# Enhancing Mathematics Curricula and Instruction to Facilitate Students' Participation

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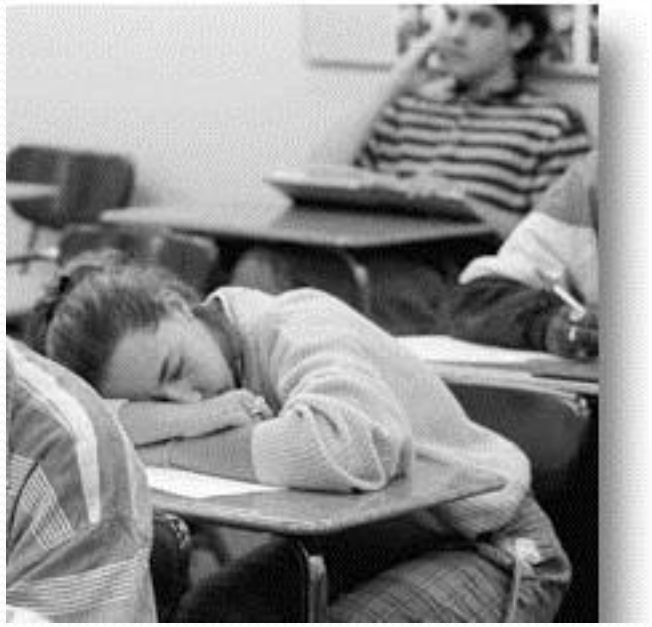
Pictures and videos have been removed to protect the children involved.

# Hermione

# The Other Extreme



Motivation Matters: 40% Of High School Students Chronically Disengaged From School

# Subtin

Eight year old's
work with
graphing calculator

$y+tr^{rxnx}$

$\pi+y\ (tr+r\cos x+n\tan r-n)$

$x+y\ (\sec\csc\ln r\ y-\pi\theta)$

$x+y(\sec\ln r\ y-\theta)$

$x+rn(\sec n\ y-\theta)$

$r-(n+y(\sec rn\ y-\theta))$

$r-(n+y(\sec rn\ y-\pi e\ y\theta))$

$((r-(n+y(\sec(yxnr)-\sin\pi e\ y\theta)))^2)^3$

# What Would Hinder…

Your participation in a faculty meeting? Professional development session? If you were a student in a Japanese classroom?

# An Image of a Student…

Think about a student that you have observed whose participation was hindered? Focus on that image. What hindered his/her participation?

students shared situations that made them feel as though they did not want to participate.

One by one, students voiced their concerns. As a result of our conversation, students realized that they *all* had fears and were reluctant to ask questions. We explored fears about being wrong, about receiving negative responses from classmates, and about not knowing an answer immediately. I was careful to validate each and every concern and to challenge the class to list ways that we could respond to each situation.

# Gifted Students

- Respect
- Engagement
- Challenge
- Opportunity for Creativity and Flexibility

# Positioning

- Teacher:  Now Janessa, Rob's gonna work with you today, okay?
- Janessa:  Thank you.
- Rob: (looks at his paper and taps his pencil against his paper)
- Teacher:  So that means you work the same speed, Rob. What do you think, how could you explain this first one to her?

# A little later in the lesson

- Teacher: Now go a little slower. Work with the second one (pulls Janessa's paper closer to Rob's), Okay?

  I'm going to walk around a little. You're (referring to Rob) going to go Janessa's speed today, okay?

# Your Role

What role can you play in facilitating the participation of students in mathematics in your classroom? School? District? State?

# Viewing the Classroom in a New Way

# Professional Development Tool

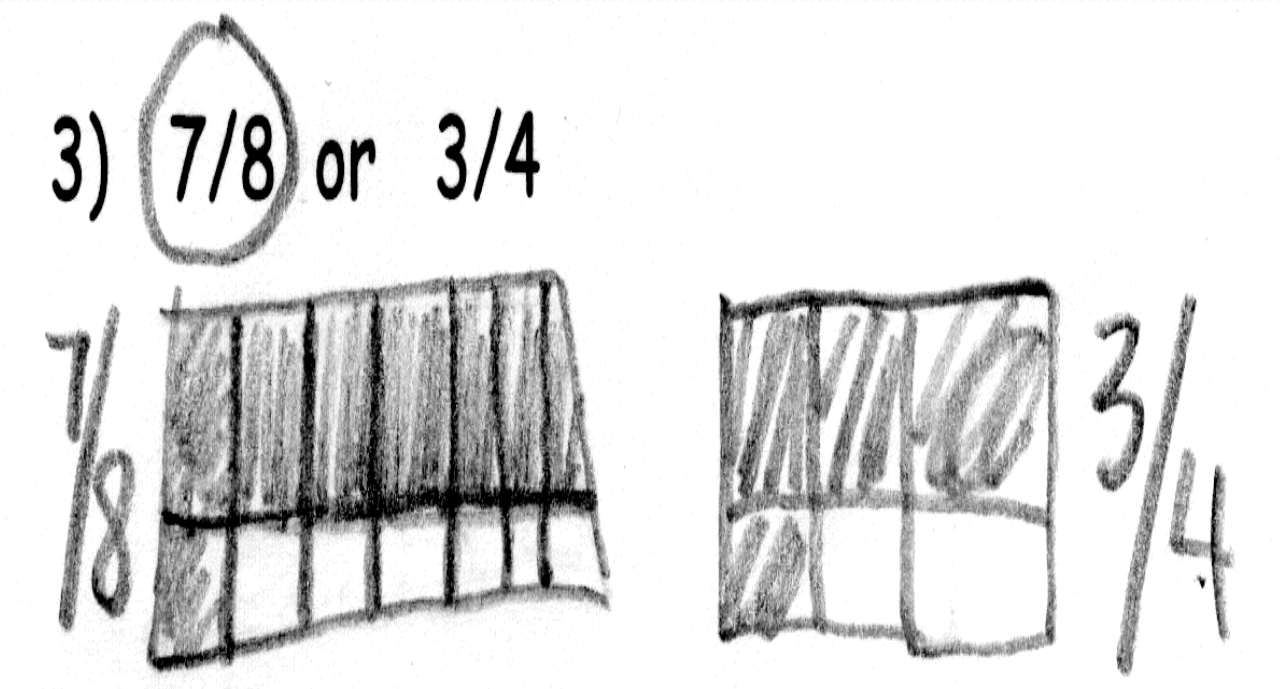
Ms. Dixon: The first time I watched a video filmed with the head cameras, I was shocked. I couldn't believe the things I missed even though I was right there! It concerned me at first, but as the year went on, I realized some great things were happening. I was able to see student interaction without the students feeling the need to please me, because I wasn't hovering over them. Another benefit is getting the opportunity to see student weaknesses. When a student takes 10 minutes to start an activity, I know he/she is struggling somewhere. I can also see what exactly the student is doing in the process of working on a problem. I can see their mistakes as they make them and am better able to understand why they make that mistake.

# Need to Consider How To:

- Support the development of mathematics.
- Support the development of language.
- Enhance curriculum materials.
- Establish, facilitate, and maintain productive classroom interactions (e.g., peer interactions and participation in small group and whole class mathematical discussions as well as independent work).

# Support the Development of Mathematics

# Maria's Representations



# The Mathematics

# Support the Development of Language

# Sara's Practice

Sara created an environment in which talk and listening are valued.

Sara immersed her students in an environment filled with words and interactions.

Sara supported students in academic language and conceptual development.

# Sara's Practice

Sara guided her students by:

(1) speaking and writing sophisticated words;

(2) using these words frequently and
in the context of solving problems; and

(3) building meaning for these words.

# Strategies in the Literature

- Emphasize meaning and the multiple meanings of words—students may need to communicate meaning through using gestures, drawings, or their first language while they develop command of the English language and mathematics (Moll, 1988, 1989; Moschkovich, 2002).
- Write essential ideas, concepts, representations, and words on the board without erasing so that students can refer back to it throughout the lesson (Stigler, Fernandez, & Yoshida, 1996).

# Strategies in the Literature

- Use concrete objects, illustrations, gestures, and demonstrations in classroom conversations (Moschkovich, 2002; Raborn, 1995).
- Connect language with visual aids (e.g., pictures, tables, and graphs) (Khisty & Chval, 2002).
- Discuss examples of students' mathematical writing and provide opportunities for students to revise their writing (Chval & Khisty, 2009).

# Enhance Mathematics Curriculum Materials

# Lesson from Curriculum Materials

Select an up coming lesson in your book.

1. What specific words may be problematic for ELLs?
2. Which specific contexts may be problematic for ELLs?
3. How could you enhance the lesson for ELLs?

# Curricular Enhancements

- Used contexts that were familiar to children or built meaning for those contexts
- Used contexts for a significant period of time
- Summarized different meanings for words
- Emphasized the specific meaning for mathematical context (e.g., round)

# Curricular Enhancements

- Focused on problematic language
- Used visual images and models
- Emphasized mathematical representations and connections among pictures, physical models (i.e., T-shirts), mathematical tools (i.e., place value blocks), and numerals.

# Courtney's Curriculum Features

- Courtney focused on creating new curriculum materials so that the ELLs in her classroom could:
  - *Further their language development* (e.g., using similar vocabulary and linguistic phrases in different problems on handouts),
  - *Extend the curriculum context*,
  - *Encourage metacognitive thinking about mathematics*.

# Connect with Students' Lives

# Establish, facilitate, and maintain productive classroom interactions

# Peer Interactions

I could show you endless videos that capture unproductive partner work. For example, the ELL's partner:

A. was disrespectful or just down-right mean.

B. ignored the ELLs' questions or requests.

C. did the math work for the ELL.

D. did not understand the ELLs' mathematical misconceptions.

These situations do not help ELLs learn mathematics.

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# Talk with Others

- What do you see as the greatest challenge in facilitating the participation of all students?
- Questions?

Thank you for your participation.

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