THE CENTER FOR TEACHING & LEARNING
MATHEMATICS
University of Northern Iowa

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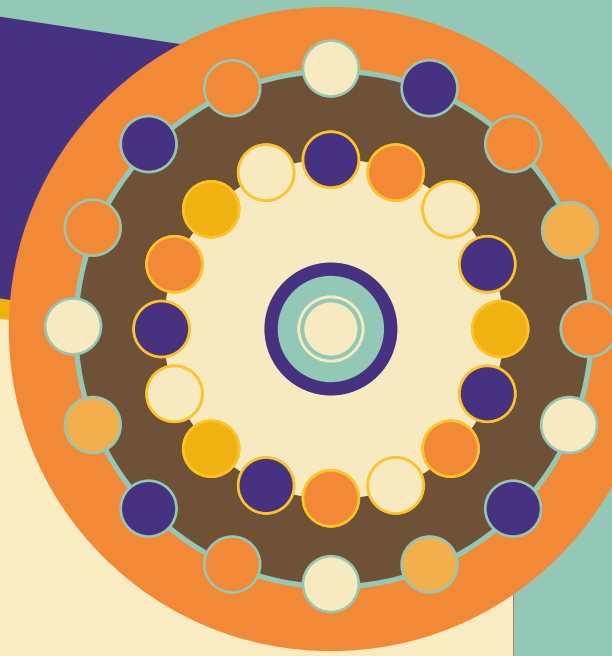

MAKING SENSE OF MATHEMATICS AND TEACHING

PROFESSIONAL DEVELOPMENT

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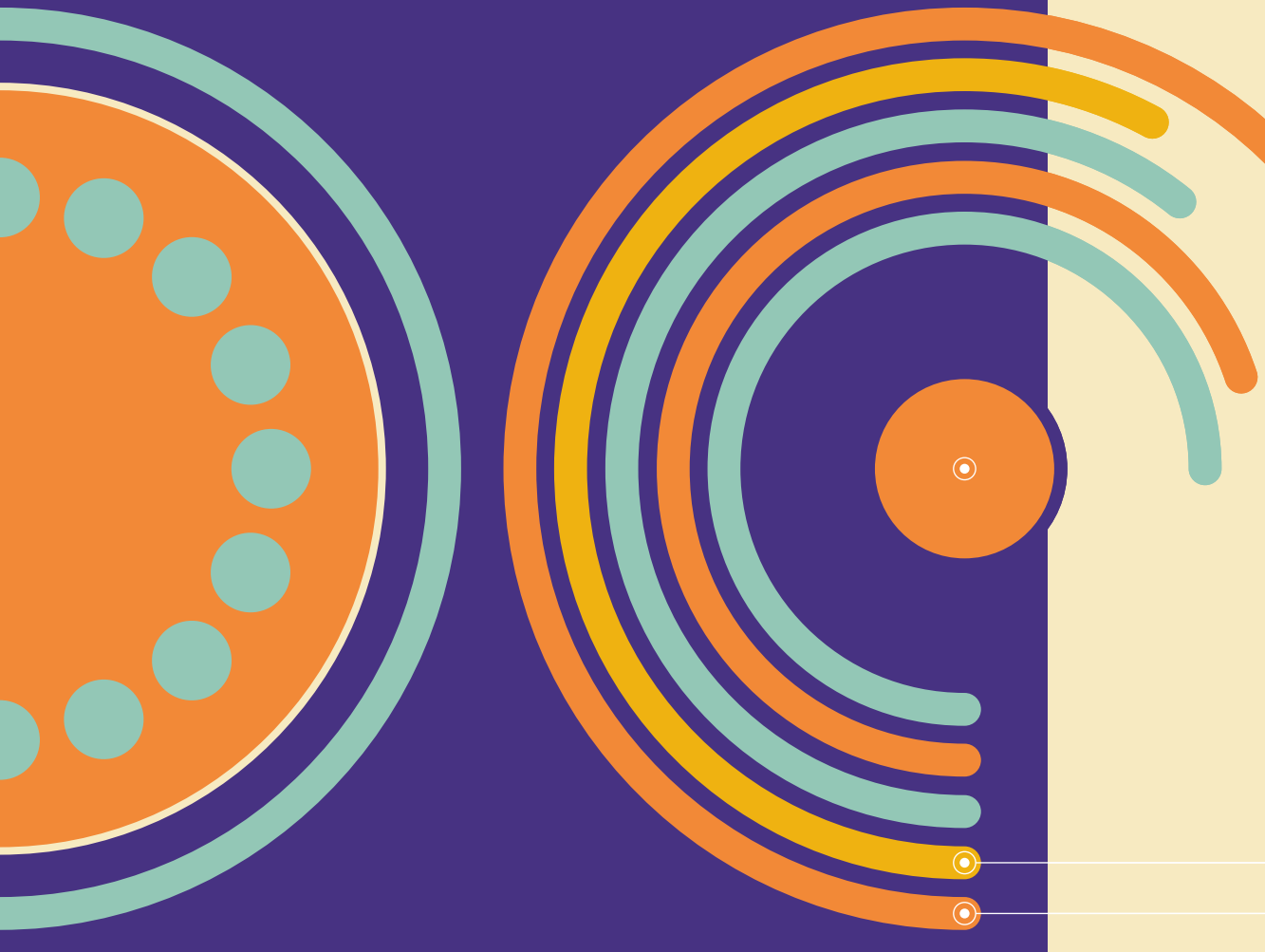


Making Sense of Mathematics and Teaching **professional development courses are offered through the Center for Teaching and Learning Mathematics at the University of Northern wa. These courses provide innovative mathematical professional development designed to directly improve teacher practice and enhance student learning.**

Our courses are designed to deepen elementary teachers' understanding of mathematical concepts and to support their implementation of research-based teaching strategies. UNI faculty and Iowa Area Education Agency consultants provide content and pedagogical expertise to further participants' growth as mathematics educators.

All courses are aligned with the Iowa Core, Common Core State Standards, Characteristics of Effective Instruction, and the Iowa Professional Development Model.

FOUNDATIONAL RESEARCH

Making Sense of Mathematics and Teaching courses reflect the importance of effective and innovative mathematics instruction and the positive impact felt by students who are taught by highly effective and capable teachers.

Five significant bodies of research guide us as we reach and expand the capacity of elementary teachers and ultimately, have an impact on student achievement:

Teacher Outcomes:

- Improved mathematical content knowledge
- Improved instruction based on the Standards for Mathematical Practice, and learning mathematics with understanding

Student Outcomes:

- Development of a deeper understanding of mathematics
- Increased use of Standards for Mathematical Practice
- Improvement of student achievement in mathematics

Mathematical Knowledge for Teaching (MKT) includes an emphasis on both subject matter and pedagogical content knowledge. MKT is concerned with knowing mathematics from the perspective of helping others to learn it, and includes being mathematically ready to teach an idea, method, or other aspect (Ball, 2011).

Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. These practices rest on important "processes and proficiencies" with longstanding importance in mathematics education (Common Core State Standards, 2011).

Learning Mathematics with Understanding encompasses conceptually-based, problem-centered instruction that focuses on student thinking (Hiebert, 1997 and Van de Walle et al., 2014).

Change Theory helps our course developers, facilitators, and participants to understand that improving quality instruction requires a healthy attitude and understanding about change principles (Hall and Hord, 2006).

Iowa Professional Development Model focuses on curriculum, instruction, and assessment, as well as participative decision making, instructional leadership, and simultaneity (Iowa Department of Education, 2011).

"THE STRATEGIES I AM LEARNING FROM THE MATH CLASS AND IMPLEMENTING IN MY CLASSROOM ARE POSITIVELY IMPACTING MY STUDENTS' MATH SKILLS AND TEST SCORES."

COURSE OFFERINGS

***Making Sense of Numbers* (MSN)** is the foundational course, with content focused on the base ten structure of our number system. Children learn to develop number sense through Meaningful Distributed Instruction (Rathmell, 2005).

***Making Sense of Operations* (MSO)** focuses on the four basic operations (addition, subtraction, multiplication, and division) for whole and rational numbers. Number Talks (Parrish, 2010) are implemented to help students build mental math and computation strategies.

***Making Sense of Geometry* (MSG)** centers on two- and three-dimensional shapes and their properties. The implementation focus is Problem-Based Instruction: three-part student-centered lessons that include Launch, Explore, Summarize (Van de Walle, et al., 2014).

***Making Sense of Measurement* (MSM)** focuses on ways to measure one-, two-, and three-dimensional attributes, develop connections among them, and make sense of standard formulas. Classroom Discussion is the implementation focus (Chapin, et al. 2009)

***Making Sense of Algebraic Thinking* (MSAT)** connects the generalization of the four basic operations to various expressions. The implementation continues to focus on productive discussions and Intentional Talk (Kazemi and Hintz, 2014)

***Making Sense of Rational Numbers* (MSRN)** focuses on unit fractions, equivalent fractions, and decimal notations. The implementation focus is Formative Assessment (Wiliam, 2011 and Creighton et al., 2015).

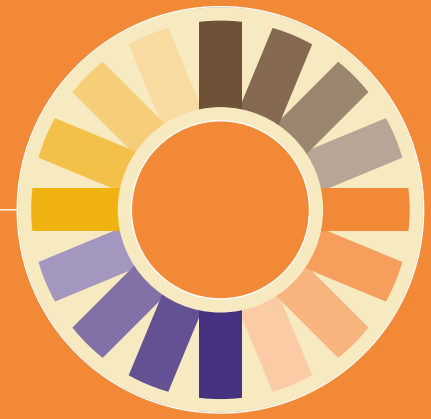
***Making Sense of Data & Statistics* (MSDS)** focuses on data and statistics in the Common Core State Standards. The implementation focus is formative assessment.

***Making Sense of Programming* (MSP)** focuses on the logic of programming. The implementation focus is coding across the curriculum.

PARTICIPANT EXPECTATIONS

The *Making Sense of Mathematics and Teaching* courses provide job-embedded professional development opportunities for teachers. To achieve the outcomes of our professional development, the following teacher actions have been strategically incorporated into the courses:

DO mathematics
STUDY theories
EXPERIENCE models
REHEARSE instruction
IMPLEMENT purposefully
REFLECT on practice
COLLABORATE with peers
SELF-ASSESS and **SELF-MONITOR**
ANALYZE evidence
USE student data

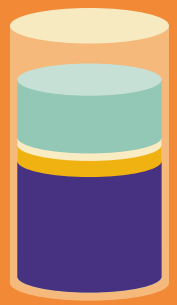


PROJECT EVALUATION

Evaluation for the *Making Sense of Mathematics and Teaching* courses is ongoing, yielding positive outcomes that have a direct impact on teachers. Results from the Learning Mathematics for Teaching assessments revealed statistically significant increases in teacher content knowledge pre to post test. Additionally, the instructional strategies that teachers learned during the courses were increasingly implemented in the mathematics classroom. Lastly, teachers reported a high level of overall satisfaction with the courses.

Assessments used in each course include:

- Learning Mathematics for Teaching Assessment (Ball)
- Concerns-Based Adoption Model (Hall and Hord, 2006)
  - > Stages of Concern Survey (pre and post)
  - > Levels of Use Survey (pre and post)
  - > Innovation Configuration Map- analysis of video-taped lessons using Characteristics of Effective Instruction
- Iowa Assessment Data (Iowa Department of Education, 2011)



MAKING SENSE OF MATHEMATICS AND TEACHING MODEL FOR PROFESSIONAL DEVELOPMENT

The following model applies to a series of eight courses: ***MAKING SENSE OF NUMBERS***, ***MAKING SENSE OF OPERATIONS***, ***MAKING SENSE OF GEOMETRY***, ***MAKING SENSE OF MEASUREMENT***, ***MAKING SENSE OF ALGEBRAIC THINKING***, ***MAKING SENSE OF RATIONAL NUMBERS***, ***MAKING SENSE OF DATA AND STATISTICS***, and ***MAKING SENSE OF PROGRAMMING***

DELIVERY MECHANISM	FOCUS	VEHICLE	INTENDED OUTCOMES	MEASUREMENT MECHANISM
36 clock hours of **face-to-face instruction** (12 half-day sessions or six full-day sessions)	1. Learn math through the lens of Mathematics Knowledge for Teaching 2. Observe models of instructional strategies 3. Rehearse effective math instruction	1. Study theory (i.e. Developing Mathematical Ideas, articles, other resources) 2. Do math (i.e. Problem-Based Instructional Tasks) 3. Talk about math (discussion and instruction) and develop mathematical vocabulary 4. Reflect (participant thinking, student thinking, instruction) 5. Complete tasks, then process (teachers experience math as a learner and reflect on math as a teacher)	1. Increased Mathematical Knowledge for Teaching 2. Increased ability to reflect upon practice 3. Deepened understanding of models of effective instruction 4. Changed teacher beliefs about the way students learn mathematics	1. Mathematical Knowledge for Teaching – Learning Mathematics for Teaching content knowledge test 2. Concerns-Based Adoption Model: Stages of Concern Survey 3. Analysis of student achievement data
15 clock hours of **online implementation** sessions (5 sessions with a minimum of two-week intervals between sessions for classroom implementation and reflection)	1. Implement instructional strategies 2. Reflect on implementation 3. Build professional learning community	1. Practice use of effective instruction in classrooms 2. Self-assess and self-monitor learning and instruction 3. Analyze evidence of student thinking 4. Use student data to guide instruction 5. Reflect on in-class experience through online implementation discussion board 6. Collaborate and coach other educators	1. Increased Mathematical Knowledge for Teaching 2. Increased ability to reflect upon practice 3. Deepened understanding of models of effective instruction 4. Changed teacher beliefs about the way students learn mathematics	1. Analysis of discussion boards using Concerns-Based Adoption Model: Levels of Use 2. Analysis of videotaped lessons using Innovation Configuration Map 3. Analysis of student achievement data
2 clock hours of **individual instructional** coaching in the participant's classroom	1. Modeling in classrooms 2. Observing instruction 3. Using Innovation Configuration Maps to reflect on instruction	1. Visit classrooms (facilitator or other instructional coach) 2. Meet with teachers to debrief modeling and observations	1. Increased Mathematical Knowledge for Teaching 2. Increased ability to reflect upon practice 3. Deepened understanding of models of effective instruction 4. Changed beliefs about the way students learn mathematics	1. Analysis of teacher interview using Concerns-Based Adoption Model: Levels of Use protocol 2. Analysis of observed lessons using Innovation Configuration Map 3. Analysis of student data