PREPARING BEGINNERS TO DO EQUITABLE MATHEMATICS INSTRUCTION, NOT JUST BELIEVE IN IT

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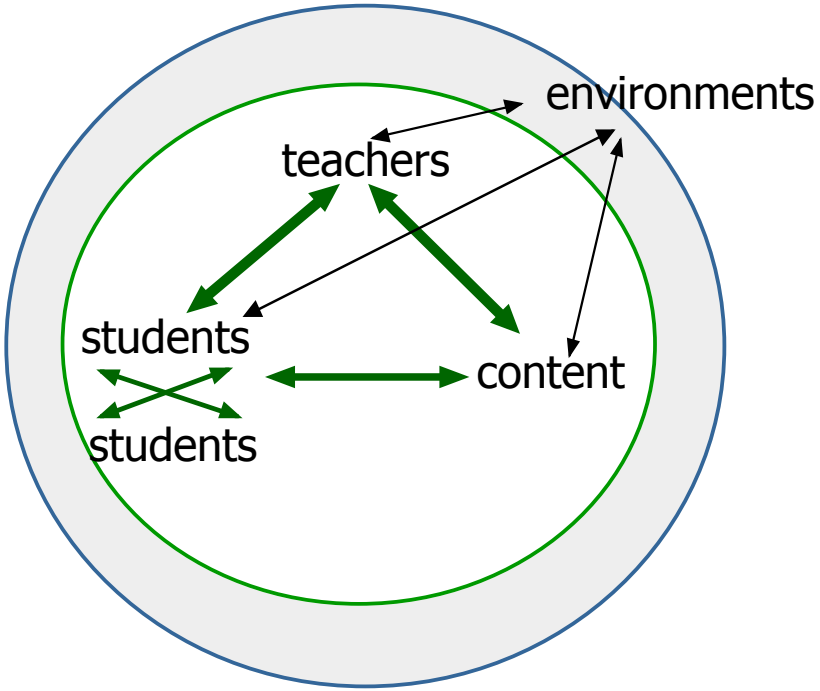
ACKNOWLEDGING OUR COLLEAGUES

- Mathematics Methods Planning Group ("MMPG") — collaborative team since 1997
- Special thanks to some specific people:
  - Imani Masters Goffney
  - Mark Thames
  - Jennifer Lewis
  - Hyman Bass

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HOW WE THINK ABOUT INSTRUCTION



(Cohen, Raudenbush, & Ball, 2003)

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① TEACHING IN WAYS THAT PROMOTE EQUITY

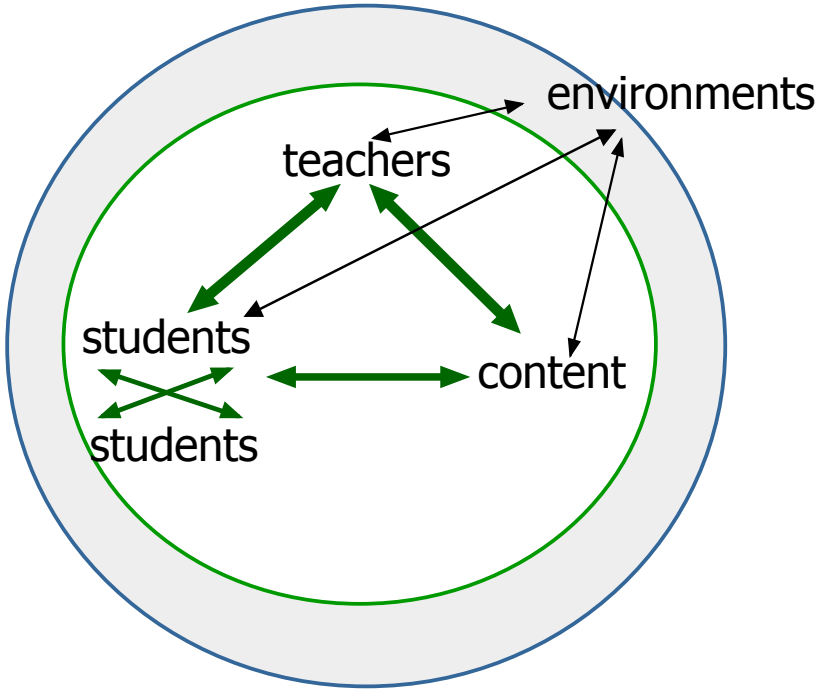


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ATTENDING DELIBERATELY TO EQUITY

- Inequity is reproduced inside of instructional practice.
- Teachers can have leverage at strategic points in their work.
- Breaking this cycle depends on joining concerns for equity with the daily and minute-to-minute work of teaching.



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THE CHALLENGE FOR TEACHER EDUCATION

- Being **aware** of inequity and bias, hearing about the importance of promoting equity in teaching is not the same as having the skill to **do** — to employ practices that are culturally sensitive and that promote equity.
- Content matters in teaching that promotes equity.
- Beginning teachers often rely on curriculum materials and their own experience as students, which potentially reproduces inequity by replicating the status quo.

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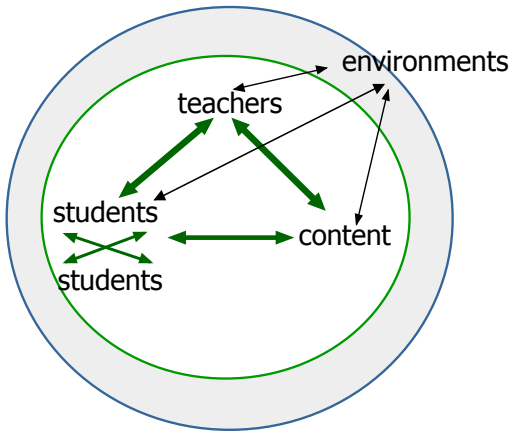
FOUR LEVERAGE POINTS IN TEACHING MATHEMATICS EQUITABLY

① **TASKS:** Select and enact mathematical tasks with care

② **LANGUAGE**: Introduce and use language carefully

③ **EXPLICITNESS:** Make mathematical practices explicit

④ **SUPPORT FOR PARTICIPATION BY ALL STUDENTS**



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SESSION OVERVIEW

① Teaching in ways that promote equity

② Learning to attend to tasks in ways that promote equity

③ Learning to be explicit

④ Challenges for beginners in learning to enact practices that promote equity

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② SELECTING AND ENACTING ACTIVITIES WITH CARE

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CONTEXT FOR THE ACTIVITY

- Teacher candidates have been learning interpretations of operations
- Teacher candidates analyze a set of story problems, identifying:
  - The operation and interpretation
  - Aspects of the story problem contexts that may be problematic
- Independent work is followed by a whole class discussion

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WARM UP: STORY PROBLEMS

For each story problem, identify the operation and the interpretation of the operation. Then, consider the context of each story problem and identify what, if anything, might be problematic about the context. Pick three of the story problems that you have identified as having a problematic context and rewrite each of the story problems.

EXAMPLE PROBLEMS:

- Jake, Jenn, and Julie were triplets. For their birthday, their parents bought them 7 presents each. How many presents did their parents buy all together?
- Terrence scored 27 points in a one-on-one basketball game. Devon scored 34. How many points did Devon win by?
- Janice gets $40 a week for allowance. If she saves up her money for the next 12 weeks, how much money will she have in all?
- Ramon and Julio got detention after school for 90 minutes every day for a week. How much time will they spend in detention all together?

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DISCUSSION

What do you notice as you work on this activity?

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DISCUSSION

What kinds of discussion is this activity likely to generate among teacher candidates?

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DISCUSSION OF THIS ACTIVITY

- Raises the question — "What makes a story problem context 'problematic'?"
  - Stereotypes
  - Experiences that are not inclusive
- Supports teacher candidates in noticing social dimensions of problems

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WHY WORK ON HELPING INTERNS LEARN TO SELECT STORY PROBLEMS WITH CARE?

- Story problems present an opportunity to work on equity issues in the context of mathematics instruction
- Many teacher candidates have not thought about the ways in which story problem contexts might:
  - Perpetuate a variety of stereotypes
  - Connect to students' out-of-school knowledge and experience inequitably
- Teachers must attend to multiple features of story problems simultaneously (e.g., mathematical meaning, pedagogical purpose) which can prevent them from noticing possible equity issues

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HOW WE TEACH TEACHER CANDIDATES TO USE CARE WITH STORY PROBLEMS

Interns:

- Discuss possible equity issues alongside other features of story problems (e.g., mathematics)
- Practice adapting story problems to address equity issues while preserving the mathematical meaning
- Select story problems to use in their field placement classrooms

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③ LEARNING TO BE EXPLICIT

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THE IMPERATIVE

With increasingly greater expectations for engagement in complex mathematical work, it is crucial to unpack and structure opportunities to learn key ideas and practices, e.g.:

- What it means to explain your thinking about an answer
- What is involved in showing your work
- How to work on a hard math problem
- How to study mathematics on your own

Mathematics learning cannot be left to chance.
This is a challenge for equitable teaching.

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EXPLICIT TEACHING: MAKING SKILLED WORK EXPLICIT

- Focusing on important aspects of mathematical ideas, concepts, and procedures: naming, labeling, writing about
- Making practices visible: naming, highlighting, encouraging
- Commenting on qualities of productive mathematical habits and mindset

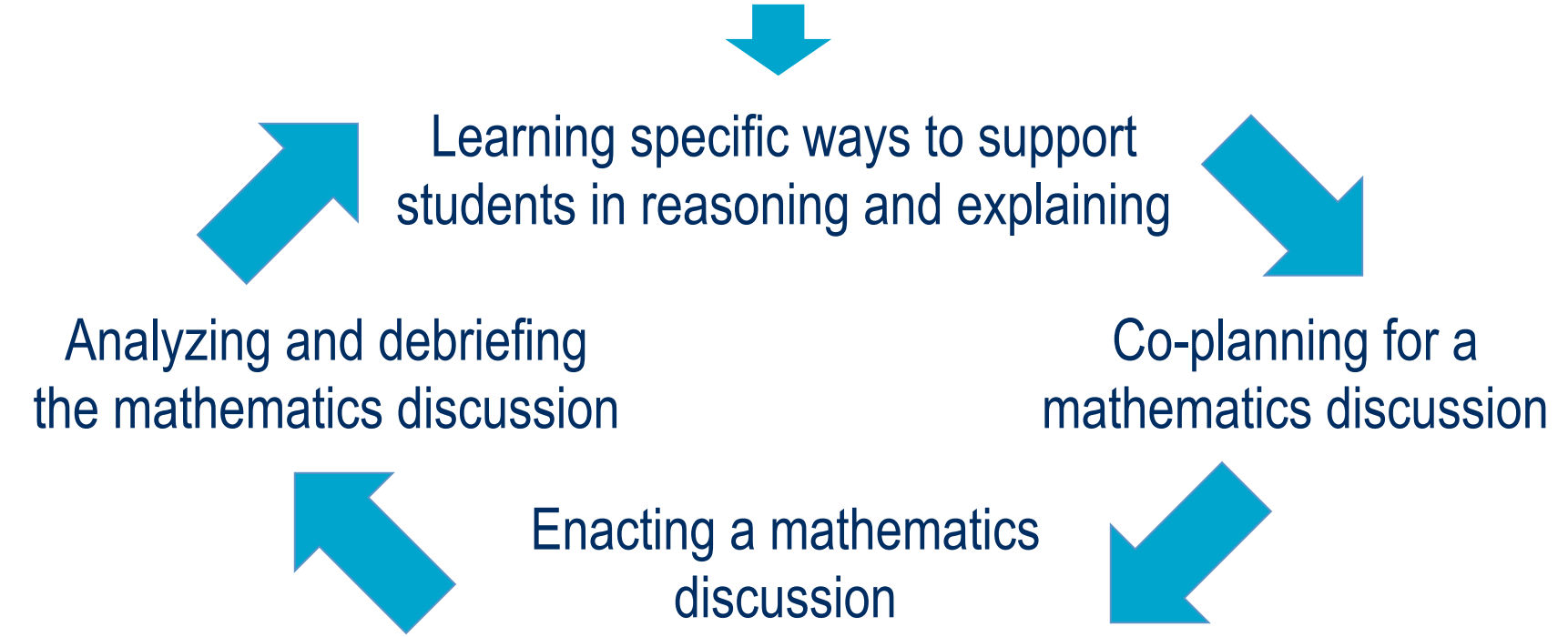
(Mann, Owens, & Ball, 2013)

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SUPPORTING TEACHER CANDIDATES IN LEARNING TO BE EXPLICIT IN THEIR TEACHING

Initial experience:
Working on reasoning and explaining as learners of mathematics



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WHY WORK ON REASONING AND EXPLAINING THEMSELVES, AS LEARNERS OF MATHEMATICS

- **Develop MKT:** Teacher candidates typically need to further their own skill with reasoning and explaining in order to be responsible for equitable mathematics learning
- **Model:** It models ways in which mathematics can be made more explicit and equitably accessible
- **Provide common reference:** It provides a common experience that can be referred to throughout the course

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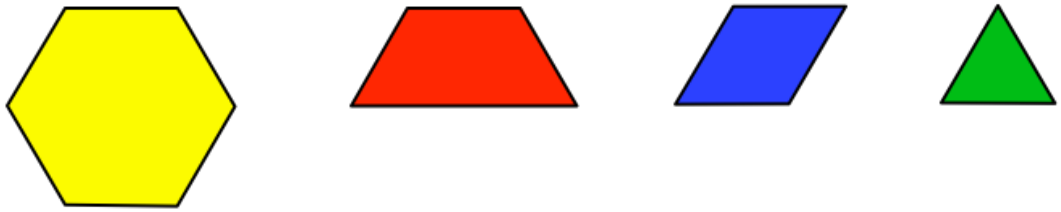
THE PATTERN BLOCK PROBLEM

You can use red trapezoids, blue rhombi, and green triangles.

If the red trapezoid is the whole, how many different combinations of these pattern blocks can you use to represent $2\frac{2}{3}$?

Prove that you found all of the ways.

Bags of pattern blocks with the following shapes:

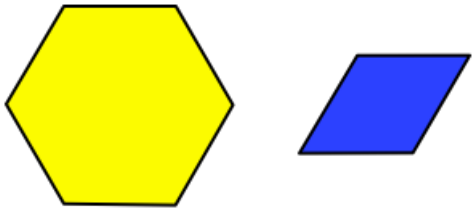


- Identify ONE solution to the problem. Why is it a solution?
- Identify ONE non-solution to the problem. Why is it NOT a solution?
- What might be involved in making sense of and interpreting this problem?

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PROPOSED SOLUTIONS



It shows $2\frac{2}{3}$ but we cannot use yellow hexagons



It does not represent $2\frac{2}{3}$.



Why is this a solution?

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THE CONDITIONS OF THE PROBLEM

You can use red trapezoids, blue rhombi, and green triangles. If the red trapezoid is the whole, how many different combinations of these pattern blocks can you use to represent $2\frac{2}{3}$? Prove that you found all of the ways.

FOUR CONDITIONS

1. Use only red trapezoids, blue rhombi, and green triangles.
2. The red trapezoid is 1.
3. Make $2\frac{2}{3}$
4. Different arrangements are not different combinations.

Connections with mathematical practices

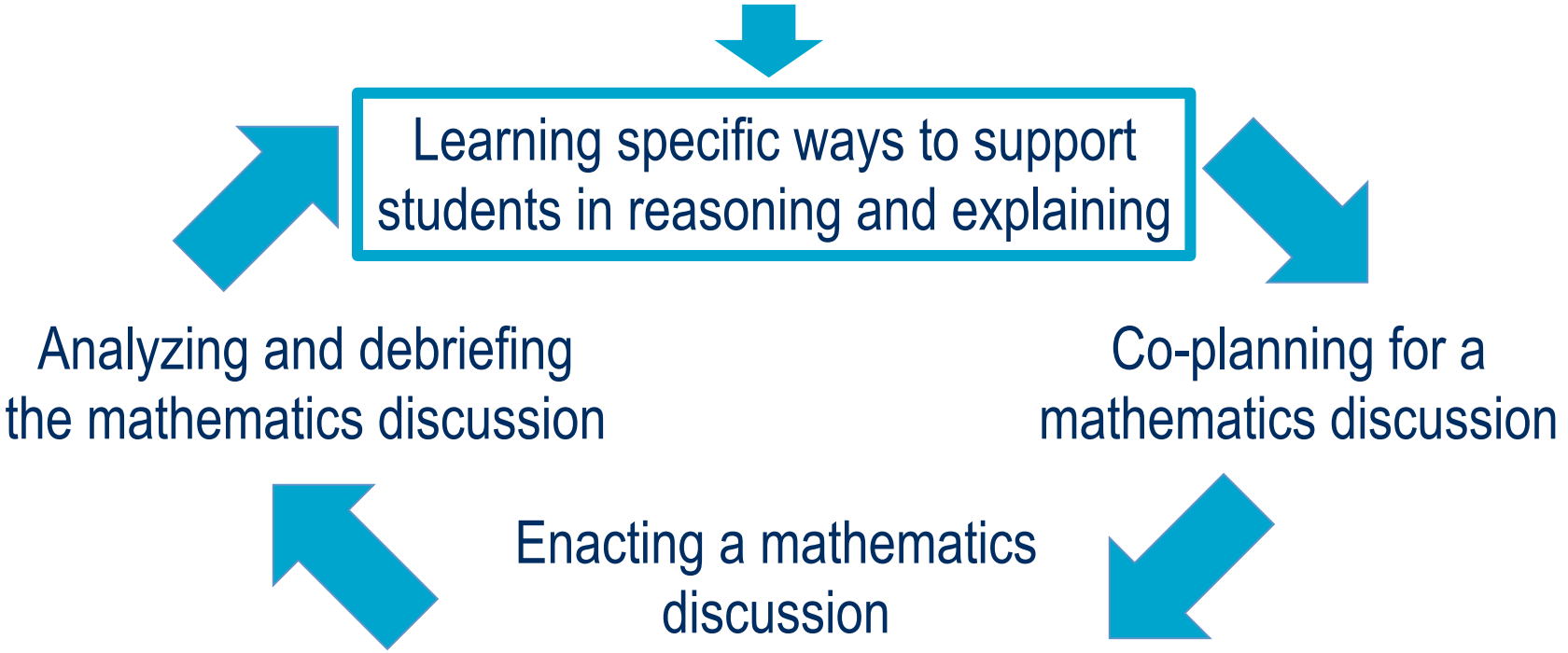
- **Making sense of problems:** Supports establishing a shared understanding of the problem
- **Constructing mathematical arguments and critiquing the reasoning of others:** Provide a means to explain whether a proposed solution is or is not a solution

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SUPPORTING TEACHER CANDIDATES IN LEARNING TO BE EXPLICIT IN THEIR TEACHING

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USING THE CONDITIONS OF A PROBLEM IN TEACHING: THE SET UP OF A PROBLEM

Components

- Build a shared understanding of what the problem is asking (without giving away the solutions or methods)
- Give directions to establish the work environment as needed, depending on routinized norms of the classroom
- Support students in learning how to make sense of a problem and tools for persevering in solving and explaining it

Features

- Succinct
- Clearly organized
- Use language that is likely to be accessible to students
- Task is publically posted

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FIFTH GRADE MATHEMATICS PROBLEM

I have pennies, nickels and dimes in my pockets. If I pull out 2 coins, what amounts of money might I have?

Prove that you have found all of the amounts possible.

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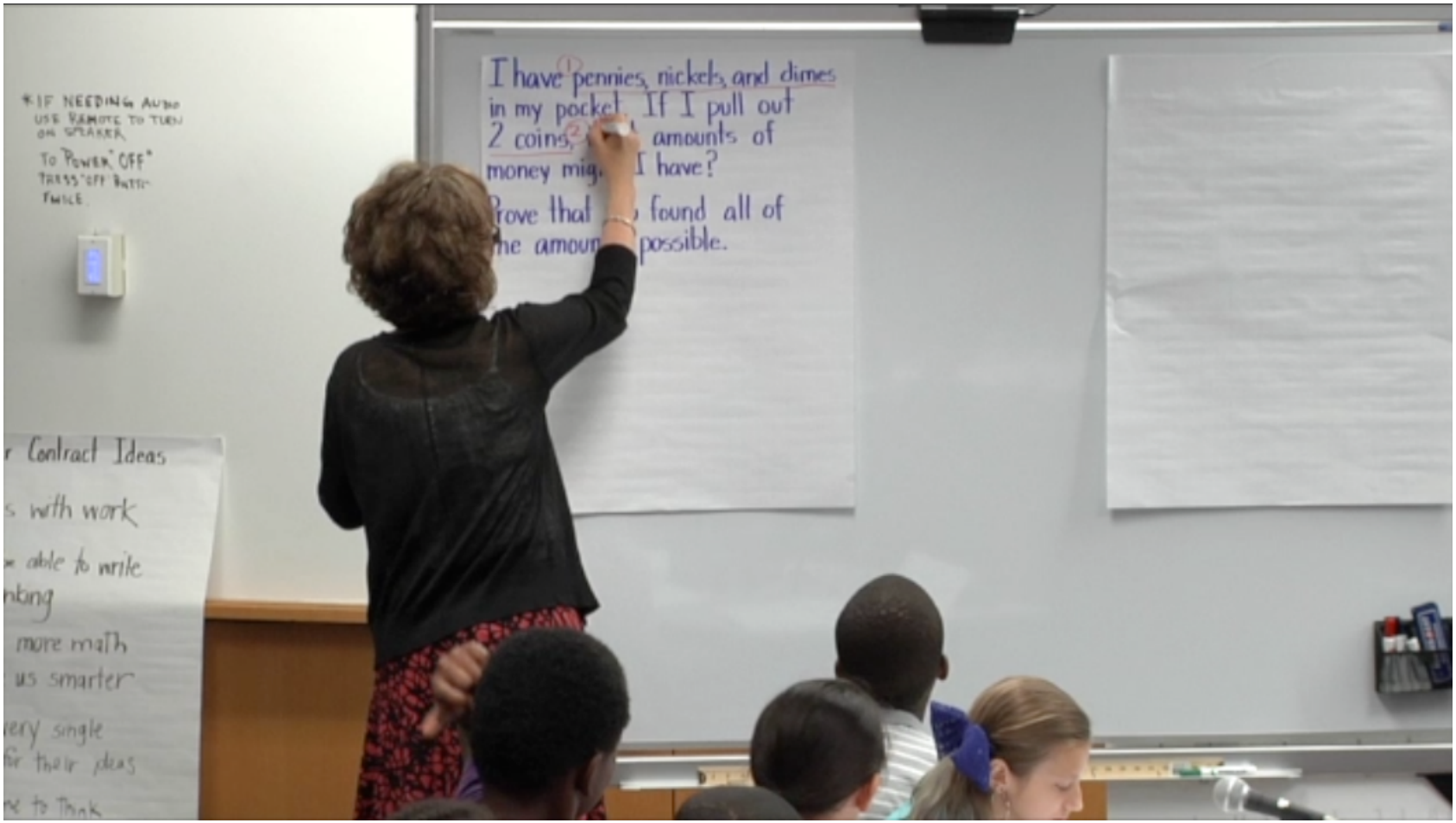
VIEWING FOCUS

- What moves does the teacher make to establish a shared understanding of the task?
- How might the set-up be improved to be more effective?

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VIDEO

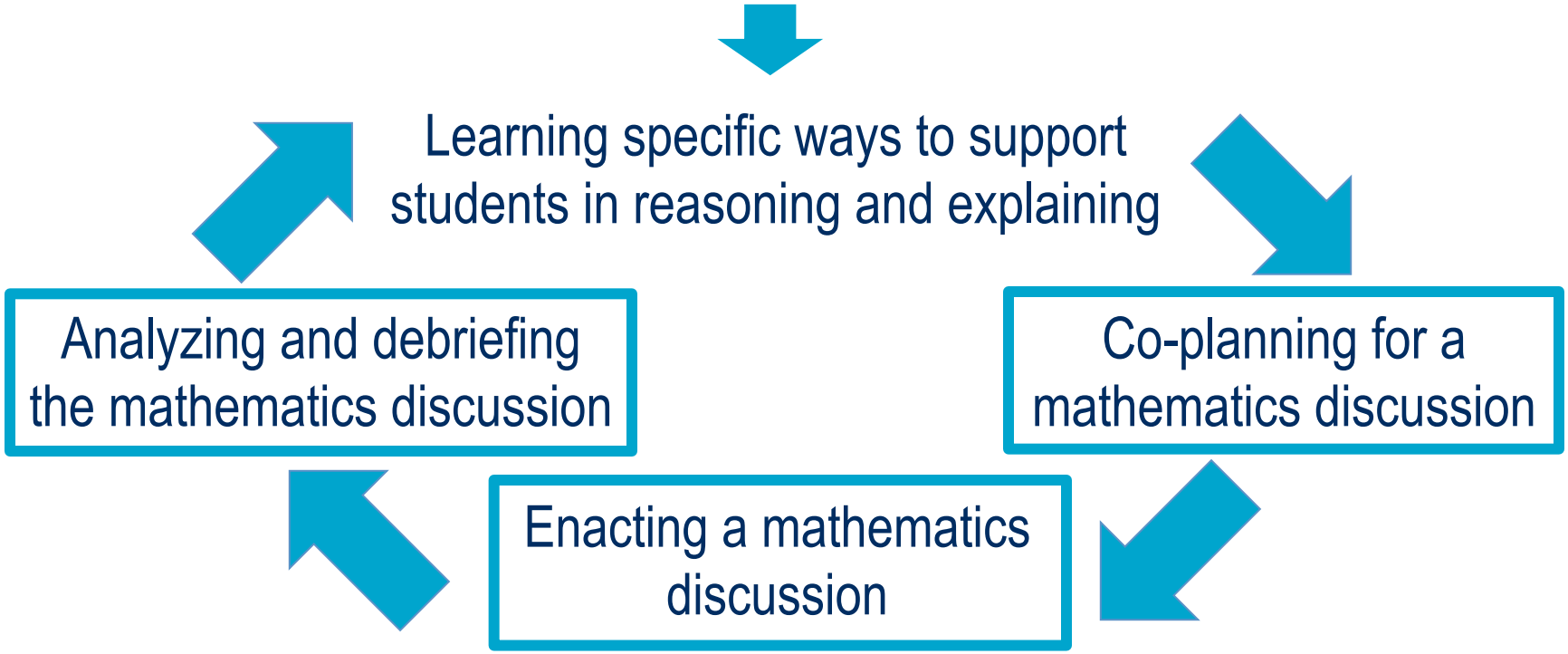


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④ CHALLENGES

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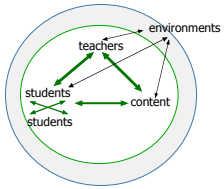
QUESTIONS AND CHALLENGES

1. **Considering entry-level standards for practice**: What are specific practices that promote equity that are possible for beginning teachers to be responsibly skillful with?
2. **Considering our learners**: How does the selection of specific entry-level practices depend on the teacher candidates' experiences, identities, etc.?
3. **Considering subject specificity**: What practices that promote equity are (a) generic, (b) similar across subjects, but require attuning to the specifics of the content areas, (c) crucial for or specific to mathematics?
4. **"Good" teaching ≠ equitable teaching?** How are "good" teaching and teaching that promotes equity related?

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