HELPING LEARNERS
PERSEVERE (HOLDE UT)
IN MATHEMATICS

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SCHOOL OF EDUCATION
UNIVERSITY OF MICHIGAN

TeachingWorks
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IS THERE A TEACHER WHO HAD A SIGNIFICANT IMPACT ON YOU?
VIDEO OF DA’YANA: MS. REYNOLDS SHOWED US THAT PERSEVERING CAN BENEFIT YOUR LIFE
TURN AND TALK

What is something you have persevered with in your life, in or out of school?
Place a ring around three of the numbers below so that they sum to 22.
How many different ways can you do this?
How do you know you have found them all?

9 9 9
7 7 7
3 3 3
1 1 1
Perseverance is contextual.

How can learners’ experiences in classrooms support children learning to persevere in mathematics?
CULTIVATING LEARNERS’ PRACTICE OF PERSEVERING IN MATHEMATICS

1. Creating a classroom culture that includes, rather than marginalizes, learners

2. Changing children’s encounters with mathematics: Confronting the “impossible” and the “infinite” in mathematics
1. CREATING A CLASSROOM CULTURE THAT INCLUDES, RATHER THAN MARGINALIZES, LEARNERS
CLASSROOM CULTURE AND NORMS

- Cultural notions of what it means to be “good at math” are disrupted.
- Learners present their thinking in a variety of ways (e.g., in notebooks, at the board).
- Learners are supported to share solutions and reasoning—even those that are incomplete or “wrong.”
- Apparently “wrong” answers are viewed as powerful learning opportunities.
VIDEO OF MEHJABEEN: DISTINGUISHING BETWEEN ENCOURAGING AND “PICKING ON”
What number does the orange arrow point to? Explain how you figured it out.
VIDEO: ANIYAH’S EXPLANATION

Aniyah: I put one-seventh because there's-
Toni: Did she say one-seventh?
THE POWER OF THE ENVIRONMENT TO SHAPE CLASSROOM EXPERIENCES

- How might people see and interpret Aniyah?
- How could the teaching moves shape Aniyah’s experience and shape the culture of the classroom?
COMMON TEACHING MOVES

TEACHING MOVE

1. Ask another learner: “Who has another answer?”
2. Remind Aniyah that the interval from 0 to 1 is the unit whole on the number line
3. Ask class who agrees/disagrees with Aniyah’s answer

RESULT

1. Signals that Aniyah is wrong
2. Positions Aniyah’s answer as incorrect; clarifies for the class
3. Puts Aniyah in the position of her answer being “voted on”
WHAT WOULD IT TAKE TO DISRUPT THE PATTERNS THROUGH WHICH BLACK GIRLS ARE MARGINALIZED?

- Seeing Aniyah’s solution as mathematically sophisticated and key to the class’s work
- Taking as axiomatic the brilliance of Black girls, and thus Aniyah
- . . . And having something different to do

(Gholson & Martin, 2014, Martin, 2012; Leonard & Martin, 2013)
VIDEO: ANIYAH’S EXPLANATION
USING DISCRETION TO DELIBERATELY DISRUPT THE PATTERNS THROUGH WHICH BLACK GIRLS ARE MARGINALIZED

A DIFFERENT TEACHING MOVE
- Ask learners to ask questions of the presenter, forestall agreeing/disagreeing.

RESULT
- Maintain Aniyah’s authority and agency and position her and her thinking to advance the key mathematical idea.
2. CONFRONTING THE “IMPOSSIBLE” AND THE “INFINITE” IN MATHEMATICS
WHAT IS A SOLUTION SPACE OF A MATHEMATICS PROBLEM?

- The nature of the solutions for a given problem: how many solutions exist for a problem

WHY IS THIS IMPORTANT AND WHAT DOES IT MAKE POSSIBLE?

- Learning to make sense of problems and persevere in solving them
- Developing habits of mind for sizing up a problem and confidence in approaching, working on, and solving problems, and justifying solutions
- Developing sense of control and agency as a thinker
DIFFERENT SOLUTION SPACES

1) No solutions
2) Unique solution (one correct answer)
3) Multiple but finite solutions
4) Infinitely many solutions
QUESTIONS TO ASK ONESELF ABOUT A MATHEMATICAL PROBLEM

1. Does this problem have a solution?
2. Does this problem have a unique solution?
3. Does this problem have multiple but finite solutions?
4. Does this problem have infinitely many solutions?
Place a ring around three of the numbers below so that they sum to 22.
How many different ways can you do this?
How do you know you have found them all?
Write equations for 10.

How many equations are there?
How do you know?
WHAT DO SOLUTION SPACE PROBLEMS AFFORD?

- Disrupt “normal” mathematical experience:
  - One right answer
  - Single entry point of access, exclusionary
  - Narrow views of who is “smart” at math

- Provide alternative and empowering mathematical experience
  - What might count as “solving” a mathematics problem (i.e., some problems are impossible)
  - Multiple entry points, easy access, different degrees and kinds of complexity, but open to all
Perseverance is contextual.

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VIDEO OF MADDY: LEARNING TO PERSEVERE SHAPED MY LIFE
TAKKE!

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Slides will be available on my website
https://deborahloewenbergball.com/
(“Google” Deborah Ball)