

**What's for Dessert?
An Enrichment Course for
Prospective Middle School
Mathematics Teachers**

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Oakland University

Suburban Detroit

One of 15 state universities

About 18,000 students, some parttime

Somewhat selective admissions

Mostly commuter students

Comprehensive (through PhD)

300 Elementary Education majors/yr

(+ a few 6–12 Secondary Ed majors)

Few get K–8 math certification

Content courses taught in Math Dept

Methods courses taught in Ed School

Math Requirements for ALL
(all courses are 4 sem. hrs.)

Proficiency through Interim Algebra

STA 225: *Introduction to Statistical Concepts and Reasoning*

(General Education course, includes probability, uses text by Moore)

MTE 210: *Numerical Structures* (first six chapters of Billstein)

EED 302: *Teaching Mathematics at the Elementary–Middle Levels*

Math Requirements for MINORS,
which gives K–8 certification
(all courses are 4 sem. hrs.)

MTH 141: *Precalculus* (college
algebra and trigonometry)

MTE 211: *Structures of Geometry*
(last four chapters of Billstein)

MTE 410: *Elementary School
Mathematics and the Computer*
(programming in BASIC or LOGO)

Math Requirements for MAJORS

10 more math content credits.

Recommended:

MTH 122: *Calculus for the Social Sciences* (baby calculus, mainly for business majors, no trig, 4 credits)

MTH 118: *Mathematical Sciences in the Modern World* (General Education course, using textbook such as *Excursions in Modern Mathematics* by Tannenbaum, 4 credits)

MTE 405: *Special Topics* (2 credits)
Meets once a week for 2 hours,
content up to the instructor, intended
as “capstone”

Do these satisfy the CBMS recommendations?

Prospective middle grades teachers of mathematics should be required to take at least 21 semester-hours of mathematics, that includes at least 12 semester-hours on fundamental ideas of school mathematics appropriate for middle grades teachers.

All courses designed for prospective teachers should develop careful reasoning and mathematical “common sense” in analyzing conceptual relationships and in solving problems.

Along with building mathematical knowledge, mathematics courses for prospective teachers should develop the habits of mind of a mathematical thinker and demonstrate flexible, interactive styles of teaching.

MTE 405 Content

1999–2004

Burger and Starbird topics (infinity, art gallery thm, error-correcting codes, ...): not used as textbook

Problem solving (*Car Talk* puzzles)

Mathematics Pentathlon

Maple

Geometer's Sketchpad

Probability (Buffon needle, birthday, Monte Hall, hatcheck, Bayes' theorem, Simpson's paradox)

Fair division

Strategic games (nim, chomp)

Computing square roots

Web surf, book reports

MTE 405 Content

2005

Navigating through
{Algebra Measurement Probability}
in Grades 6–8 (NCTM)

Functions

Change

Linear relationships

Symbols of algebra

Accuracy and precision

Estimation

Perimeter–area–volume

Proportionality

Derived units

Probability distributions

Law of large numbers

Prediction

...

MTE 405 Content

2006

“Middle School Contest Math”

MATHCOUNTS

hundreds of problems,
free materials
complete solutions

AMC 8

Written homework (individual and joint), student presentations at blackboard, discussions, instructor mini-lectures and sermons, three short midterms (new problems), final exam (old problems)

Special Feature

Guest lecture by Chairman of the Board of MATHCOUNTS (Oakland University Adjunct Professor Gary McDonald), including discussion of the program, encouragement to have their schools participate, video of MATHCOUNTS finals (broadcast on ESPN), and discussion of Glenn Commission report.

Student Comments

This class has been an interesting one throughout the duration of the semester. It was nothing that I expected and I really did not think that I would take so much away from a two-credit course. I have learned several different strategies in problem-solving. ... Methods that I have become particularly fond of include trying examples, considering simpler cases of the same or easier problem, going away and then coming back to the problem, making a table or chart, and drawing a picture.

Exploring problem solving in this class was a rough journey. I began the semester feeling frustrated and confused. I was overwhelmed at the difficulty of many of the problems, often asking “How was I supposed to think of that?” I was intimidated by the fact that middle school students were able to do the same problems that I struggled with, and yet in a few short months I would be eligible to teach those same students. As the semester went on, I improved on my ability to solve many of the problems ... and I gained confidence. ... Now at the end of the semester I can see the important impact this class has had on me as a math student and future math teacher.

I felt frustrated several times throughout the semester and wondered what was wrong with my brain that it didn't problem solve well. Then reflecting on the experience, I realized that in my school years as a student, no one had bothered to show me problem-solving methods and strategies. No one ever offered the option of drawing a picture or making a table or graph. In fact I never really learned from teachers how to take information from a problem and apply it to the solution. ... However, toward the end of the course, my confidence grew a little bit more. ... I hope that my confidence in problem-solving wears off on my students. ... The course was definitely an eye-opener to what I don't know.

I was able to learn a tremendous amount by watching students show their solutions on the board using several different methods. ... This will prove to have a huge effect on my teaching. Just because there may be one answer doesn't mean that all students will find it using the same way. ... I can remember in elementary school being marked down if you didn't find the answer exactly as how you were taught to. If creativity is encourage in other aspects of the classroom, it should definitely be encouraged in math as well.

It is our job as future teachers to know different approaches and strategies to solving problems so we are able to help all of our students learn. ... To be able to solve a problem proves that you know how to do it, but to be able to communicate what is happening in a problem or solution to others is the heart of what we call teaching mathematics.

I viewed [math] as something that was “black and white”. I thought of math as a subject that was very methodical and procedural. This class has allowed me to see ... that math is not limited to algorithms and direct answers, but it is a process that involves creativity, resourcefulness, and ingenious thinking.

Many of the problem-solving strategies that I learned about in MTE 405 I have been using for years. What the MATHCOUNTS program has done for me is to clarify when is the best time to use each type of strategy. One technique which I found very useful was simply going away or jumping out of the system so to speak. On numerous occasions I used this technique on problems that were frustrating me. Nearly every time I did this I found that when I came back to the problem I was able to look at it from a totally different perspective. This allowed me to get past the mental block which was initially keeping me from solving the problem.

One of the main skills that I will take away with me from this class is that guess and check is not the most efficient way to solve problems.

I have gone through this semester with a different attitude than I have had for the last three years. I am taking two college classes for sheer joy and not because I am required. I have been able to work these math contest problems from a challenge and enlightenment point of view. I would often rush home from school and start on some of them right away. I even attempted the unassigned problems. What elation I felt when I discovered the twist or just simply found the answer after a long struggle.

I learned a lot about myself and a lot about the others in the class. Every time someone presented a way of doing a problem that was different from the way I did it, I copied it down. ... I plan on using the notes I took in this class to help me be a quality teacher in the future. ... I have, also, learned a lot about MATHCOUNTS, and different school programs that promote math. This is so exciting for me because I love math and want my students to love it too. ... I am quite pleased that this course was offered. I want to be a middle school teacher and this math applies to me. It is obvious that I need to brush up on my skills, but I think I have learned exactly what skills I need to possess.

I have learned that middle school students are capable of solving problems much more complex than I originally expected. Knowing this, I will introduce my students to complex problem-solving and help them develop workable strategies. As the semester progressed, my knowledge and outlook on the subject has matured in a unique way. I have always considered myself a strong student in math; I learn the material quickly and I have a distinctive talent to manipulate numbers in my mind. I want to instill an appreciation for math in my students, to help them realize what a fascinating and useful subject it is. This course is a culmination to my [elementary education mathematics] minor; and, ironically, it has challenged everything I thought I knew about mathematics.

I have learned that mathematics, like all subjects, requires one to see beyond what is given. To find the solution to a problem, one does not always need to apply an equation or memorized formula. In this instance, the solution requires thought or strategy. To implement a provided equation or formula is straightforward -- simply plug in the correct components to find the answer. Mathematics is much broader than this. It is meant to be understood conceptually, not procedurally.

I found this class to be particularly challenging because I was required to recall upon every mathematical concept I had learned in my academic career. ...

There was such an abundance of material that I often found myself overwhelmed.

Generally a math class is designed to cover one concept; this class is designed to encompass all of the concepts and introduce them in a way that is feasible for middle school students to understand.

... MATHCOUNTS is an excellent program because it is designed to challenge students in a fun and meaningful way. Students learn strategies to solve mathematical problems, work as a team member, and take pride in their work.

Seeing MATHCOUNTS competitions in action, and working on some of the problems sixth through eighth grade students solve, have opened my eyes to some of the high achieving students I may be working with in my teaching career. A teacher should be able to challenge all levels of students in his or her classroom. I have learned that I need to continue to work on problems and stay current in some of my higher mathematical skills in order to better educate my high achieving students.

By learning more about these techniques and how to apply them to countless types of math problems, I have certainly improved my abilities as a math teacher. By understanding these problem-solving strategies and how to teach them, I will undoubtedly be a far more efficient educator of mathematics.

[Student comments used with permission.]

For more on MTE 405, see:

personalwebs.oakland.edu/~grossman/MTE405