The mission of the Center is to build partnerships among higher education, K-12 education, and the interested public to improve the teaching and learning of mathematics and science K-16.

- The Center promotes and supports a variety of efforts that include organizing conferences, supporting faculty planning and development of activities and proposals, distance learning, and professional development for K-12 math and science teachers.
CSMCE Activities

- Programs to enhance undergraduate science and mathematics at UNL
- Outreach Activities to encourage K-12 students
- Support individual investigator grants in science and mathematics education
- Large interdisciplinary grants
Undergraduate science and mathematics at UNL

• Arts and Sciences Testing Center
• EDU Help Desk
• Sigma Xi Lecture Series
• February Forum
Outreach Activities

• Women in Science

• All Girls/All Math

• Astronomy Camp
Support Individual Investigators

• Administer Teaching & Learning Seed Grant Program

• Support preparation and administration of grants
  – Math Matters (NSF)
  – Assessment and Student Achievement (NSF)
  – Astronomy Education (NSF)

• The Essential Exponential!
  – Albert Bartlett, U. Colorado
    • Robert Fuller, Vicki Plano-Clark, John Rogers
Nebraska Astronomy Applet Project
"The greatest shortcoming of the human race is our inability to understand the exponential function"
A major research and development effort designed to improve K-12 student achievement in mathematics and science.

Types:
- Comprehensive (FY02 and 03) 12 awards
- Targeted (FY02, 03, 04) 23 awards
- Institute (FY04) 6 awards
- Research, Evaluation and Technical Assistance (FY02, 03, 04) 20 awards
NSF/MSP seeks to improve K-12 student achievement by:

- Ensuring that all students have access to, are prepared for and are encouraged to participate and succeed in challenging and advanced mathematics and science courses;
- Enhancing the quality, quantity and diversity of the K-12 mathematics and science teacher workforce; and
- Developing evidence-based outcomes that contribute to our understanding of how students effectively learn mathematics and science.
NSF/MSP Distinctive Features:

- Engagement of science, engineering and mathematics faculty
- Partnerships
- Commitment to institutional change
- Emphasis on research and evidence
- A collaborative learning laboratory
NSF/MSP Institute Partnerships

- Develop school-based intellectual leaders and master teachers
- For experienced teachers who wish to deepen content knowledge and build leadership skills
- Institutes will be multi-year programs of coherent study within particular discipline
MSP – FY’02 and FY’03 Partnership Awards

Comprehensive partnerships – lead institutions
Targeted partnerships – lead institutions
Institute partnerships – lead institutions
Additional sites impacted by projects

FY’02
FY’03
Math in the Middle Institute Partnership

Principal Investigators
Jim Lewis
Ruth Heaton
Barb Jacobson
Tom McGowan

(Funding began August 1, 2004)
Math in the Middle Institute Partnership

Nebraska Educational Service Units

Yellow denotes year 1 ESU partners.
Blue denotes additional ESU partners joining in year 2.
Red signifies ESU partners joining in year 3.
Math in the Middle Institute Partnership

• Focus
  – math; middle grades; teacher ed; rural education

• Foundation
  – The Mathematical Education of Teachers
  – Math Matters – NSF grant to change Elem Math Educ at UNL
  – The LPS-UNL Professional Development Workshops
  – The Vermont Mathematics Initiative

• Partnerships
  – Math & College of Education
  – UNL & LPS
  – UNL and Nebraska’s ESUs
Math in the Middle Institute Partnership

• Vision
  - create and sustain a University, Educational Service Unit (ESU), Local School District partnership
  - educate and support teams of outstanding middle level (Grades 5 – 8) mathematics teachers who will become intellectual leaders in their schools, districts, and ESUs.
  - provide evidence-based contributions to research on learning, teaching, and teacher professional development.
  - special focus on rural teachers, schools, and districts.
Math in the Middle Institute Partnership

By investing in high-quality teachers, our long-term goal is to improve K-12 student achievement in mathematics and to significantly reduce achievement gaps in the mathematical performance of diverse student populations.
Math in the Middle major components

• The **M² Institute**, a multi-year institute that offers participants a coherent program of study to deepen their mathematical knowledge for teaching and to develop their leadership skills;

• **Mathematics learning teams**, led by M² teachers and supported by school administrators and university faculty, which develop collegiality, help teachers align their teaching with state standards, and assist teachers in examining their instructional and assessment practices; and

• A **research initiative** that will transform the M² Institute and the M² mathematics learning teams into laboratories for educational improvement and innovation.
Math in the Middle Institute Partnership

Question
What Mathematics Should Middle Level Teachers Know and How Should They “Come to Know” Mathematics?

The Mathematical Education of Teachers
Is guided by two general themes:
• the intellectual substance in school mathematics;
• the special nature of the mathematical knowledge needed for teaching.
Math in the Middle Institute Partnership

$M^2$ courses will focus on these objectives:

- enhancing mathematical knowledge;
- enabling teachers to transfer mathematics they have learned into their classrooms;
- leadership development; and
- action research.
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and the Masters Exam
- A 25-month, 36-hour graduate program.
Math in the Middle Summer Courses

• Combination of 1 week and 2 week classes.
• Teachers are in class from 8:00 a.m. - 5:00 p.m.
• 32 students – 5 instructors in class at one time.
• Substantial homework each night.
• Substantial End-of-Course problem set
  – Graded for purpose of helping teacher learn to work the problems.
  – Presentation of solutions/celebration of success at start of next class.
Math in the Middle
Academic Year Courses

• Two-day (8:00 – 5:00) on-campus class session.
• Course completed as an on-line, distance education course.
  – Major problem sets
  – Professional Writings
  – Learning and Teaching Projects
  – End-of-Course problem set
  – Substantial support available for teachers
Math in the Middle Institute Partnership

Research Questions

• What are the capacities of teachers to translate the mathematical knowledge and habits of mind acquired through the professional development opportunities of $M^2$ into measurable changes in teaching practices?

• To what extent do observable changes in mathematics teaching practice translate into measurable improvement in student performance?
“Habits of Mind” Problems

• **The Triangle Game**: Consider an equilateral triangle with points located at each vertex and at each midpoint of a side. The problem uses the set of numbers \{1, 2, 3, 4, 5, 6\}. Find a way to put one of the numbers on each point so that the sum of the numbers along any side is equal to the sum of the numbers along each of the two other sides. (Call this a Side Sum.)
  
  – Is it possible to have two different Side Sums?
  – What Side Sums are possible?
  – How can you generalize this game?
What do Math Teachers Need to Be?

Read “What do Math Teachers Need to Be?” by Herb Clemens, a mathematics professor at The Ohio State University. The article was published in 1991 in Teaching academic subjects to diverse learners (pp. 84-96). In this article, Clemens lists what he thinks teachers of mathematics need to be. Where does your own practice of teaching mathematics stand in relationship to what Clemens says mathematics teachers need to be: unafraid, reverent, humble, opportunistic, versatile, and in control of their math. On p. 92, Clemens lists four fundamental questions about mathematics teaching that matter to him. If he came to your classroom and watched you teach math, how would he answer his own last question about your practice: Can this teacher teach it [math] with conviction, and with some feeling for its essence? Explain.
Select a challenging problem or topic that you have studied in MSL. This is to be the basis for a mathematics lesson that you will videotape yourself teaching to your students.

How can you present this task to the students you teach? How can you set the stage for your students to understand the problem? How far can your students go in exploring this problem? Remember that you want your students to discover as much as possible on their own. But there may be some critical points where you need to guide your students over an intellectual “bump” so that they can move on to the next part of the problem.

Finally, produce a report analyzing the mathematics and your teaching experience.