

METHODS AND MATERIALS OF MATHEMATICS
FOR ELEMENTARY TEACHERS
EDUC 371

11-12:40 M-F
TRC 119
5 Credit Hours

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PREREQUISITE:

Entrance to the Teacher Education Program.

COURSE DESCRIPTION:

An introduction to the objectives, skills, and strategies of instruction, teaching aids, manipulatives, assessment devices (including alternative), curriculum and resource materials used in the elementary school mathematics program and the application of the findings with emphasis on methods (i.e. inquiry, guided inquiry, problem solving, etc.) and materials; use of the NCTM Standards and the Model Competency-Based Mathematics Program (Ohio Dept. Ed.).

TEXT:

Troutman, A. And Lichtenberg, B. Mathematics: A Good Beginning (5th Ed.). Pacific Grove: Brooks/Cole, 1995.

Model Competency-Based Mathematics Program - Ohio Dept. of Ed.

ELEMENTARY EDUCATION CERTIFICATION:

Methods and Materials of Mathematics for Elementary Teachers is a required course for all students seeking certification in Elementary Education.

Goals:

1. To exemplify Christ by attitude, word, and deed.
2. To explore a number of Big Ideas in mathematics using various methods such as inquiry/discovery, inductive/deductive, problem solving, direct instruction, cooperative learning, etc.

3. To consider ways of implementing and promoting the NCTM Standards, the Ohio Math Model and equity in elementary school mathematics.
4. To successfully implement the NCTM Standards, the Ohio Math Model, and equity in the elementary school setting.

Themes :

1. Working in groups - brainstorming, cooperative learning, diagnosing and prescribing, etc.
2. Problem solving - inquiry, posing problems, simplifying, multiple approaches, multiple solutions.
3. Reasoning - conjecturing, testing, counterexamples, etc.
4. Communication - logs, lab reports, peer coaching, discussion.
5. Connections - real-world to mathematics (modeling) - topic to topic within mathematics, mathematics to other disciplines - applications.
6. Research - How research is useful in our teaching.

REQUIREMENTS/ACTIVITIES:

All assignments should be prepared on a computer.

Tests:

Tests will include assigned text reading, presentations, class discussions, and other material.

Scripture memorization: Choose one passage

Romans 12:1-3 Phil. 3:12-14 Psa. 51: 10-13 Phil. 2:3-8

Integrating Math and Children's Literature

Select a trade book for your grade of interest. Look for a mathematical slant. **1)** List the bibliographical information of the book. **2)** Summarize the story in one short paragraph. **3)** List five creative mathematical questions and **4)** five hands-on activities which can be used when sharing the book with a class. The creative mathematical questions should be open-ended. Example: Millions of Cats - "The story says the hill was quite covered with cats. (Show picture) How many cats do you think were on the hill? How did you decide which number to use?" (Standards 3 and 5) Creative questions do not necessarily have one right answer. **5)** Identify the particular NCTM Standard or the OMM Strand addressed by the specific concept of the questions/activities.

Activity - Students may create their own family of cats. Encourage them to be creative and take their time. During the week, students may use the cats as manipulatives for practice in counting, addition, classifying, etc. (Standard 6) **6)** Write one original limerick or poem. (Standard 4) Be sure the activities, etc., are given a mathematical slant. This assignment should be sent to Dr. Baker on the T drive. (More information will be given in class) - Evaluation: Standard identification, creativity, bibliography, activities/questions, summary. Deductions for incorrect spelling, incorrect grammatical structure, etc.

Exploration:

Examine the teacher's edition of a basal textbook at a middle school grade level (**gr. 6-8**). Select a lesson on geometry or measurement. Remember, the authors of the pupil's books are restricted to the printed page by the very nature of books. Teachers are not so restricted. Use the inductive/example/non-example/concept attainment strategy. Your lesson should be problem-solving based and include visuals/hands-on activities. With the lesson plan, include a copy of the textbook pages you select, name of text publisher, grade level, and copyright date. Evaluation: Mesh of strategy and concept, materials, completeness, quality of thought - Follow lesson plan outline given in class.

Textbook evaluation: Directions will be given in class. For your comments at the end of the evaluation, compare the text examined with the approach suggested by your text and class activities.

Family math: Each person will be responsible for presenting a 10 min. activity for parents and students at Greeneview North Elementary. You need a 20-30 sec promo to sell your activity. You may include posters, signs, etc. which would add interest and "sell" your particular activity. The activities will be presented in class. A demonstration will be given by Mr. Hayes. If you are unable to attend the session, you should video yourself presenting your activity to a child and parents.

Problem Solving Group Presentation: Your group will be responsible for reading an article from an Arithmetic Teacher (will be provided) and presenting the information in an interesting manner (power point?). You should provide an outline and possible test questions for each student in the class. The presentation should be 10-12 min. long (deductions taken is longer). Write a reflection of your work with the group.

Modeling with Manipulatives - More will follow in class.

Cooperative Learning Groups : Assignments given in class to be completed by a group (lab time) - If any sessions are missed, no make-up will be allowed.

Peer teaching	Diagnosing error patterns
Problem-solving activities	Prescribing remediation
Lesson planning	Inquiry lessons
Discussion groups	

Materials need for class

Scissors, crayons or markers, tape, ruler

Instructional Strategies:

Lecture	Discussion	Role playing
Inductive teaching	Guided discovery	Games/activities
Laboratory instruction		Cooperative learning
Computer/calculator use		Inquiry

CLASS ATTENDANCE:

Attendance is required. Unexcused absences will result in the loss of one point per class hour from hour final average. Two tardies will represent 1 unexcused absence.

EVALUATION:

Final grade will be determined by:

Quizzes, activities, tests, field experience*

*If your performance in field experience is outstanding, your final grade can be raised by 5 percentage points. If the teaching experience is marginal or worse, the final grade for the course will be lowered by 10 percentage points. Being late, absent, not meeting requirements can also lower your final grade by 5 percentage points.

If you have not earned a C or above in content (tests/quizzes), you will not be allowed to participate in the field experience.

Grading scale:	100-97	A	96-94	A-
	93-91	B+	90-88	B 87, 86 B-
	85-83	C+	82-78	C 77, 76 C-
	75-70	D		
	69-0	F		

Late assignments will be penalized one letter grade per class.

STUDENT ACTIVITIES:

Problem solving	Role playing	Critiquing
Preparing and teaching	Diagnosing and prescribing	Using computers, teaching aids, models
Textbook evaluations	Software evaluations	Lesson planning
Demonstrating		

QUESTIONS/SUGGESTIONS TO GUIDE YOUR READING

Chapter One

1. Discuss the differences between an instructional model that focuses on teaching mathematics and one that focuses on learning mathematics.
2. What is meant by the statement "Children should construct their own mathematical knowledge?"
3. Describe the teacher's role in a teaching/learning environment where children construct their own knowledge.
4. Describe three levels at which knowledge can be represented and provide examples of each.
5. What is the essential difference between a concept development activity and a reinforcement activity?
6. How should advancing technology affect the emphases on mathematics learning objectives in the curriculum?
7. What is meant by didactic teaching? What are the limitations of this style of teaching?
8. Describe each of the four types of activities presented in this chapter.

- Give examples of each.
9. Why should children manipulate and make observations using concrete objects?

Chapter Two

1. Explain what is meant by conservation of the as-many-as relation. Give examples.
2. List the classification tasks discussed in this book and give example activities for each. Identify materials you might use and questions you might ask.
3. Identify a collection of objects. Name three general attributes that could be used to classify the objects. Identify some specific attributes for each of the general attributes you choose.
4. Describe at least four difficulties children may encounter when learning the number concepts for 0-10.
5. Describe the prenumber tasks children should be able to perform before being introduced to numerals for numbers.
6. Explain what is meant by this statement: A child could correctly decide that one set of objects has more than another set of objects for the wrong reasons.

Chapter Three

1. Describe an activity using play money that teaches place value concepts. Specify the appropriate grade level for your objectives and possible questions you might ask.
2. What is a numeration system and what is its purpose?
3. List five significant features of our base ten numeration system.
4. The NCTM recommends that students develop sound number sense abilities. What concepts in this chapter would you stress to make sure students do so?
5. What is the difference between the two learning objectives—identifies the place value of digits in a base-ten numeral and interprets a numeral in various ways using nonstandard names? Give your answer using the number 3584.

Chapters Four and Five

1. Why is it important for children to be able to rename 7 as $6 + 1$, $5 + 2$, $4 + 3$? Give examples to verify your claims.
2. How does the fact that addition is a commutative operation help a child find $2 + 9$?
3. Carefully describe an activity for teaching the family of facts for 6. (This should include all appropriate addition facts.) Indicate what materials you would use and include questions you would ask.
4. Give the different interpretations for addition and subtraction. Write a simple story (work) problem that demonstrates the meaning of each.
5. Explain how a knowledge of the identity element for addition, counting, and commutative property for addition can reduce the amount of memorization required. Sketch the table and indicate where these three ideas help.

Chapters Six and Seven

1. Name the different interpretations for multiplication and division. Write a word problem and a number sentence for each one. Explain how the numbers in the number sentence relates to the numbers in the word problem.

2. Explain how knowledge of the multiplication properties of 0 and 1 and the commutative property of multiplication helps reduce the amount of memorization required to learn the basic facts of multiplication. Sketch a multiplication and relate your discussion to it.
3. Explain and sketch how you can use exactly twelve objects to demonstrate the four basic facts of multiplication and the four related division sentences.
4. Discuss why division by zero is meaningless.

Chapters Nine and Ten

1. Give logical explanations for each of the following without using algorithms, rules, or rote procedures.
 - A. Which is smaller: $\frac{3}{4}$ or $\frac{3}{8}$? Explain your reasoning
 - B. Which is larger: $\frac{7}{7}$ or $\frac{9}{10}$? Explain your reasoning.
 - C. Name a number represented by a fraction or a decimal that you know is close to $\frac{47}{98}$.
 - D. Which is larger: $\frac{4}{9}$ or $\frac{21}{20}$? Explain your reasoning.
 - E. Why is $\frac{5}{8}$ equal to $\frac{15}{24}$?
 - F. What are some things that a numerator of a fraction tells us?
 - G. What are some things that a denominator of a fraction tells us?
 - H. Why do we find common denominators when we add or subtract fractions?
 - I. What is meant by simplifying a fraction?
2. Show how you could use paper folding to convince children $\frac{2}{3} = \frac{4}{6}$.
3. Show how you could use coins to illustrate the computation for $0.42 - 0.27$.
4. How could you illustrate to children that $0.27 \cdot 0.09$?
5. Explain why $\frac{2}{3}$ divided by $\frac{5}{7} = \frac{2}{3} \times \frac{7}{5}$.
6. Use rectangular regions approach to demonstrate $\frac{2}{3} \times \frac{4}{5}$.

Chapter Eleven

1. Describe and sketch a model for problem solving.
2. What problem-solving commitments should a teacher make to ensure that problem-solving activities are nurtured in their classrooms?
3. Give some examples of exercises or assignments that are often called problems but are not really problems.
4. Define cognition and metacognition and explain how they differ.

Chapter Sixteen

1. Explain the following:
 1. Measurement involves the use of an appropriate standard unit.
 2. Measurement is approximate.
 3. Some measures are direct, but some are indirect.
2. Why is the cubic decimeter an important unit of measurement in the metric system?
3. Explain the Celsius scale for measuring temperature by relating it to the Fahrenheit scale.
4. How does the term "conservation" apply to the measurement of length?
5. Estimation should be a deliberate part of activities involving measurement. What is this true?
6. Why might a traditional circular clock be more useful for teaching time than a digital clock?
7. What is area?

Chapter Nineteen

1. Discuss what is meant by assessment of performance. Indicate conditions that ensure valid outcomes.
2. Describe at least four possible limitations of pencil and paper testing.
3. Explain how assessment activities affect what students perceive as important to learn.
4. Describe at least three strategies for assessing performance other than pencil and paper testing.
5. What is the difference between assessing mathematical knowledge and diagnosing mathematical difficulties?
6. Suppose a teacher determines the types of errors a student made on an addition test. Does that mean the teacher has diagnosed? Why or why not?
7. Describe cultural expectations and influence from parents that might lead to different opportunities in mathematics for boys and girls.
8. List some strategies for conquering gender bias in mathematics.