

Prospective Elementary Teachers' Analysis of Student Thinking

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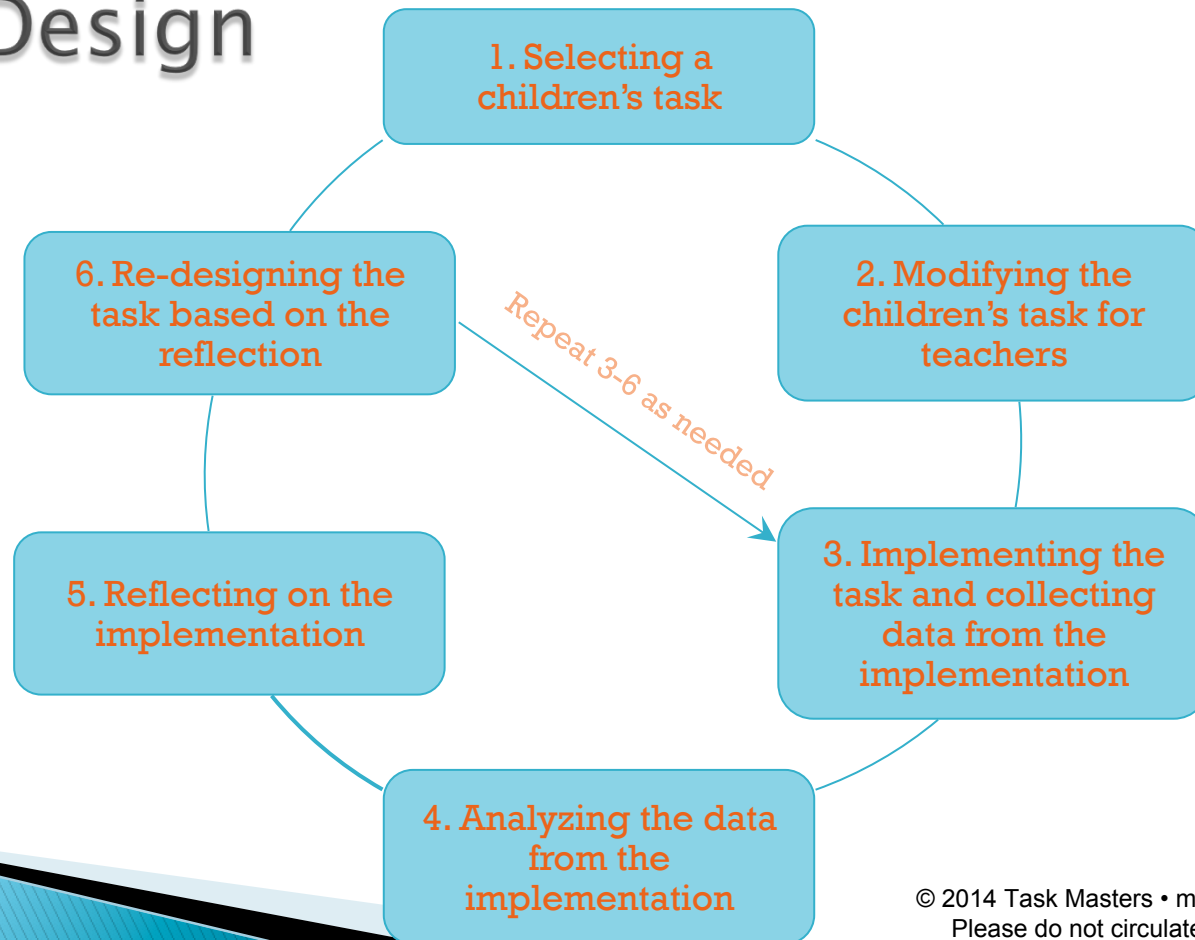
Introduction

- ▶ Collaboration among six MTEs teaching content courses for prospective elementary teachers (PTs).
- ▶ Designed, modified, implemented, and revised fraction comparison tasks for prospective elementary teachers.
- ▶ Implementation across six institutions in the U.S. during Spring 2013, Fall 2013, and Spring 2014 semesters.

Research on Task Design

- ▶ Liljedahl, Chernoff, & Zazkis (2007)
 - used an iterative cycle for task design consisting of *predictive analysis, trial, reflective analysis, and adjustment*
- ▶ Yackel, Underwood, and Elias (2007)
 - modified children's tasks for use with PTs, which provided them with “experiences similar to those children encounter and for which the [prospective] teachers could not draw on familiar knowledge” (p. 354)

Task Design Cycle



Fraction Comparison Task #2

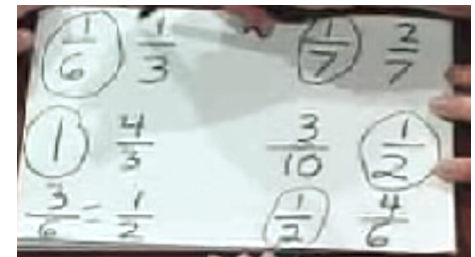
1. For each set of fractions below, circle the fraction that is greater (or if the fractions are equivalent, write “=” in between them).

a. 1 $\frac{4}{3}$

b. $\frac{3}{6}$ $\frac{1}{2}$

c. $\frac{1}{7}$ $\frac{2}{7}$

2. Suppose that a student incorrectly answers all three of the fraction comparisons above, but she has a reason for each of her wrong answers. What might her reasons be? Try to anticipate multiple reasons.
3. The case of Ally: You will be watching a video clip showing Ally (IMAP, 2002), a fifth-grade student from a high-performing school, solving a set of fraction comparison problems, including the three you completed above. Ally's responses are illustrated below. After watching the video clip, describe any misconceptions that Ally may have.



Video and screen shot are from: Philipp, R. A., Cabral, C., & Schappelle, B. (2002). IMAP: Integrating mathematics and pedagogy video collection: Children's mathematical thinking clips. San Diego, CA: San Diego State University.

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Goal of Task

- ▶ PTs will understand children's common misconceptions around fraction comparisons.
- ▶ In the video, Ally exhibits the following misconceptions around fractions:
 - $1 > 4/3$ because whole numbers are always greater than fractions.
 - $1/2 > 3/6$ because 2 is closer to 1, which would make $1/2$ closer to $1/1$, a whole number.
 - $1/7 > 2/7$ because with fractions smaller numbers are greater.

Goals of Our Analysis

- ▶ We analyzed the written responses of 49 PTs in one institution to determine:
 - the types of incorrect strategies/reasoning that PTs anticipate children might use.
 - PTs' ability to correctly interpret a child's incorrect strategy/reasoning.

We analyzed data from one institution across two enactments: Spring 2013 (n=25) & Fall 2013 (n=24)

Results: 1 vs. $\frac{4}{3}$

Provided Incorrect Solution		Anticipated Incorrect Reasoning		Interpretation of Child's Reasoning (video)	
$1 > \frac{4}{3}$	45 (92%)	Whole numbers are greater than fractions	45 (92%)	Correct	43 (88%)
None	4 (8%)	Other	4 (8%)	Incorrect*	1 (2%)
				No interpretation	5 (10%)

*Looks only at denominators

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We analyzed data from one institution across two enactments: Spring 2013 (n=25) & Fall 2013 (n=24)

Results: $1/2$ vs. $3/6$

Provided Incorrect Solution		Anticipated Incorrect Reasoning		Interpretation of Child's Reasoning (video)	
$3/6 > 1/2$	42 (86%)	$3 > 1$ and $6 > 2$; $3/6$ has bigger numbers	29 (59%)	Correct	12 (24%)
$1/2 > 3/6$	1 (2%)	$3/6$ has more pieces (i.e., $3 > 1$)	6* (12%)	Partially Correct**	26 (53%)
None	6 (12%)	$3/6$ has greater denominator (i.e., $6 > 2$)	6 (12%)	Incorrect	3 (6%)
		$3/6$ looks bigger	5* (10%)	No interpretation	8 (17%)
		Other	4 (7%)		

We analyzed data from one institution across two enactments: Spring 2013 (n=25) & Fall 2013 (n=24)

Results: $1/7$ vs. $2/7$

Provided Incorrect Solution		Anticipated Incorrect Reasoning		Interpretation of Child's Reasoning (video)	
$1/7 = 2/7$	35 (71%)	Focus on denominators	34 (70%)	Correct	1 (2%)
$1/7 > 2/7$	2 (4%)	Confusion about inequality sign	2 (4%)	Repeated Ally	19 (39%)
None	12 (25%)	Blank/no reason given	8 (16%)	Partially Correct	3 (6%)
		Other*	5 (10%)	Incorrect**	20 (41%)
				No interpretation	6 (12%)

Conclusions

- ▶ PTs were mostly successful at anticipating incorrect solution strategies and reasons that children might provide.
 - However, they did not correctly anticipate Ally's incorrect strategies for $1/2$ vs. $3/6$ and $1/7$ vs. $2/7$.
- ▶ PTs struggled to interpret/explain a particular child's mathematical thinking.
- ▶ Data supports need to expose PTs to *particular instances* of children's mathematical thinking.

Thank you!

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