

University of Arkansas – Fort Smith
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General Syllabus

MATH 23373 Structures of Arithmetic

Credit Hours: 3

Lecture Hours: 3

Laboratory Hours: 0

Prerequisite: MATH 11003 College Algebra or higher MATH or required placement

score Effective Catalog: 2018~2019

I. Course Information

A. Catalog Description

Designed for prospective middle level teachers. Students study pedagogical methods used by current practitioners. Content includes computation designed to bridge from whole numbers to the real number system as well as functions, probability, and statistics.

B. Additional Description - None

II. Student Learning Outcome

A. Subject Matter

Upon successful completion of this course, the student will be able to:

1. Draw significant connections between knowledge of numerical mathematical domains and age appropriate pedagogical methodologies that lead to significant mathematical knowledge for students in grades 4-8.
2. Have an understanding of pre-numeration concepts such as patterns, informal counting, and the meaning of number.
3. Understand four basic operations (e.g., addition, subtraction, multiplication, division) with whole numbers, rational numbers, fractions, decimals, percents, and integers and their properties (e.g., commutative, associative, distributive, order of operations), including solving problems using multiple strategies.
4. Understand basic number systems (e.g., natural numbers, whole numbers, integers, rational numbers) and basic concepts of number theory (e.g., factors, multiples, place value, prime/composite) as well as understand age appropriate methods for engaging students in learning about fractions and decimals.
5. Write and compute with place-holder numeration systems other than Hindu-Arabic. Understand ratio concepts and use proportional reasoning to solve

problems using multiple strategies and understand age appropriate methods for engaging students in learning about ratios and proportions.

6. Understand basic algebraic methods and representations (e.g., variables, expressions, ordered pairs, tables, graphs).
7. Solve real-life and mathematical problems using numerical and algebraic expressions and equations and understand age appropriate methods for engaging students in learning to solve equations and inequalities.
8. Understand fundamental counting techniques (e.g., permutations, combinations, tree diagrams).
9. Understand simple probability and intuitive concepts of chance (e.g., flipping a coin, spinning a spinner, rolling a number cube) and understand age appropriate methods for engaging students in learning simple probability.
10. Understand basic descriptive statistics (i.e., mean, median, mode, mean absolute deviation, and range) and appropriate displays of quantitative data (e.g., dot plots, stem plots, box plots, and histograms) and understand age appropriate methods for engaging students in learning statistics.
11. Use different representations of functions to solve problems using algebraic reasoning and understand age appropriate methods for engaging students in learning different representations of functions to solve problems using algebraic reasoning.
12. Use problem-solving techniques with these topic areas and develop mathematical classroom ecologies that lead to development of middle school student problem solving ability.

B. University Learning Outcomes

Structures of Arithmetic enhances student abilities in the following areas:

Analytical Skills

Critical Thinking Skills: Students will evaluate solutions by fellow students to compare strategies used in terms of correctness, ease of implementation, and flexibility. Students will solve problems using whole numbers, rational numbers, and data sets to analyze patterns. Students will apply strategies required of them as middle school mathematics teachers which are non-standard and standard/traditional. Students will analyze various representations of numbers and data sets to compare the usefulness of each representation.

Quantitative Reasoning: Students will assign and use numbers, read and analyze data, create models, draw inferences, and support conclusions based on sound mathematical reasoning. Students will solve problems with whole numbers, rational numbers, graphical representations, and data sets. Students will compute using base ten and other base systems to derive concepts regarding place value of whole numbers and decimals. Students will solve problems using a variety of techniques, with the understanding that mathematics is a coherent set of rules regarding numbers which follow patterns.

Communication Skills (written and oral)

Students will communicate proficiently by small group and individual presentations of problem-solving strategies as well as written reflections of various techniques for whole number calculations.

Ethical Decision Making

Students will model ethical decision-making processes while working with other students and during assessments. Students will practice the expectations concerning plagiarism by completing their own work.

Global & Cultural Perspectives

Students will reflect upon cultural differences and their implications for interacting with people from cultures other than their own. Students will be given various numeric systems and bases in which to calculate, leading to an appreciation for the base ten system and the changes in mathematics made to simplify calculations.

III. Major Course Topics

- A. K-8 Mathematics Pedagogy, with emphasis on grades 4-8
 - 1. Use of manipulative to establish conceptual understanding
 - 2. Standards of Mathematics
 - 3. Multiple strategies for computation
- B. Operations with Bases other than Base 10
 - 1. Expanded form using place value for various based
 - 2. Computations with bases other than 10
 - 3. Conversions to base 10 using place value
- C. Computations on Whole Numbers, Integers, Fractions, Decimals, Rational Numbers, and Percents
 - 1. Using manipulatives and drawing representations to show exchanges
 - 2. Establishing models for operations such as “take away” model for subtraction and “repeated addition” model for multiplication
 - 3. Multiple strategies used such as expanded form, partial quotients,, partial sums, partial products, number lines, manipulatives
- D. Divisibility with Prime and Composite Numbers
 - 1. Use divisibility for 2, 4, 5, 6, 9, and 10 to create prime factorizations
- E. Greatest Common Divisor and Least Common Multiple
 - 1. Listing divisors or multiples
 - 2. Using prime factorizations
- F. Ratio and Proportion
 - 1. Establish proportions as linear functions with a y-intercept of zero and a constant y to x ratio
 - 2. Solve applications such as unit rates and scale drawings
- G. Functions
 - 1. Definition of a function
 - 2. Use of variables
 - 3. Linear functions
 - 4. Constant rates of change

5. Writing equations of lines when given points or slopes
- H. Solving Equations
 1. Using models such as Hands-On-Equations or other manipulatives
 2. Solving application problems using equations
- I. Properties of Real Numbers
 1. Closure, associative, commutative, distributive, density, identity, inverse
- J. Permutations and Combinations
- K. Probabilities
 1. Theoretical vs. Experimental probabilities
 2. Simulations with and without technology
 3. Simple and compound probabilities
 4. Solving application problems using tools such as tree diagrams
 5. Combinations and permutations
- L. Descriptive Statistics
 1. Measures of center: mean, median, mode
 - a. Meanings of each and when to use each
 2. Measures of spread: range, interquartile range, mean absolute deviation, standard deviation
 3. Uses of each measurement in displaying data (median for box plots, mean for bell curves)
 4. Displays of numerical data
 - a. Box plots, line plots, histograms, stem-and-leaf plots
 - b. Normal curve