Math 507 Math Concepts for Elementary Teachers
Summer 2019

Instructor	Office	Phone	Email
Dr. Hope Marchionda	COHH 3103 Office Hours: **Tuesdays & Wednesdays** 10 AM – 11 AM & by appointment	745-2961	hope.marchionda@wku.edu

Address: Western Kentucky University, GRH 1104
1906 College Heights Blvd. #61030
Bowling Green, KY 42101-1030

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

Textbook:
Lamberg, T. (2013). *Whole Class Discussions: Improving In-Depth Mathematical Thinking and Learning*.

Graduate Course Description:
This course is designed to explore topics related to the elementary mathematics curriculum. In this course, topics of interest include conceptual understanding of elementary place value, operations, number theory, and basic algebra and functions. This course is meant to encourage and develop conceptual understanding of mathematical concepts that you may have encountered in a traditional classroom setting. Infused throughout the course will be materials and discussions relevant to developing problem-solving and communication in mathematics. Course intended for graduate students in Elementary Education only

Course Objectives/Student Learning Outcomes:
Upon completion of this course, successful students will be able to:

1. Make connections between mathematical topics found in the elementary school curriculum and higher-level mathematics.
2. Employ both inductive and deductive reasoning appropriately.
3. Construct visual representations as needed and then analyze those constructs to reach a solution.
4. Identify patterns and predict other mathematical connections suing the patterns identified.
5. Analyze and evaluate the mathematical thinking and strategies of others.
6. Communicate their mathematical thinking orally and in writing to peers, faculty, and others.
7. Analyze the use of discussion in the mathematics to develop conceptual understanding of content.

Course Assignments, Projects, and Evaluation: MATH 507

Major Course Experiences	Course Objectives/Student Learning Outcomes	SPA Standard(s): NCTM/CAEP Elementary Math Specialist	KY Teacher Performance Standards
Math Assignments & Math Discussion Boards ☐Clinical;	SLO 1-7	Standards: 1a, 2a, 2b, 2d, 2f	KTPS Standard 4a, 4b, 5
Writing Assignments ☐Clinical;	SLO 6-7	Standards: 2d, 2f	KTPS Standard 4a, 4b, 5

Standards addressed in this course:

Kentucky Teacher Performance Standards (KTPS):	**MATH 507 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 Assignments & Math Discussion Boards Writing Assignments
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 Assignments & Math Discussion Boards Writing Assignments

NCTM CAEP Standards 2012 Elementary Math Standards	**Course Alignment**
	MATH 507
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 Assignments & Math Discussion Boards Writing Assignments
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. • 2d) Organize mathematical thinking and use the language of mathematics to express ideas precisely, both orally and in writing to multiple audiences. • **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 Assignments & Math Discussion Boards 2a, 2b, 2d, 2f Writing Assignments 2d, 2f

AMTE Elementary Mathematics Specialist Standards Alignment:

From AMTE Standard I. Content knowledge for teaching mathematics:

Deep Understanding of Mathematics (Standard Ia):

Number and Operations

- Pre-number concepts: Non-quantified comparisons (less than, more than, the same), containment (e.g., 5 contains 3), 1-to-1 correspondence, cardinality, meaningful counting, and ordinality.
- A comprehensive repertoire of interpretations, representations, and properties of the four operations of arithmetic (whole numbers) and of the common ways they can be applied.
- Place value: The structure of place-value notation in general and base-10 notation in particular; how place-value notations efficiently represent even very large numbers, as well as decimals; use 1 Based on recommendations in Mathematics Education of Teachers Report (2001, 2012) and Guidelines for Assessment and Instruction in Statistics Education (GAISE) Report (2007). 2 Because EMS professionals may work with teachers, their pedagogical knowledge for teaching must apply to teachers-as learners. Thus, in this section —learners‖ includes elementary students and elementary teachers. of these notations to order numbers, estimate, and represent order of magnitude (e.g., using scientific notation).
- Multi-digit calculations, including standard algorithms, mental math, and non-standard ways commonly created by students; informal reasoning used in calculations.
- Basic number systems: Whole numbers (non-negative integers), integers, non-negative rational numbers, rational numbers, and real numbers. Relationships among them, and locations of numbers in each system on the number line. Use of standard and non-standard algorithms. What is involved in extending operations from each system (e.g., whole numbers) to larger systems (e.g., rational numbers).
- Multiplicative arithmetic: Factors and factorization, multiples, primes, composite numbers, least common multiple, and greatest common factor.
- Quantitative reasoning and relationships that include rate, ratio, proportion, and rescaling.

Algebra and Functions

- Axioms: Recognize commutativity, associativity, and distributivity, and 0 and 1 as identity elements in the basic number systems; understand how these may be used in computations and to deduce the correctness of algorithms. Understand the relationship between addition and subtraction and between multiplication and division. The need for order-of-operations conventions.
- Algebraic notation, equations and inequalities: Literal symbols, as shorthand names for mathematical objects, or, in the case of numerical variables, as indicating an unspecified member of some class of numbers (the —range of variation‖). The process of substitution of particular numbers into variable expressions. The solution set of an algebraic equation or inequality. Transformations of equations (or relations) that do not change the solution set. Solution of pairs of simultaneous linear equations.
- Modeling of problems, both mathematical and —real world,‖ using algebraic equations and inequalities.
- The concept of a function as defining one variable uniquely in terms of another. Familiarity with basic types of functions, including constant, linear, exponential, and quadratic. Representations and partial representations of functions: Formula, graph, table, or verbal description; or, when the variable is discrete, by recursion. Familiarity with functional language such as independent and dependent variables.
- Finding functions to model various kinds of growth, both numerical and geometric.

Geometry and Measurement

- Visualization: Geometric objects are pictured on a 2-dimensional page; for 3-dimensional objects this requires perspective or projection renderings. Producing and reading such representations calls for special skills, both mathematical and drawing.
- Composition and decomposition: A geometric figure can be assembled by joining together various component figures. Conversely, a geometric figure may be decomposed into pieces, for example decomposing a polygon into an assemblage of triangles.
- Congruence and similarity: Congruence is the basic concept of geometric —sameness.‖ Similarity has to do with rescaling: Two figures are similar if one of them is congruent to a rescaling of the other. For example, all circles are similar, as are all squares and all isosceles right triangles.
- Geometric measurement: a way of attaching a numerical quantity to a geometric figure. Doing this involves a choice of some standard figure (the —unit‖) and then the measurement is a kind of ratio of the given figure to the unit, or, put differently, how many copies of the unit does it take to compose the given figure? It follows that if a geometric figure is decomposed, then its measure is the sum of the measures of its components. Changing the unit has the effect of multiplying all measurements by a constant (relating the two units). For example, relating feet to inches, or centimeters to meters.
- Common units of geometric measurement: Linear: The unit may be the interval [0, 1] on the number line. Area: The unit is a unit square. Volume: The unit is the unit cube. Angle: Draw a unit circle centered at the vertex of the angle, and consider the arc of the

circle cut out by the angle. The radian measure of the angle is the length α of that arc. The degree measure of the angle is $360\alpha/2\pi$, i.e. 360 times the fraction of the circumference of the circle formed by the arc.

- Basic geometric figures and relationships in each dimension: Dimension 1: Line segments, rays, arcs of circles; parallel and perpendicular Dimension 2: Polygons, circles; Dimension 3: Polyhedral solids, cylinders, cones, spheres. Elements of these figures, (e.g., vertex, edge, face). Properties of regularity and symmetry; definitions, names, and classification; various kinds of measurement, and some basic formulas, their relationships, and their rationale (i.e. – perimeter, area, volume); invariance under congruence, and behavior under rescaling.
- Plane coordinates: How they are introduced, and how they support algebraic expression of geometric objects and relationships. Reciprocally, how they afford geometric interpretation of algebraic relations.
- Transformations: Reflections, rotations, translations, dilations, glide reflections; composition of transformations; symmetry and its expression in terms of transformation (e.g., reflection through a line of symmetry); development and expression of congruence and similarity in terms of transformations.
- Geometric constructions; Axiomatic reasoning; Proof: Making and proving conjectures about geometric shapes and relations.

<u>Data Analysis and Probability</u>

- 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.
- Categorical (discrete) data (e.g., gender, favorite ice cream flavor) and measurement (continuous) data.
- Appropriate types of representation of data, and what they afford: For categorical data, relative frequencies. For measurement data, displays of shape, center, and spread.
- Basic concepts of probability and ways to represent them; making judgments under conditions of uncertainty; measuring likelihood; becoming familiar with the concept of randomness; and understanding the relationship between experimental and theoretical probability.
- Conclusions: Understand which representations best support communication of inferences from data, use probability models when appropriate, and account for variability. Understand the limits of generalizability due to non-randomness of a sample population. b.

b. Specialized mathematics knowledge for teaching. EMS professionals must have mathematical knowledge that enables them to:

- Support the development of mathematical proficiency as characterized by conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition (National Research Council, 2001).

Required Experiences of EMS WKU Sequence	**MATH 507 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 reliable and 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 forms of communication with you will be 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 summer class, this course would meet in person every day for an hour and forty minutes and you would be expected to put in additional time outside of class for reading, completing assignments, and studying. 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!

ADA Accommodation 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 in Downing Student Union, 1074. The phone number is 270 745-5004/V or 270 745-3030/TDD. Please DO NOT request accommodations directly from the professor or instructor without a letter of accommodation from the Student Accessibility Resource Center.

Assessment / Evaluation: The course grade will be computed as follows:

Participation (12%): Even though this is an online course that utilizes an asynchronous environment, your participation is expected. While I hope those of you who live near one another will take advantage of that fact, I will only require participation via discussion boards on Blackboard. I will post Discussion Board prompts and expect you to participate fully in that discussion. In addition, I expect homework questions to be posted on discussion boards so that the entire class can benefit from the question and answer format. Even if you understand all the homework, you should be participating in the discussions and helping others reach a better understanding as well. Sometimes we can learn from others even when we understand a topic. Please see the general structure document located on Blackboard for information regarding discussion boards.

Assignments (68%): Assignments will be given on a regular basis – either to turn in or to discuss on Blackboard. Most assignments will be collected and graded so make sure that you are keeping up with assignments. You will find that doing the homework (even the ones I am not collecting) and corresponding with classmates or with the instructor will increase your chances for success in this class. Also, for a variety of reasons, assignments should be turned in via the links given. Homework assignments can be typed in MS Word or handwritten and scanned. Any scanned work should be legible and uploaded as ***ONE*** file (doc or pdf). Multiple page documents are not accepted. Please do not use Excel unless you format it for printing. Keep in mind that many scanners will allow you to scan more than one page into one document even if there is not a document feeder.

Assignments will include a due date and these dates will be adhered to unless the student contacts the professor by email prior to the date the work is due. The professor may or may not decide to give an extension based on circumstances and the student's prior history of turning in late work. Once the assignment has been graded for the class, no late work will be accepted.

Writing Assignments/Projects (20%): You will have assignments during the semester which will vary in format. The requirements for each will vary and will be communicated at the time the assignment is made.

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

Percentage	0% – 67%	68% – 75%	76% – 83%	84% – 91%	92% – 100%
Letter Grade	F	D	C	B	A

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.

Academic dishonesty will not be tolerated. 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.

Withdrawal Dates: The last day to withdraw from this course without a grade and without paying a fee is Wednesday, June 5, 2019. The last day to withdraw from this course with a W, or change from credit to audit, is Tuesday, June 18, 2018.

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

Title IX Misconduct/Assault 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://wku.edu/eoo/documents/titleix/wkutitleixpolicyandgrievanceprocedure.pdf and*

Discrimination and Harassment Policy (#0.2040) at *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*.