

MAT 694
TOPICS IN MATHEMATICS FOR TEACHERS
DEVELOPING A “PROFOUND UNDERSTANDING”
OF MIDDLE GRADES MATHEMATICS
(3 credits Summer, 2003; 1 credit Fall 2003; 2 credits Spring 2004)

Note: This course is open only to students who have completed Math 140 – 141: Math for Elementary and Middle Grades Teachers or the equivalent. Permission of the instructor is required to register.

Instructor: Dr. Linda Sheffield

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Office Hours		
Blackboard.com site: http://learnonline.nku.edu	Class website: http://www.nku.edu/~sheffield	

Texts: Ma, Liping.. *Knowing and Teaching Elementary Mathematics*. Mahwah, NJ: Lawrence Erlbaum, 1999.

Becker, Jerry and Shigeru Shimada. *The Open-Ended Approach: A New Proposal for Teaching Mathematics*. Reston, VA: National Council of Teachers of Mathematics, 1997.

National Council of Teachers of Mathematics. *Principles and Standards for School Mathematics*. Reston, VA, 2000.

Sutton, John and Alice Krueger. *EDThoughts: What We Know about Mathematics Teaching and Learning*. Aurora, CO: Mid-continent Research for Education and Learning, 2002.

Selected texts chosen from middle grades reform curriculum including *Connected Mathematics*, *MathScape*, *Math in Context*, and *Math Thematics*.

Note that you will need Internet access to check NKU email, access the class website, and participate in coursework on Blackboard.com. You must also read the Math General Syllabus at <http://www.nku.edu/~math/GeneralSyllabus.html>

Course Description: The main emphasis of this course will be on developing a profound understanding of the fundamental concepts of the middle grades mathematics topics on the Kentucky Program of Studies and Core Content and the National Council of Teachers of Mathematics *Principles and Standards*. Knowledge of this is essential for the intelligent teaching of mathematics at any level. Topics for the course include developing a deeper understanding of geometry, measurement, probability, statistics, proportional reasoning, rational numbers and algebra. Students are expected to attain an understanding of the conceptual foundations of these topics and a practical concrete knowledge enabling them to pose and solve problems in these areas and to explain the topics to others. The course will be taught in a manner consistent with the National Council of Teachers of Mathematics *Principles and Standards for School Mathematics*, and students will be expected to take an active part in constructing their own knowledge of mathematics through active investigations of interesting problems. In addition to the Kentucky Core Content Mathematics strands and the NCTM Standards of Algebra, Number and Computation, Probability and Statistics, Geometry and Measurement, students are expected to use the standards of Problem Solving, Reasoning and Proof, Communication, Connections, and Representation. Students are expected to work individually and in peer groups during class as well as when doing homework, studying for exams and working on projects. Appropriate tools for the course include graphing

calculators, computer programs such as *Geometer's Sketchpad*, physical models such as geometric solids, algebra blocks, dice, spinners, and most importantly, an inquiring mind.

Written, oral, and visual modes of communication are essential to understanding and doing mathematics. Students will need to be actively engaged in making observations, seeking patterns, and making and testing conjectures. These should be discussed and analyzed with others in peer groups as you work on homework and projects.

During the course, students will work both individually and cooperatively on problem solving activities. When appropriate, calculators and physical models will be an essential part of these investigations. Problems should be approached with a desire to discover all that you can about any given problem. The solution to the initial problem should be looked upon as the beginning of this investigation. This solution should lead to some interesting extensions with such questions as: Why? What if I changed this...? Is that always true? Is that ever true? Is there another way to solve this? How can I convince someone that this is correct?

As you solve problems, you should always be on the lookout for connections. You should try to connect the solutions from one problem to those you have solved earlier as well as connect the mathematics you are learning to everyday problems and to other subject areas. You should use your mathematical reasoning and inquiry skills to connect the abstract concepts to real world examples, physical models, and pictures and diagrams.

Keep in mind that this is a mathematics class and not a methods class. We will often use manipulatives during class to give you a strong foundation for the mathematics that underlies the middle grades curriculum. The Chinese refer to this as developing a "profound understanding". It is important for you to master this profound understanding yourself so that you will later be able to share this with other teachers and your own students.

Objectives: At the completion of the course the students should be able to:

1. Correctly explain and give examples of basic concepts related to each of the topics listed above.
2. Pose and solve problems in a variety of ways requiring the use of the basic concepts connected with each of the given topics.
3. Construct physical and visual models and make connections within mathematics and to other subject areas for each of the basic concepts.
4. Share expertise with other teachers as well as middle grades students.

Student Requirements

Summer, 2003

1. Do assigned readings and problems from the texts and other sources both individually and in peer groups.
2. Participate fully in class and on Blackboard.com. Attendance will be taken and the Blackboard discussion board will be monitored.
3. Successfully complete exam.
4. Plan and lead a lesson for middle grades students based on a rich learning task using an open approach. Conduct a Lesson Study Group session for lead teachers. This lesson will be posted on the class website for other teachers in the program. You may wish to use these in your own Education portfolio.
5. Write one strand of an end-of-year exam for 5th, 6th, 7th, and 8th grade, based on state and national standards.
6. Develop one strand of a competency checklist for 6th, 7th, and 8th grade based on state and national standards.

Fall 2003

1. Record use of Curriculum and Assessment Guide daily, make additions and corrections.
2. Lead professional development for all teachers in cluster (include fifth and ninth grade teachers in one meeting after 11/1).
3. Observe and meet with each math teacher in cluster at least once using Stonewater observation form.
4. Create/adapt rich learning task, write up three complete solutions, investigate task with students, use teaching and questioning techniques and scoring guide for in-depth, open-ended problems.
5. Create one new open response math question using KY guidelines, include scoring guide and sample student work.
6. Post and respond to discussions on Blackboard.
7. Complete additional activities such as the following:
 - Speak/attend KCTM
 - Attend Alliance mtgs
 - Conduct Family Math night
 - Lead math club and/or competitions
 - Other
8. Take Final Exam (credit only)

Spring 2004

1. Record use of Curriculum and Assessment Guide daily, make additions and corrections.
2. Lead professional development for all teachers in cluster (conduct final meeting jointly with science).
3. Observe and meet with each math teacher in cluster at least once using Stonewater observation form.
4. Develop own plan for spring project. (proposal, project, reflection)
5. Create new open response math questions using KY guidelines, include scoring guide and sample student work.
6. Post and respond to discussions on Blackboard.
7. Complete additional activities such as the following:
 - Speak/attend KTLC
 - Attend Alliance mtgs
 - Conduct Family Math night
 - Lead math club and/or competitions
 - Other
8. Take Final Exam (credit only)

Grades Recorded – Summer 2003

Reflections on Readings	10 reflections x 5 pts.	50
Individual Journal Problems	5 problems x 15 pts.	75
Lesson / Study Group plans		100
End-of-year Exam Development		50
Competency Checklist Development		50
Class Participation		25
Exam		50
Total		400

Fall 2003

Task	Points
Record of use of Curriculum and Assessment Guide with additions and corrections	20
Professional development for all teachers in cluster (3 sessions x 25 pts)	75
Observations, meetings, and reflections with each math teacher in cluster using Stonewater observation form	30
Original rich learning task, three complete solutions, student work, scoring and reflection	50
Original open response math question using KY guidelines, including scoring guide and sample student work	30
Discussions on Blackboard	10
Additional optional activities	10
Final Exam (credit only)	25
Total	250

Spring 2004

Task	Points
Record of use of Curriculum and Assessment Guide with additions and corrections	20
Professional development for all teachers in cluster (3 sessions x 25 pts)	75
Observations, meetings, and reflections with each math teacher in cluster using Stonewater observation form	30
Chosen Spring Project (Plan – 10 pts., Project – 30 pts., Reflection – 10 pts.)	50
Original open response math questions using KY guidelines, including scoring guides and sample student work	30
Discussions on Blackboard	10
Additional optional activities	10
Final Exam (credit only)	25
Total	250

Grading Scale

90% - 100%	A
80% - 89%	B
70% - 79%	C
60% - 69%	D
0 - 59%	F

Please note that you are expected to follow the University Honor Code and the College of Education Code of Ethics.

**Planting Seeds, Cultivating Clusters:
Strengthening Middle Grades Mathematics and Science**

IEQ Grant Requirements
Mathematics
Spring, 2004

Task	Due 1/10	Due 2/7	Due 3/13	Comments
1. Record use of Curriculum and Assessment Guide daily, make additions and corrections	X	X	X	
2. Lead professional development for all teachers in cluster	X	X	X	Final PD materials including forms for stipends and all orders for materials for the clusters should be turned in by April 1
3. Observe and meet with each math teacher in cluster at least once using Stonewater observation form			X	
4. Develop proposal for spring project (1 – 2 page description)	X			
5. Develop plan & design materials (e.g. units, problems, websites, webquests, rich learning tasks) for spring project		X		
6. Analyze student work, reflect on spring project			X	
7. Post and respond to discussions on Blackboard	Throughout semester			
8. Recommended activities <ul style="list-style-type: none"> • Speak/attend KTLC • Attend Alliance mtgs • Conduct Family Math night • Lead math club and/or competitions • Other 	X	X	X	
9. Final Exam (credit only)			X	

Other Items of Note:

- Topics for first spring PD – Include Focus on Algebra
- Topics for second spring PD – Include Focus on Data Analysis and Use of Technology
- Topics for third spring PD – Schedule jointly with science – Include Focus on Integrating Math and Science, possibly using Astronomy, Space Exploration, NASA and Mars
- Put these dates on your calendar:
 - Thursday, February 26 – Star gazing at Thomas More Observatory; 6 – 8 pm
 - Saturday, March 20 – Science Fair - NKU
 - March 4 – 6 – KTLC – Louisville

1. Use the Notes/Comments section of the Curriculum and Assessment Guide for your grade at least weekly to comment on topics taught on the Guide. Add resources (print and electronic) and assessment items as you use them. Email corrections and additions to me regularly (no later than one week before each Saturday meeting.) Use “Track Changes – Highlight Changes – Track changes while editing” section of MS Word (under tools).
2. For each professional development session, ask the principals of each partner school in your cluster to assist you in finding a time when all math teachers and the principals themselves can attend. For all meetings, each math teacher in grades 6, 7, and 8 in each cluster school is expected to attend. Encourage each principal in your cluster to attend also. The final PD should be a joint session planned with the science cluster leader for all math and science teachers in the cluster.
3. For each professional development session, use the IEQ Professional Development Planning form and ask each teacher and administrator in attendance to complete the PD evaluation form. Bring Planning form and evaluation forms to the Saturday meeting following the PD.
4. Observe each teacher in the cluster at least once during the spring and discuss results with the teacher using the Stonewater Standards Observation form. Determine any support needed to strengthen the mathematics program. Bring all observation forms to March 6 meeting. Write a brief (about 2 pages) report about the progress of the mathematics teaching in your cluster and include this with the observation forms. (You might also remind the principals to get these turned in.)
5. Design a project that will benefit your cluster. This might be creating additional resources such as the open response items and rich learning tasks that you did in the fall or it might be a new topic that is needed in your cluster. Other ideas include the development of a webquest matched to your core content, design of a website with descriptive links to useful materials (or adding descriptions and sites to the current math education site), development of a unit, taking an online course in teaching middle grades mathematics from Annenberg or another source, or another project of your choosing. On January 10, you should give me a 1 – 2 page description of the project. On February 7, 2003, you should have all materials ready to carry out the project with the students. By March, you should conduct the project with your students, analyze their work on the project, and write up a reflection on the project, including anything you might change in the future.
6. Respond to all discussions on Blackboard and post topics of your own to discuss. Let the group know by email when a topic is posted.
7. Choose other areas of professional growth or leadership in mathematics education and turn in a brief summary of these at each Saturday meeting (1 – 2 pages). Share information on opportunities and resources with others on Blackboard.
8. Credit people will also have an exam at the end of the semester.

