Using Online Courses to Link Research to Practice in Mathematics Classrooms

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"Life is good for only two things, discovering mathematics and teaching mathematics."
- Simeon Denis Poisson
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Teacher Preparation

- Middle School licensure
  - K-8
  - 7-12
- Neither licensure adequately addresses National Middle School Association Standards
Goals of Online Classes

1. To encourage beliefs that support inquiry-based practices
2. To provide opportunities to enhance both content and pedagogical content knowledge
3. Focus the teachers’ decision-making processes on evidence of student learning
4. To provided easy access to professional development
Course Development Rationale

- Identify teachers’ beliefs
  - Beliefs influence instructional decisions
  - Beliefs influence learning from a cognitive perspective

- Building teachers’ content knowledge by focusing on the development of students’ content knowledge
  - Pedagogy $\rightarrow$ PCK $\leftarrow$ Content Knowledge
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Course Development Rationale

❖ Teachers as learners of mathematics  
  (Ball, 1996; Loucks-Horsley, Hewson, Love, & Stiles, 1998; Ma, L., 1999)

❖ Using standards-based middle school curricula in professional development  
  (Ball & Cohen, 1996; Beckmann, et.al., 2004; Reys, Reys, Beem, & Papick, 1999)
Course Development Rationale

- Using cases of mathematics instruction (Merseth, 1996; Stein, Smith, Henningson, & Silver, 2000)

- Collaborative examination of student work in order to increase teachers’ flexibility in mathematical thinking (Franke & Kazemi, 2001; Wilcox & Jones, 2004)
Course Design

- Synchronous, asynchronous, & face-to-face
  - Centra software
  - Blackboard software
Course Design

❖ 4 Courses
  ▪ rational number
  ▪ algebra
  ▪ geometry
  ▪ data analysis and probability

❖ Cohort groups
  ▪ 3-5 members @ local schools
  ▪ Each Tuesday 4-7 pm
Centra Software

- Order of operations (CMS)
  - Integers
  - Fractions
  - Decimals
  - Exponents

- Patterns (NWMS)
  - Number patterns
  - Extending patterns

- Concept of unknown numbers/variables
  - Symbolic representations

- Integers
  - Positives and negatives
  - Where are they and why are they?

- Inequalities
  - Concept of inequality
  - Inverse operations
Centra Software & Notetaker
Data Sources

- Class assignments
- Online class recordings
- Discussion Board postings
Data Analysis

- Constant comparative
- Generating themes
- Grounded Theory
Results

Emerging Themes

- Language - mathematical terms
- Use of multiple representations
- Use of activities that encourage social construction of ideas
- Autonomous learners
- Integration with other concepts & disciplines
Results

- Language - mathematical terms
  - Inverses, reciprocals, and opposites
  - Capacity vs. volume
  - Variables vs. Symbols
Results

- Use of multiple representations
  - Division of fractions
  - Probability problems selected
Results

- Use of activities that encourage social construction of ideas
  - Geometric definitions
  - Pythagorean theorem
  - Algebra sorting activities
Results

❖ Autonomous Learners

▪ Big Ideas
▪ Respectfully challenging peers
▪ Shift in roles of instructor and students
Results

- Integration with other concepts & disciplines
  - Algebra and geometry
  - Measurement and science
  - Data and science
Challenges

- Technology
  - Learning curve
  - Speed & Down time
  - Shift in thinking from deficit model to an abundance model
Challenges

- Students could “hide”
- Modeling inquiry practices
  - Making instructional decisions based on student work
  - Using manipulatives
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