Five Considerations when using MKT Tasks as Representations of Practice for Undergraduate Preparation for Teaching

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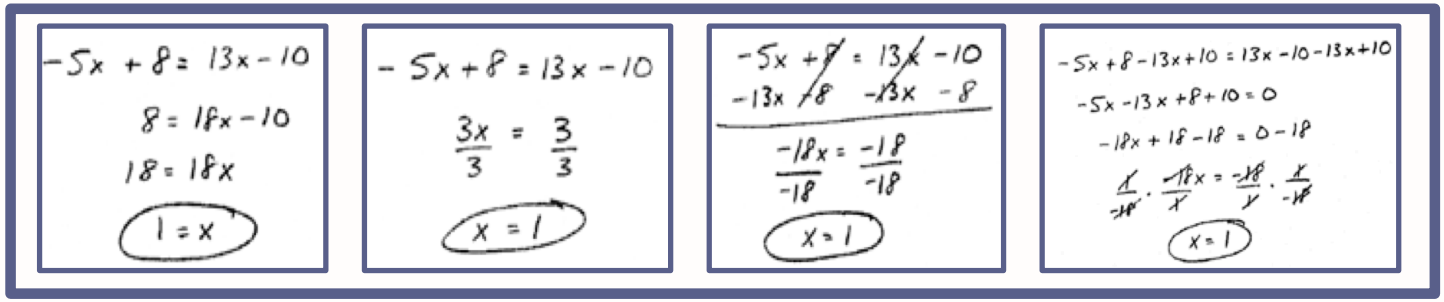
MKT Tasks as representations of practice

- Mathematical knowledge for teaching (MKT): knowledge interweaving content and teaching (Ball, Thames, & Phelps, 2008)
- Instruments measuring MKT show effects on teaching and learning (Baumert et al., 2011; Hill, Rowan, & Ball, 2005; Rockoff, Jacob, Kane, & Staiger, 2011)
- The MKT tasks in these instruments often embed a pedagogical context (e.g., COACTIV, CVA, DTAMS, LMT, MET, TEDS-M, ...)
- View MKT tasks as "representations of practice" (Grossman et al., 2009)

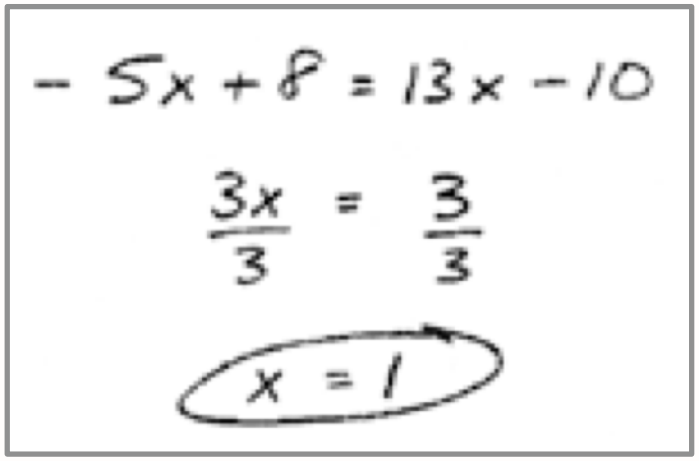
Kane MKT task as a representation of practice

Ms. Kane asked her students to solve the equation –5x + 8 = 13x – 10. While walking around, she noticed several different strategies. For each, <u>indicate whether or not the work provides evidence that the student is reasoning correctly about this problem.</u>



Record of practice in Kane task

(B)



Instructional purposes

For teachers to learn to:

- Practice appraising incomplete or "messy" work
- Know which mathematical ideas underlie algebraic "steps"
- Practice diagnosing mathematical understanding in terms of these mathematical ideas.

... What happened when an instructor used the Kane task for these purposes?

Prospective teachers' analysis

Marisa: "For (b), I thought **they showed *some* understanding**, but they didn't get it completely right, but **so I wasn't sure how to answer**."

Karen: "I was thinking the same thing as Marisa ... it looks like **they knew to move the terms to one side.**"

Marshall, in response: "I think what's more likely is that **they had a misconception about like terms**. They combined 13x and -10 and got 3x. That shows there's **not complete evidence that the student understands**."

Tom, in response: "I think that **the reason why they all got the same answer** is that x=1."

The study

How does pedagogical context interact with movement toward instructional purpose?

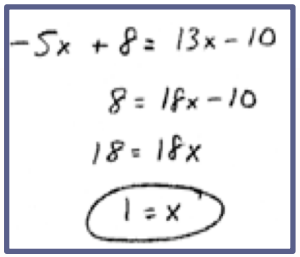
Analysis of two MKT tasks

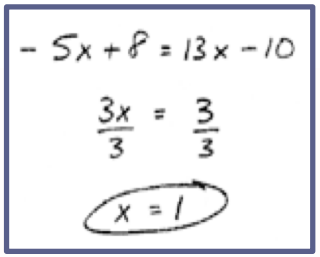
- Embedded pedagogical context
- Instructional purposes of the teacher educator
- When pedagogical context was used (counterfactual analysis)
- Whether/how use moved toward an intended instructional purpose

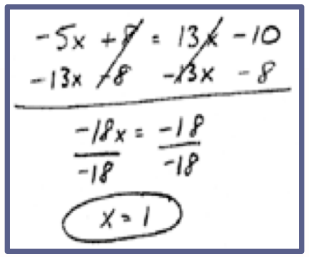
Embedded pedagogical context

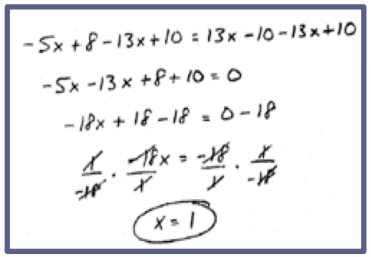
Ms. Kane asked her students to solve the equation $-5x + 8 = 13x - 10$.

While walking around, she noticed several different strategies. For each, indicate whether or not the work provides evidence that the student is reasoning correctly about this problem.







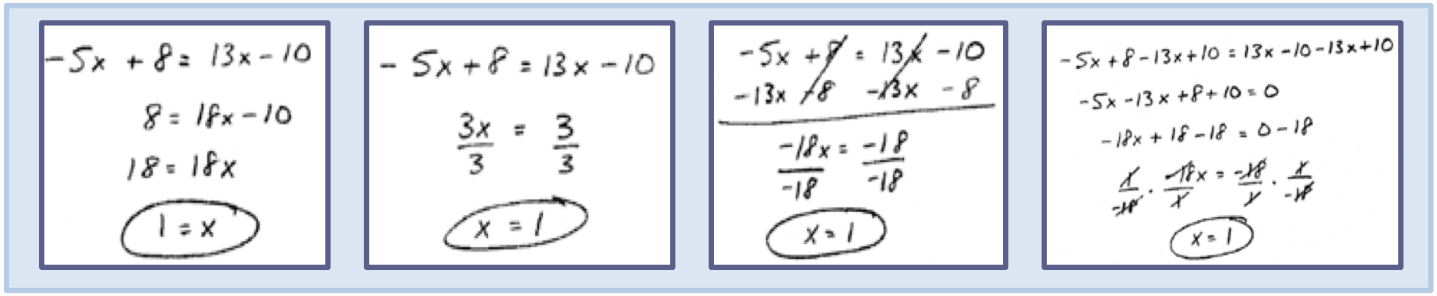


Embedded pedagogical context

Teaching purpose	Records of practice	Organization of instruction	Student background

Ms. Kane asked her students to **solve the equation $-5x + 8 = 13x - 10$**.

While **walking around**, she noticed several different strategies. For each, indicate whether or not **the work provides evidence that the student is reasoning correctly about this problem**.



Categories of instructional purposes

Category	Example
Knowledge	The distributive property and concept of variable underlies “combining like terms”
Model	To model how a teacher might think about a problem from the student’s point of view in order to understand the students’ work
Norms and responsibilities	To argue that formative assessment is important to help students build confidence and see their own progress
Practice	To practice appraising and giving diagnoses of student work
Show	That students misapply “rules” such as the distributive property or adding fractions.

Findings: Types of Interaction

- Anchor example
- Engagement toward a purpose
- Structure for work
- Uncharted interpretations of work
- Uncertainty of purpose

Interactions with pedagogical context

Anchor example:

Instructor or prospective teachers used specifics of pedagogical context as a basis for teaching decisions, in ways that support instructional purpose.

Marisa, Karen, and Marshall's dialogue with each other about the Kane task's records of practice.

Interactions with pedagogical context

Engagement toward a purpose:

Prospective teachers willingly reason within the given pedagogical context in a way that engages them in the work of teaching.

(Anderson Task) Marshall's analysis of potential assessment purposes that a math problem could be used for.

Interactions with pedagogical context

Structure for work:

Instructor used, adapted, or extended the pedagogical context to structure prospective teachers' activities.

Instructor's use of Kane task to pursue nuances related to embedded teaching purpose.

Interactions with pedagogical context

Uncharted interpretations of work:

Without realizing that they are doing so, prospective teachers engaged in work that differed from that intended by the instructor.

Delving into own work instead of students' potential work; analyzing mathematical structure of math problem instead of appraising student understanding

Interactions with pedagogical context

Uncertainty of purpose

The prospective teacher's perception of an aspect of teaching practice conflicts *knowingly* with MKT task's representation of that aspect.

Marisa and Karen's reticence to give a "does provide"/"does not provide" evaluation of students' reasoning.

Synthesis of interactions

- Interactions of depicted teaching purpose, records of practice, and instructional purpose are crucial for **problematizing the mathematical aspects of teaching**.
- The depicted teaching purpose provides **warrants** for discourse about teaching decisions.
- The records provide **grounds** for discourse about teaching decisions.

Next steps for enhancing teacher educators' capacity to use MKT tasks?

- Charting a "geography" of purposes
  - Depicted purposes, instructional purposes, their "proximity"
- Developing norms and processes for designing MKT tasks for use in instruction
  - Build on existing communities developing expertise in task writing and commentary
  - Deliberate use/design of teaching purpose and records of practice
- Fluency in "geography" and norms/processes could help instructors manage interactions with pedagogical context towards instructional purposes

Thank you!

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