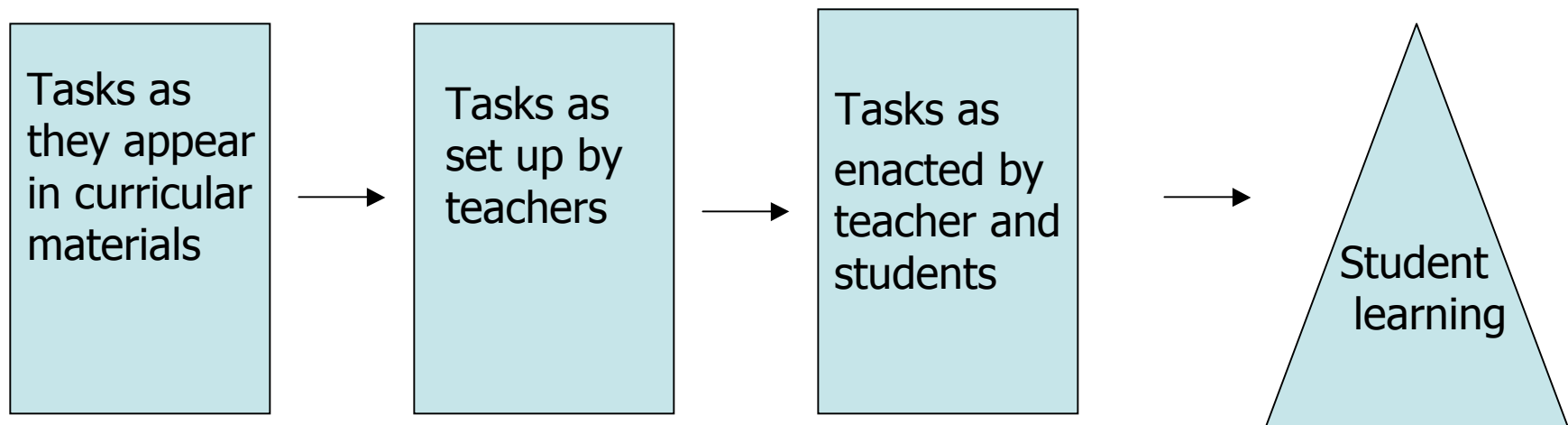


Block 4:

Enacting mathematical knowledge for teaching tasks

The Mathematical Task Framework



Stein, Grover & Henningsen (1996)

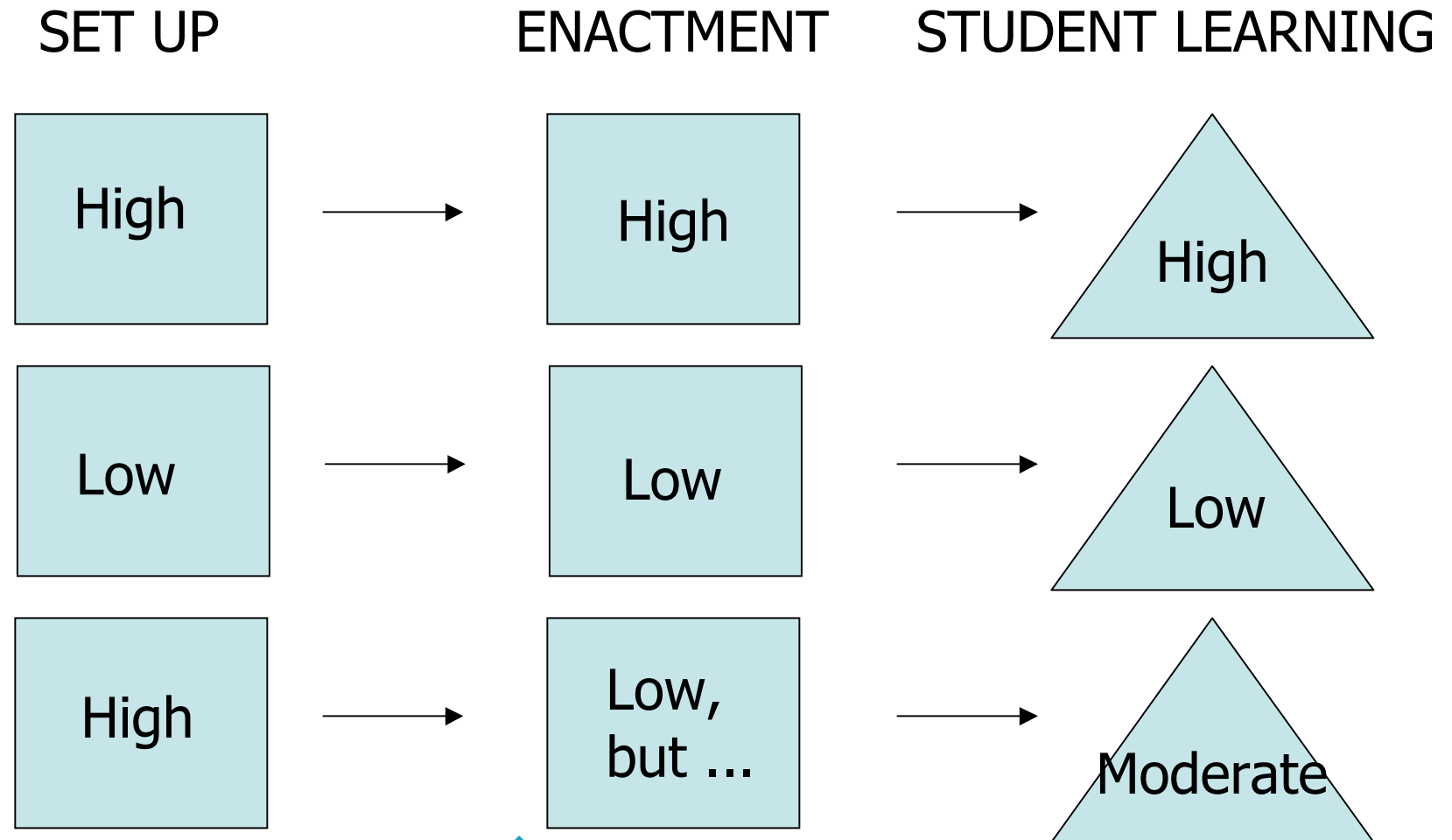
Smith & Stein (1998)

Stein, Smith, Henningsen & Silver (2000)

What can become of high-level tasks during a lesson?

- Maintain high-level demands
- Decline into procedures without connection to meaning
- Decline into unsystematic and unproductive exploration
- Decline into absence of mathematical activity

Enactment affects student learning



Teacher actions affect task enactment & student learning

- Build on students' prior knowledge
- Scaffold students' thinking
- Provide appropriate amount of time
- Model high-level performance
- Sustain pressure for explanation and meaning

Henningsen & Stein (1997)

Factors associated with decline of high-level demands

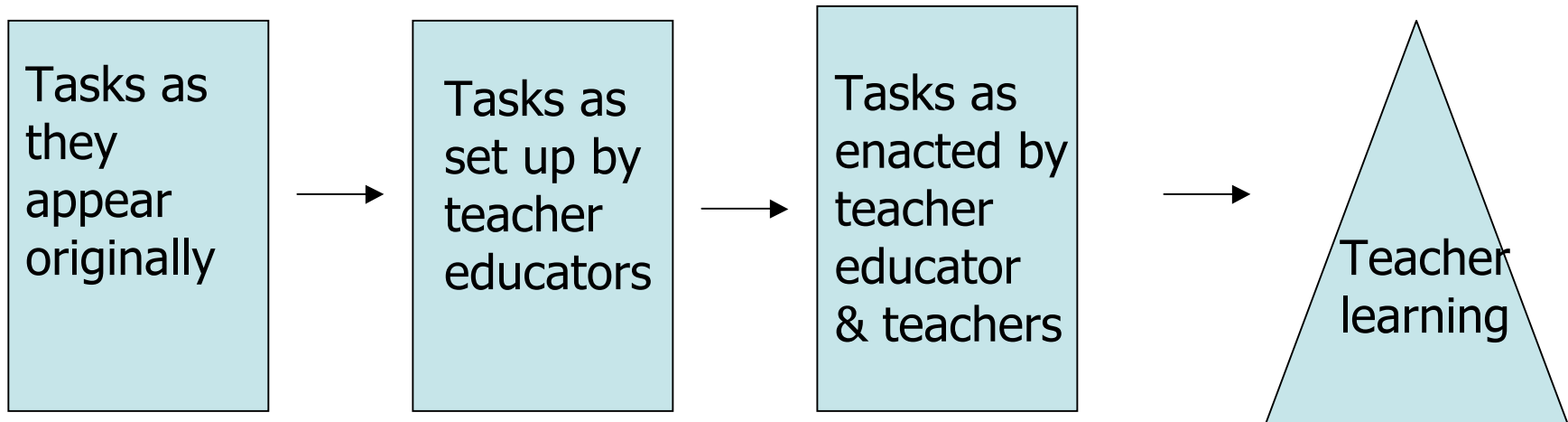
- Challenging aspects are removed or reduced to render the task a non-problem
- Goal shifts attention from process and reasoning to answer only
- Too much or too little time is provided

Henningsen & Stein (1997)

Some MTF-related challenges facing all teachers of mathematics

- Resisting the persistent urge to tell and to direct; allowing time for students to think
- Knowing when/how to ask questions and to provide information to support rather than replace student thinking
- Helping students accept the challenge of solving worthwhile problems and sustaining their engagement at a high level

The Mathematical Task Framework adapted to teacher education



What can happen to MKT tasks during a lesson?

- Maintain focus on MKT
- “Morph” into consideration of mathematics without connection to teaching
- “Morph” into consideration of teaching without connection to mathematics
- Devolve into ritualized activity

Teacher educator actions affect task enactment & teacher learning

- Provide appropriate amount of time
- Model consideration of MKT
- Prompt teachers to make comments and give explanations that focus on MKT
- Scaffold teachers' thinking about MKT to keep MK and T both in play whenever possible

Enactment: What are key questions and moves that can be used to keep a task focused on developing MKT?

- Asking students to explain their solutions to the class
- Having students explain what is/was confusing them
- Asking students to figure out what might be confusing/difficult for someone else about the problem
- Having students ask questions to become more clear about their classmates' solutions
- Asking students to make correspondences between solutions and/or representations
- Asking students to explain someone else's thinking
- Providing opportunities to "talk mathematics" and write on the board
- Provoking a common error
- Narrating how something a student does/says relates to or is a skill used in teaching

Looking at practice...



Focus questions

- What teacher educator actions influence opportunities to learn MKT from a task?
- What moves and questions can teacher educators use to maintain a task's focus on MKT?

Video context:

The summer institute lab class

- A one- or two-credit mathematics content course for elementary education students
- 18 preservice elementary teachers:
 - 7 master's level certification program students; 11 undergraduate certification program students
- Content course (MKT):
 - fractions
 - mathematical practices: using representations, making and evaluating mathematical explanations
- Laboratory
- Third and fourth days of class: The bagel problem

The bagel problem

Becky has 3 dozen bagels that she wants to share equally among 5 people. How many dozen or how much of a dozen can she give to each person?

Enacting the bagel problem

2004 Summer Institute

Class #3, June 8

Class #4, June 9



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Launching the bagel problem

Teacher: I'm going to put up the Bagel Problem, and I'm going to start the same way that we did before, which is I want you to just read it. It's very short, so I didn't print it for you, and put it in your notebook, and I want you to size it up kind of the way you did with the Cookie Jar problem, and that is: What's the problem seem to be involving? What's your reaction to it? Do you have a sense about what it's going to be like, what kind of solution it might have, and so on.

After 3 minutes of individual writing...

Teacher: Does anyone have a question about the problem for the whole group? [*no questions*] Turn to person next to you and make sure the two of you have a shared sense of what the problem is asking.

Students began working on the problem in pairs.

Clip #1

Circulating among students

Class #3, June 8

Launch Students work in pairs;
Teacher circulates

Clip #1

Class #4, June 9

Whole-group discussion
Share and discuss students' solutions Build correspondences among representations

Wrap up

Clip #2

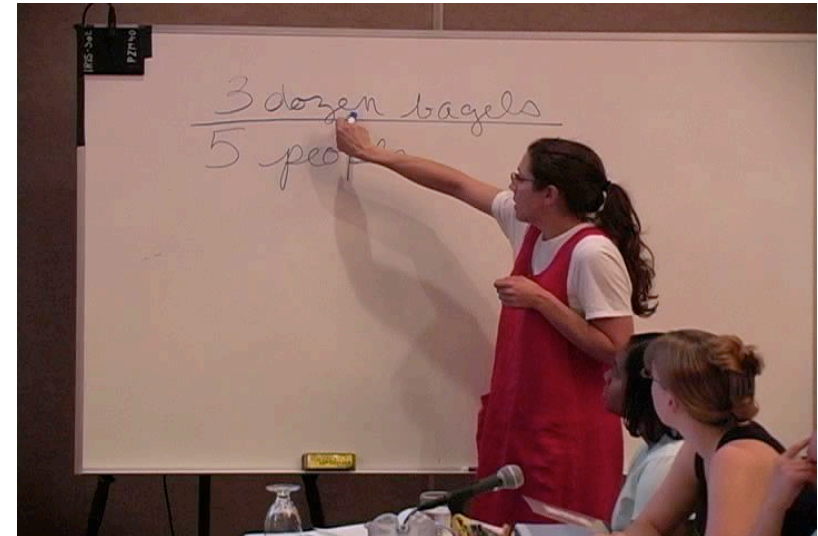
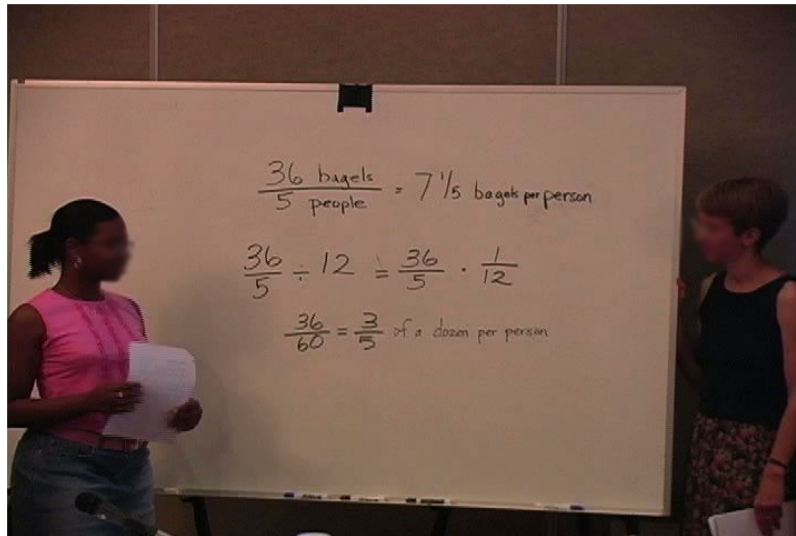
Clip #3



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Whole-group discussion: Students share solutions



Clip #2: Building correspondences

Class #3, June 8

Launch Students work in pairs;
Teacher circulates

Clip #1

Class #4, June 9

Whole-group discussion
Share and discuss students' solutions Build correspondences among representations

Clip #2

Wrap up

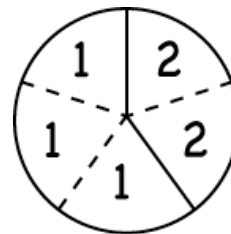
Clip #3



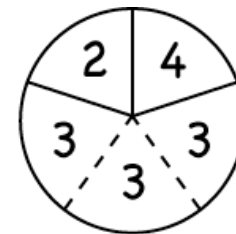
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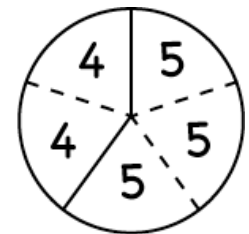
Clip #3: Concluding the bagel problem



1 dozen



1 dozen



1 dozen

The answer $\frac{3}{5}$ of a dozen is equivalent to:

$\frac{3}{5}$ dozen = ___ of 1 dozen

$\frac{3}{5}$ dozen = ___ of 3 dozen

If a bagel shop sold bagels by the "1/5 dozen," how many "1/5 dozens" does each person get? ___ "1/5 dozens"



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CPTM goals

Make visible two keys to improving the quality of teachers' learning

- Awareness of teacher developers' role and the nature of their work
 - The need for professional development for teacher developers
1. Develop a professional community of teacher developers
 2. Build teacher development into doctoral programs
 3. Create portfolio of approaches to professional development of teacher developers
 4. Learn from involvement with community of teacher developers

Next steps: What would be good things to do to spur our collective work?

Next steps

- What would be good things to do to spur our collective work?

Wrap up



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