Course Syllabus
Southeast Missouri State University

Department of Mathematics **Course No. MA621**
Title of Course: Number and Operations **New: Fall 2013**

I. Catalog Description and Credit Hours of Course:
The course is designed to develop an understanding of the learning and teaching of pre-number concepts, counting and cardinality, and numbers and operations in base ten. Emphasis will be given to how children think about and learn these concepts and how they fit into the elementary school curriculum. (3)

II. Co-requisite: MA611 Internship in Numbers and Operations

III. Purposes or Objective of the Course:
This course will focus on the content and complexities of teaching and assessing number and operations in an elementary setting and will include topics from grades 6-8 to develop an understanding of how the mathematical ideas in the elementary grades build to those in the middle grades.

A. Candidates will develop an expertise related to number and operation that will support fellow teachers and enhance student learning.
B. Candidates will also examine the learning trajectories children exhibit as they develop concepts and skills in these areas.
C. Course content will include the teaching and learning of counting, cardinality and number and operations in base 10 including both whole numbers and decimal numbers.

IV. Student Learning Outcomes

A. Students will construct and justify models for counting and place value including identifying common student errors.
B. Students will construct and justify models for whole number addition, subtraction, multiplication, and division concepts and problem types including identifying common student errors.
C. Students will prove how place value and whole number operations extend to decimal numbers.

V. Expectations of Students:

A. Develop an understanding of the intricacy of learning to count and appropriate pedagogy.
B. Analyze counting errors made by young children and provide intervention suggestions.
C. Describe and provide examples of the different types of problems that are solved using addition, subtraction, multiplication and division.
D. Describe the learning paths for single-digit addition, subtraction, multiplication, and division and appropriate pedagogy.
E. Describe multiple strategies and models for helping children develop an understanding of the structure of the base-10 system.
F. Apply properties and place-value concepts to develop an understanding of base-ten computation methods.
G. Describe common student computational errors and provide suggestions for interventions.
H. Determine if student-invented algorithms are valid.
I. Describe how to use drawings and manipulatives to explain the rationale behind computational methods.
J. Extend the base-10 system to decimal numbers.
K. Use the Common Core State Standards for Mathematics and the Learning Progressions to guide the planning, implementation, and assessment of the teaching of number and operations.
L. Develop in themselves the mathematical practices described in the Standards for Mathematical Practice from the Common Core State Standards for Mathematics in the context of numbers and operations.

VI. Course Content or Outline (Indicate number of class hours per unit or section):

A. Overview of Counting and Cardinality and Number and Operations in Base 10 domains of Common Core State Standards for Mathematics. (1/2 hour)

B. Common Core Learning Progressions for Counting and Cardinality and Number and Operations in Base Ten (1/2 hour)

C. The Teaching and Learning of Counting and Cardinality (8 hours)
   1. Learning path for counting
   2. Classification
   3. Non-quantified comparison
   4. Subitizing
   5. Cardinality
   6. Examining student thinking and work
   7. Developing pedagogical content knowledge
   8. Common student errors in counting

D. The Teaching and Learning of Numbers in base 10. (6 hours)
   1. Structure of base-10 system.
   2. Number bonds, 5- and 10-frames, place value cards
   3. Composing and decomposing numbers
   4. Examining student thinking and work regarding place value
   5. Developing pedagogical content knowledge
   6. Common student errors with place value

E. The Teaching and Learning of Operations (30 hours)
   1. Fluency
   2. Single-digit addition and subtraction methods
      a. Direct modeling by counting all or taking away
      b. Counting on
      c. Convert to an easier problem
   3. Addition and Subtraction situations
      a. Add To
      b. Take From
      c. Put Together/Take Apart
      d. Compare
   4. Examining student thinking and work regarding addition and subtraction
   5. Multi-digit Addition and Subtraction
      a. Using base 10 pieces to develop standard algorithm.
      b. Use of open number line to model word problems
      c. Place value/Non-standard algorithms
      d. Mental math
      e. Common student errors with addition and subtraction
   6. Single-digit multiplication and division methods
      a. Making and counting all quantities
      b. Repeated counting on
      c. Use of associative or distributive property to compose and decompose
   7. Multiplication and division situations
      a. Equal groups or objects
      b. Arrays of objects
      c. Compare
   8. Examine student thinking and work regarding multiplication and division
   9. Multi-digit multiplication and division
      a. Using base 10 pieces to develop standard algorithm.
      b. Use of open number line to model word problems
      c. Place value/Non-standard algorithms

d. Interpretation of remainder
e. Mental math
f. Common student errors with multiplication and division

10. Use primes, factors, prime factorization and relatively prime numbers to solve problems.
    a. Factors and multiples
    b. Primes and Composites
    c. Problem solving involving GCF and LCM
    d. Analysis of student work and development of appropriate remediation and enrichment
11. Extension of understanding of base ten to decimals
    a. Connection between decimal representation and fractions with denominators of powers or 10
    b. Reading and writing decimal numbers
    c. Use understanding of base 10 place values to make sense of addition and subtraction of decimal numbers
12. Examine students thinking and work with decimal place values and addition and subtraction of decimal numbers.

Total Hours 45

VII. Textbook(s) and/or Other Required Materials or Equipment:

A. Common Core Progressions Documents
B. *Adding it Up* Jeremy Kilpatrick, Jane Swafford, Bradford Findell, *Editors*; Mathematics Learning Study Committee; National Research Council
C. Dougherty, B., Flores, A., Louis, E., Sophian, C., & Zbiek, R. M. (2010). *Developing Essential Understanding of Number and Numeration for Teaching Mathematics Pre-K-Grade 2.* Reston, VA: NCTM
D. Karp, K., Caldwell, J., Bay-Williams, J., & Zbiek, M. (2011). *Developing Essential Understanding of Addition and Subtraction for Teaching Mathematics Pre-K-Grade 2.* Reston, VA: NCTM.
E. Otto, A., Caldwell, J., Hancock, S. W., & Zbiek, R. M. (2011). *Developing Essential Understanding of Multiplication and Division Teaching Mathematics Grade 3- Grade 5.*
F. Suggested teacher resources:
    a. *Developing Mathematical Ideas* Dale Seymour Publications
    b. Hundred Board Activities- see book *100 Activities for the Hundred Number Board* by Sandra Pryor Clarkson Ideal School Supply Company 0-89099-519-2
    c. *Mental Math in Primary Grades* by Hope, Leutzinger, Reys and Reys

VIII. Basis for Student Evaluation:

Homework Assignments **20%**

Students will be asked to complete a variety of assignments related to the teaching and learning of number and operations in the elementary grades.

Midterm Exam **30%**

Final Exam **30%**

Journal article reviews and reflections **10%**

Students are to read three articles on number and operations from *Teaching Children Mathematics.* For each, write a 3-4 page reflection that:

- Provides bibliographic information.
- Provides a brief summary of the article.
- Describes the strengths of the article.
- Describes any weaknesses or questions raised by the article.
- Describes how the students would use information from the article in his/her classroom.
- Describes how the student would share the information from the article with others in his/her school.

Discussion board posts and replies **10%**

Questions will be posted on the Discussion Board. Students are expected to post a response to each and reply to two students for each original post.

IX. Grading Scale

90% - 100% = A
80% - 89% = B
70% - 79% = C
0% - 69% = F

The weight of the evaluation criteria may vary according to each instructor and will be communicated at the beginning of the course.

X. Academic Policy Statement:

Students will be expected to abide by the University Policy for Academic Honesty regarding plagiarism and academic honesty. Refer to:
http://www6.semo.edu/judaffairs/code.html

XI. Student with Disabilities Statement:

If a student has a special need addressed by the Americans with Disabilities Act (ADA) and requires materials in an alternative format, please notify the instructor at the beginning of the course. Reasonable efforts will be made to accommodate special needs.