

WHAT DOES LEARNING AND DOING MATHEMATICS HAVE TO DO WITH SOCIAL JUSTICE? MAKING HIGH-QUALITY MATHEMATICS ACCESSIBLE TO ALL STUDENTS

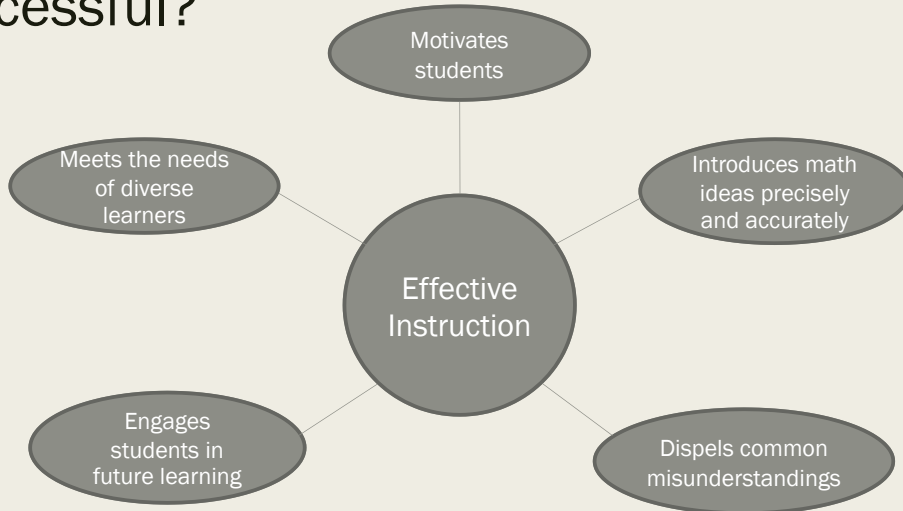
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Importance of Learning Mathematics

- Etymology: from “mendh” (PIE root-to learn or that which is learned)
- Enhances problem solving
- Improves persistency and curiosity
- Promotes access to a wide range of STEM careers
- Predicts later school success

What Makes Mathematics Instruction Successful?



Motivates students

Ego-oriented or Mastery-oriented? How should we motivate attention?

| Ego-Oriented Classroom | Mastery-Oriented Classroom |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| WHAT IT LOOKS LIKE | |
| <ul style="list-style-type: none"> •Focuses on total number correct •Provides feedback based on the final answer •Emphasizes learning as an individual process | <ul style="list-style-type: none"> •Focuses on students' reasoning •Provides feedback based on students' thought process •Emphasizes learning as a collaborative process |
| WHAT IT SOUNDS LIKE | |
| <ul style="list-style-type: none"> •"What did you get for this problem?" •"Check your answers with a partner." •"You did not simplify the fraction correctly." •"Try to do as many problems as you can." | <ul style="list-style-type: none"> •"How did you approach solving this problem?" •"Compare with a partner how you solved the problem." •"You did a great job finding equivalent fractions. Share how you simplified the fraction." •"Try to come up with innovative ways to solve these problems." |

Introduces math ideas precisely and accurately

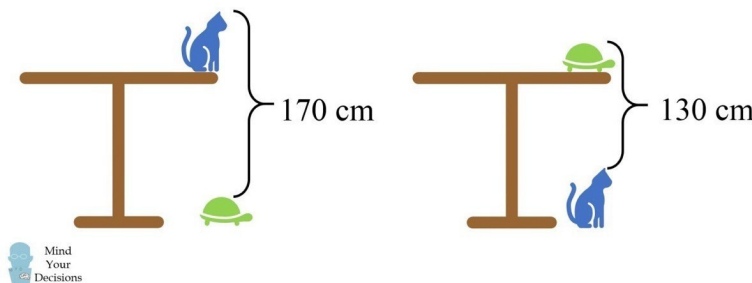
Specific steps we can take toward introducing mathematical ideas precisely and accurately:

- Strengthen our own knowledge of mathematical ideas.
- Build students' knowledge on a strong foundation of conceptual understanding and procedural fluency.
- Develop powerful models (concrete, pictorial, visual representation, and abstract).
- Use precise but developmentally appropriate vocabulary.

Introduces math ideas precisely and accurately

Let's explore a problem together!

How tall is the table?



Mind Your Decisions

What do we know?

What ways can we think about this?

What are your impulses?

How can you turn this into mathematical expressions?

Introduces math ideas precisely and accurately

Identifying Prerequisite Knowledge and Skills

| |
|---------------------------------------------------------------------|
| Possible Prerequisite Skills for Solving $7 + 23$ |
| <i>YOUR LIST</i> |
| |
| <i>OUR LIST</i> |
| |

Introduces math ideas precisely and accurately

Develop Powerful Concepts and Properties

| Step | Concept or property |
|------------------------------------------|-----------------------|
| $\frac{2}{3} \times (14 - 3y + 4) + 2xy$ | (Original expression) |
| | |
| | |
| | |
| | |

Introduces math ideas precisely and accurately

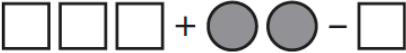

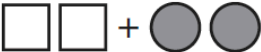
| Expressions and equations: Use properties of operations to generate equivalent expressions, Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients. | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | These shapes, perhaps blocks and spheres (or rectangular and circular chips), represent unknown quantities. |
|  | By rearranging the objects, we illustrate the commutative property of addition as well as the understanding that the subtraction symbol is really addition of a negative integer coefficient. |
|  | Continuing to use what students have previously learned, they can combine like terms to get a set of objects that is equivalent to that in the first row. |

Figure 4.5. Concrete models for learning about expressions. (© Copyright 2010 National Governors Association Center for Best Practices and Council of Chief State School Officers. All rights reserved.)

For each step, what words can you use to move students through the process of creating equivalent expressions.

Dispels common misunderstandings

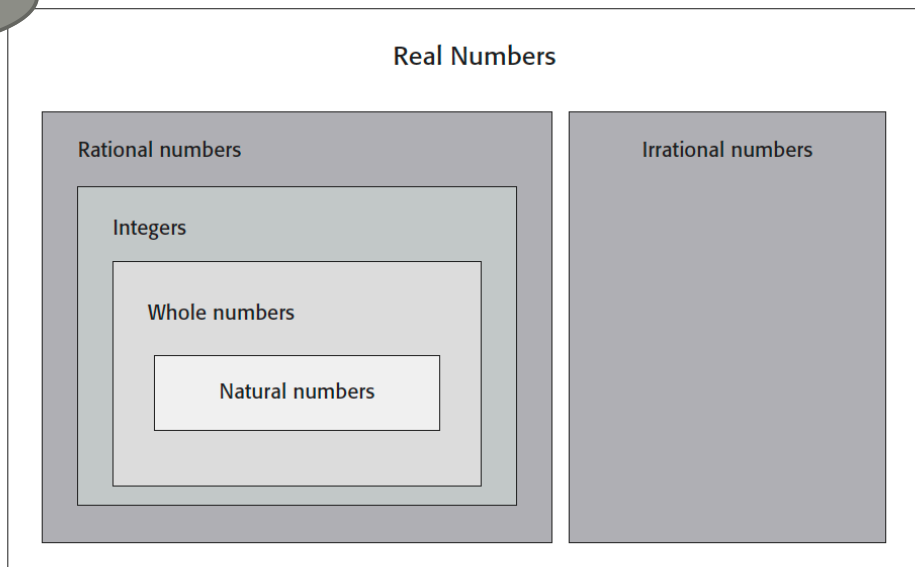


Figure 4.8. Relationships among real numbers.

Engages
students in
future learning

Engage Students for Future Learning

- Sometimes give students problems that are not easily solvable.
- Sometimes ask students to only do the first few steps without finding an answer.
- Spend time doing mathematical translations.
>Concrete-English-Mathematical-English-to-Concrete<
- Encourage students to find problems they want to share.

Meets the needs
of diverse
learners

Meet the Needs of Diverse Learners

- Screen students to identify those who may need intervention.
- Intervention should focus on deep learning of whole number and rational numbers.
- Intervention should include explicit instruction in verbalizing problem-solving, guided practice, corrective feedback, and frequent review.
- Solving word problems should focus on underlying problem structures (schema).
- Invest time regularly in building fluency with number.
- Monitor and motivate.

Source: Gersten, Chard, et al. (2009)

Remember!

- Your disposition to mathematics is important to your students.
- Much of their success depends on their curiosity, persistence, and engagement in their world.
- Their world and their understanding of it is dependent on their understanding mathematical ideas.
- I believe access to mathematical ideas, knowledge, and skills is a human right.