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Integrating Portfolio Assessment with Learning to Enhance Pre-Service Elementary Teachers' Mathematics Knowledge for Teaching

Outline

- Previous history

- Present position

- Course(s) Description

- Problem/questions

- Instruction and assessment

- My self study/course assessment

- Questions

Course Description

- Three semesters of mathematics foundations, encompassing, number sense, algebraic thinking, data analysis, probability, geometry and measurement

What is The "Problem"

- Many pre-service elementary education majors have _negative preconceptions_ about themselves as mathematics learners and misconceptions about what it means to understand mathematics
- In most mathematics content courses, students encounter _traditional assessment instruments_ consisting of tests, quizzes, and textbook homework exercises that focus on procedures, skills and concepts
- A teacher "needs to know _more and different mathematics_ –not less" than other adults

The Questions:

1.) To what extent do students reveal growth in mathematics knowledge for teaching (MKT)?

2. How and to what extent do students reveal evidence of learning and deep-understanding in their portfolio entries?

3. What dispositions toward mathematics are observed in journal writings collected during the course?
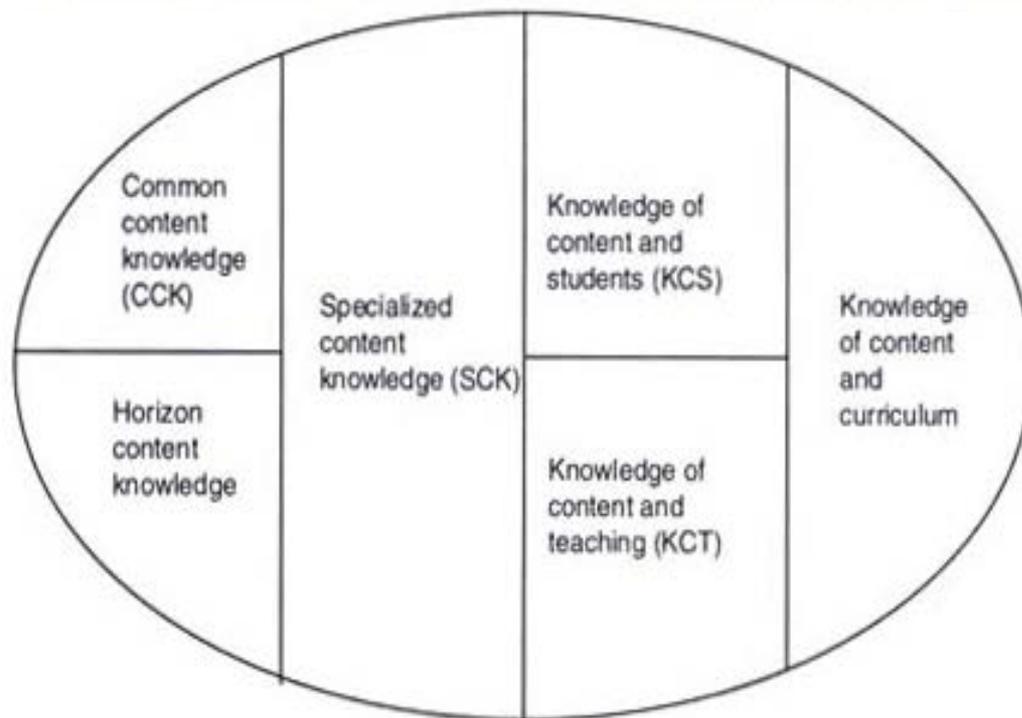
Mathematics Knowledge for Teaching

- Ball, et al (2009) builds on the pedagogical content knowledge (PCK) framework put forward by Shulman (1986)

- professes that a teacher "needs to know more and different mathematics –not less" than other adults

- this understanding must be detailed in ways not necessary for everyday functioning in mathematics…not just about "doing"

- categorized in sub-domains including *common content knowledge, specialized content knowledge, horizon content knowledge, knowledge of content and students, knowledge of content and teaching,* and *knowledge of content and curriculum*

Domains of Mathematical Knowledge for Teaching

SUBJECT MATTER KNOWLEDGE   **PEDAGOGICAL CONTENT KNOWLEDGE**

Common content knowledge (CCK)

Specialized content knowledge (SCK)

Horizon content knowledge

Knowledge of content and students (KCS)

Knowledge of content and teaching (KCT)

Knowledge of content and curriculum

MKT addressed in 10X Courses

- *common content knowledge*, the knowledge teachers have in common with others who know and use mathematics

- *specialized content knowledge,* mathematical knowledge specific to teaching such as recognizing multiple representations, unpacking the mathematics and understanding the "why" of the concepts and procedures, making connections beyond and within mathematics, etc

- *horizon knowledge*, "an understanding of the wider mathematical landscape".

Course Goals

- Deepen and broaden students' understanding of fundamental elementary mathematics

- Increase students' knowledge and expertise as problem-solvers

- Collaborate and communicate with colleagues in solving problems and making connections to the "real" world and across mathematics topic areas

Course Goals cont:

■   Develop fluency and proficiency in [algebraic thinking, rational number sense, data and probability as well as other content areas].

■ Strengthen students' abilities to reason and communicate mathematically and to analyze and evaluate the mathematical thinking and strategies of others.

■ Develop the ability to self-assess and evaluate their own mathematical growth, to share their understanding or lack of understanding with others and take any steps necessary to improve.

Instructional Model

- Non-traditional mathematics classroom

- Students are engaged in explorations, investigations and problem-solving in groups.

- (Re-) discovering fundamental mathematics

- Conversations with their peers is essential

- Traditional lecture/note-taking is rare

Assessment Goals

- To enhance students' dispositions toward mathematics

- To allow students' the opportunity to provide evidence of their mathematical thinking through performance tasks and reflective journals

- To provide feedback to students on their thinking and to further stimulate it

Portfolio Contents

- A minimum of 5 instructor-selected tasks

- 3-5 student-selected tasks

- Three self assessment and reflection essays collected at the beginning, middle and end of the course

- 14-16 other journal entries…one for each week of the semester (may include responses to instructor-posed prompts)

- Other

Key Points

- No quizzes or tests and no traditional grades during the semester

- Students focus on their thinking and understanding

- Tasks are "works in progress"

- Puts ownership and responsibility for learning directly on the students

- Integrates learning with assessment

- Provides a larger window to view both the students ability to "do" mathematics and their conceptual understanding of the content and processes of mathematics.

Portfolio Assessment Logistics

- Assigned Tasks

- Portfolio Entry Slips

- Evaluation and Feedback (word "scores" rather than number or letter grades)

- Revisions

- Sample Student work

- Journal Entries

- Sample Portfolios
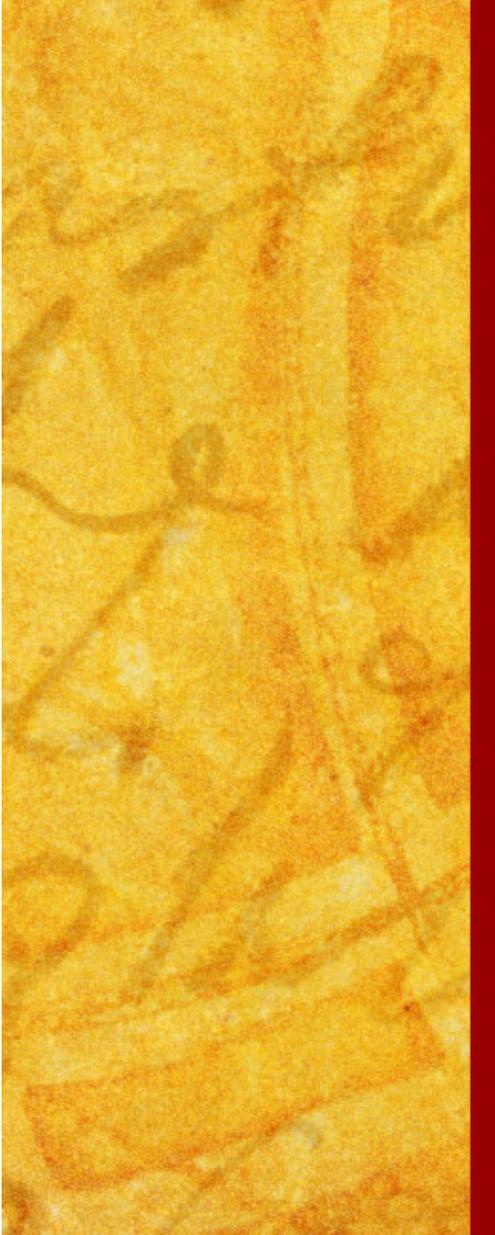
What might success look like?

- TKAS Pre-tests and post-test assessments provide evidence of growth in MKT as measured by those instruments. (the catch) (Early Results)

- Random Sampling and analysis of First-Middle-Last journal essays for evidence of language that shows positive changes in disposition. (one example)

- Students' portfolios show evidence of proficiency in course content and process

MA 103 Geometry Spring 2011: Pre- to Post-Assessment Change Scores.
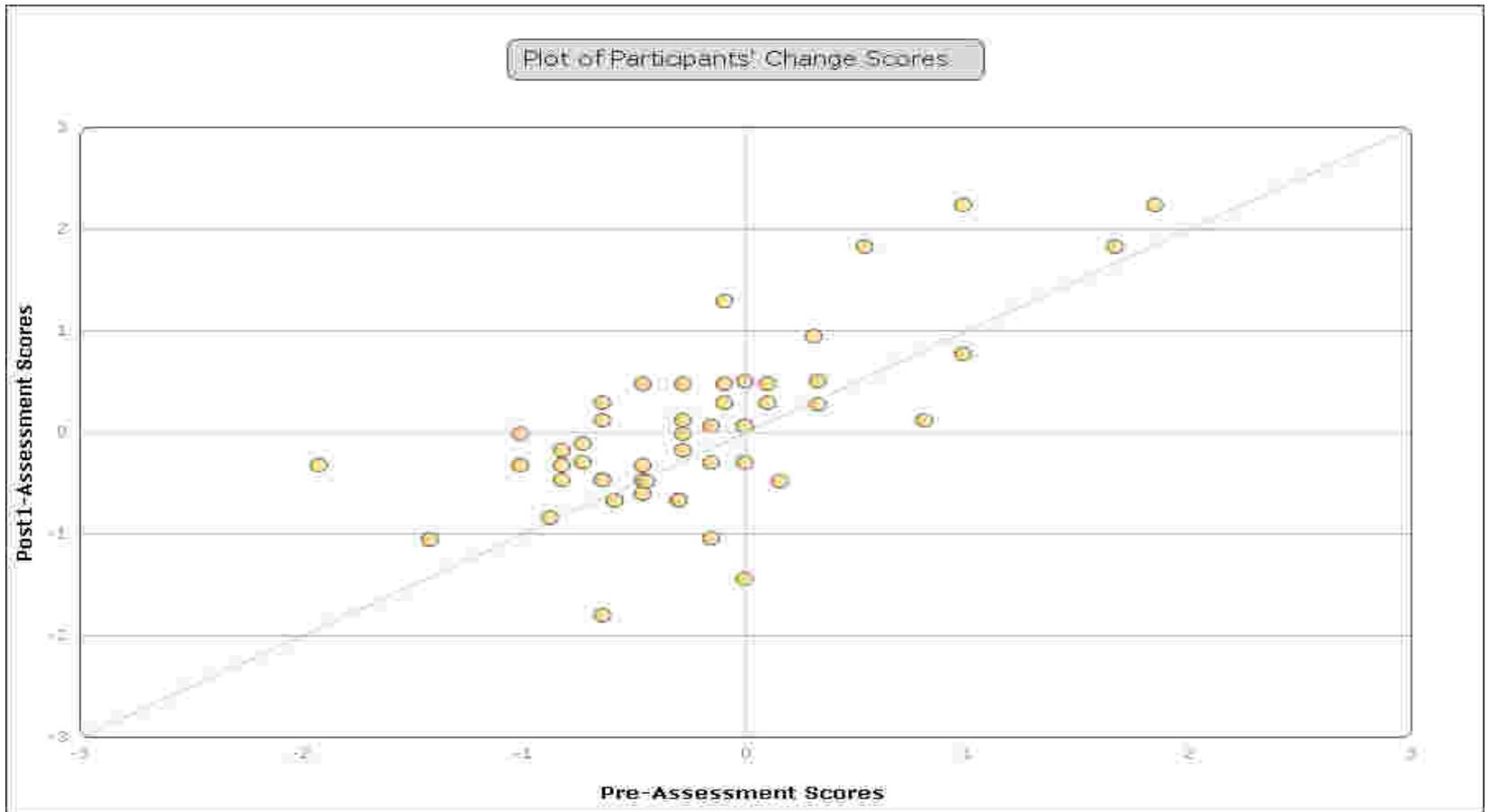
Questions?

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