final Course Grade: Final course grades will be determined using the following scale:

Percentage	0% – 59%	60% – 69%	70% – 79%	80% – 89%	90% – 100%
Letter Grade	F	D	C	B	A

Understanding Course Grades:

A Pre-service teacher consistently demonstrates competencies that signal that they are proficient in the mathematical topics covered in the course. This qualification includes a deeper level of understanding than that expected of the students they are preparing to teach. Pre-service teacher demonstrates this level of understanding by consistently going beyond the information explicitly presented by the course instructor to completing new kinds of tasks. This ability to apply one's knowledge to new contexts and to put together various ideas is *essential* for effective classroom teaching because good teachers are able to respond to children's questions, to support and assess children's mathematical proficiency, and to interpret new curricula.

B Pre-service teacher occasionally demonstrates the competencies and the knowledge transfer abilities that characterize the mathematical proficiency of A-level students, but at times is limited to learning well just the information explicitly presented by the course instructor. Pre-service teacher shows evidence of better-than-acceptable level of mathematical proficiency in the topics studied and a deeper level of understanding than that expected of the students they are preparing to teach.

C Pre-service teacher consistently demonstrates good levels of performance on tasks measuring straightforward learning of course content, but rarely completes knowledge transfer tasks successfully. Shows evidence of an acceptable level of mathematical proficiency of the topics studied and shows evidence, although inconsistent, of a deeper level of understanding than that expected of the students they are preparing to teach.

D Pre-service teacher does not consistently show acceptable levels of performance, even on tasks measuring content explicitly presented by the course instructor. Although the pre-service teacher may have mastered some of the course content, and they show signs of considerable effort, serious questions persist about their mathematical proficiency and whether they have developed a deeper level of understanding than that expected of the students they are preparing to teach.

F Pre-service teacher shows a profile similar to that of the D student but, in addition, appears to be unprepared to teach others at this time. Pre-service teacher consistently exhibits lack of effort, profound and persistent misconceptions, and/or the failure to master some of the course topics.

Gradebook: Please consider the online gradebook as a courtesy to you, subject to errors given various upgrades and shifts in the software. I reserve the right to make gradebook corrections to keep it consistent with the syllabus so that your grade reflects true performance, not software or user error. If you see something that doesn't make sense, please alert me.

Withdrawal Dates: The last day to withdraw from this course without a grade and without paying a fee is Monday, August 30, 2021. The last day to withdraw from this course with a W, or change from credit to audit, is Monday, November 1, 2021.

Academic Dishonesty: Students who commit any act of academic dishonesty will receive, from the instructor, a failing grade in the course without possibility of withdrawal. The instructor will also present the case to the Office of Student Conduct for disciplinary sanctions.

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

Masks, Vaccines, and other COVID information: All students are strongly encouraged to get the COVID-19 vaccine. Out of respect for the health and safety of the WKU community and in adherence with CDC guidelines and practices of all public universities and colleges in Kentucky, the University requires that a cloth face covering (reusable or disposable) that covers both the nose and mouth must be worn at all times when in public areas within all buildings. Students must properly wear face coverings while in class regardless of the room size or the nature of the classroom activities. Students who fail to wear a face covering as required will be in violation of the WKU Student Code of Conduct and will be asked to comply or will face disciplinary action, including possible dismissal from the University. Accommodations can be requested in special cases through the Student Accessibility and Resource Center (SARC): 270-745-5004 (voice), 270-745-3030 (TTY), or 270-288-0597 (video).

All students must immediately report a positive Covid-19 test result or close contact with a person who has tested positive to the Covid-19 Assistance Line at 270-745-2019. The assistance line is available to answer questions regarding any Covid-19 related issue. This guidance is subject to change based on requirements set forth by public health agencies or the office of the governor. Please refer to the Healthy on the Hill website for the most current information. www.wku.edu/healthyonthehill

ADA Statement: In compliance with University policy, students with disabilities who require academic and/or auxiliary accommodations for this course must contact the Student Accessibility Resource Center located in Downing Student Union, 1074. SARC can be reached by phone number at 270-745-5004 [270-745-3030 TTY] or via email at sarc.connect@wku.edu . Please do not request accommodations directly from the professor or instructor without a faculty notification letter (FNL) from The Student Accessibility Resource Center. For further information please visit: https://www.wku.edu/syllabusinfo/.

Title IX Discrimination/Harassment Statement: Western Kentucky University (WKU) is committed to supporting faculty, staff, and students by upholding WKU's Title IX Sexual Misconduct/Assault Policy (#0.2070) at https://www.wku.edu/policies/docs/182.pdf and Discrimination and Harassment Policy (#0.2040) at https://www.wku.edu/policies/docs/251.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. For further information please visit: https://www.wku.edu/syllabusinfo/ and https://www.wku.edu/emergency/ .