# Thinking about Instructional Routines in Mathematics Teaching and Learning

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# Plan for Tonight

- What are routines?
  - Daily Routines
- School and Classroom Routines
- What are Instructional Routines
- Instructional Routines in Mathematics Teaching and Learning
  - Mathematical Proficiency
  - Critiquing IRE and GRR
  - Unpacking Instructional Routines that support mathematical practices
  - Resources
  - Questions, Comments, & Compliments

# What are routines?

Routines are a significant part of our everyday lives. People use routines for all kinds of things.

- Routines are a sequence of actions regularly followed.
  - Routines give structure to time and interactions.
  - Routines provide a flow that governs the actions taking place.

# Daily Routines

Many people have regular routines. For example, a morning routine might include when one:

- Brush their teeth
- Take a shower
- Get dressed
- Eat breakfast and
- Drive to work.

It is likely that one might do these in the same order and in the same way each day. Daily routines might influence one's disposition throughout the day.

# Classroom Routines

Schools and classrooms flourish on routines. How else would a small number of adults survive 180 days among hundreds of energetic people. Many classrooms have routines like when and how students enter the room, how to submit classwork, when and how to access materials, and when and how to be excuse from the room (Ellis, 2018).

The issue is not whether schools and classrooms must have routines, that is a given. Rather, this issues are the nature of these routines and the interactions they intended to nurture (Ellis, 2018).

# What are Instructional Routines?

- Instructional routines are specific and repeatable designs for learning that support both the teacher and students in the classroom… enabling *all* students to engage more fully in learning opportunities while building crucial mathematical thinking habits. (Kelemanik, Lucenta, & Creighton, 2016).

- Instructional [routines] are tasks enacted in classrooms that structure the relationship between the teacher and the students around content in ways that consistently maintain high expectations of student learning while adapting to the contingencies of particular instructional interactions (Kazemi, Franke, & Lampert, 2009).

# What are Instructional Routines?

- Instructional routines are “designs for interaction that organize classroom instruction” (Lampert & Graziani, 2009).

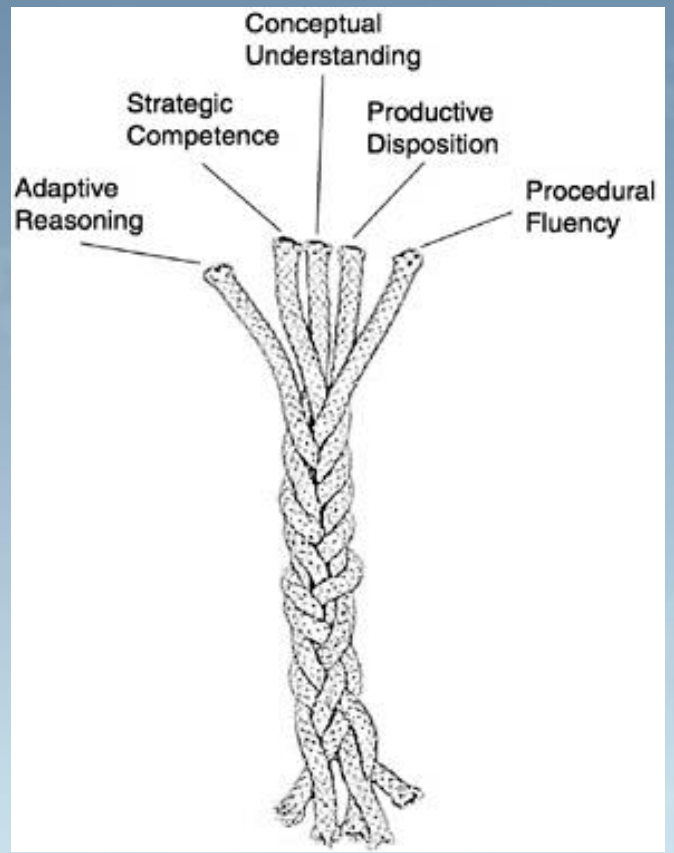
# Instructional Routines in Mathematics Classrooms

Routines are an essential part of mathematics classrooms because they give structure to time and interactions, letting students know what to expect in terms of participation, supporting classroom management and organization, and promoting productive classroom relationships for teaching and learning.

# Instructional Routines in Mathematics Classrooms

- Curriculum design and teacher planning are strongly influenced by considering which instructional routines will best support specific learning goals.
- Having clearly defined routines for interactions, discourse and habits support students' engagement in mathematical practices and their learning of mathematics content.
- A well-designed instructional routine opens up conversations and thinking about mathematics that might not happen by themselves (McCallum & Nowak, 2018).

# Five Interconnected Strands of Mathematical Proficiency




- Students with ***conceptual understanding*** know more than isolated facts and methods. They understand why a mathematical idea is important and the kinds of contexts in which it is useful.
- Students displaying ***procedural fluency*** know procedures and when to use them, and they can perform them flexibly, accurately, and efficiently.
- Students exhibiting ***strategic competence*** can formulate mathematical problems, represent them, and solve them.
- Students using ***adaptive reasoning*** can think logically about relationships among concepts and situations, consider alternatives, reason correctly, and justify conclusions.
- Students with a ***productive disposition*** see that mathematics makes sense and is both useful and worthwhile, and see themselves as effective learners and doers of mathematics. (Kilpatrick, Swafford, and Findell 2001, chap. 4)

# Mathematics Teaching and Learning

If the goal in mathematics teaching and learning is to support student success with mathematical proficiency, then we must be explicit about using instructional routines that focus on student engagement in activities that support reasoning and sense making, communication with and about mathematical ideas, making meaningful connections, building procedural fluency from conceptual understanding, and productive struggle.

# Instructional Routine

- Observational studies have documented that many mathematics classrooms employ a familiar instructional routine in which students mimic procedures demonstrated by the teacher. In this routine, students often take notes on the demonstrated procedure, and are then expected to apply by rote what was shown to them on a set of similar problems.

- Curriculum materials built around this routine structure questions to become progressively more difficult, but often the materials do not expect or encourage students to draw on their funds of knowledge gained outside the mathematics classroom.

# Initiation–Response–Evaluation

- "Initiation–Response–Evaluation (IRE)" is a common instructional routine observed in many mathematics lessons.
- It is a teacher-centered instructional routine with teacher-initiated explanations and questions, student responses to the teacher, and teacher evaluation of correctness.
  - Little emphasis is placed on students explaining their thinking, working through mathematical ideas publicly, making conjectures, or coming to consensus about mathematical ideas as a community of mathematical thinkers.

# I do—We do—You do

- The "I do—we do—you do" instructional routine used across several content areas is related to IRE. "I do—we do—you do" is sometimes described as a gradual release of responsibility (GRR) model.
  - "I do"—where the teacher demonstrates procedures before students attempt to solve problems on their own;
  - "We do"—students are guided by the teacher to model the procedures demonstrated; and
  - "You do"—where students practice the procedures demonstrated.

# I do—We do—You do

- "I do—we do—you do" as practiced in many mathematics classrooms, focuses on doing processes and procedures with little understanding of:
  - how and why they work or the appropriate use of different processes and procedures and how they can be applied in varied mathematical situations;
  - focus is on mimicry and memorization;
  - rather than deep mathematical thinking and understanding, flexible use of mathematical concepts, communication of mathematical arguments and justifications, and developing a positive disposition that values connections between mathematics and students' identities beyond the classroom.

# I do—We do—You do

- It is important that mathematics teachers use instructional routines that not only build procedural fluency through conceptual understanding but also support strategic competence, adaptive reasoning, and productive dispositions.

# You do—We do—I do

- "You do—we do—I do" is an adaptations that address the concerns of "I do—we do—you do"
  - "You do"—the teacher gives students a task to see what students know and understand. The task should have multiple entry points, have varied solution paths, and focus on mathematical processes. The teacher monitors the classroom for strategies and asks probing questions.
  - "We do"—after working on the task independently, students collaborate with peers in pairs or small groups.
  - "I do"—the teacher engages in instruction, pulling together the mathematical ideas that arose during "you do" and "we do."

# You do—We do—I do

- "You do—we do—I do" provides opportunities for students to engage in the mathematical practices that deepen their understanding of mathematical content and the practices.

# Orchestrating Productive Mathematics Discussions

1. Anticipating likely student responses to challenging math task
2. Monitoring students' actual responses to the task (while students work on the task)
3. Selecting particular students to present their mathematical work during whole group discussion
4. Sequencing student responses that will be displayed in a specific order
5. Connecting different students' responses and connecting to key mathematical ideas.

Stein, M. K., & Smith, M. (2018). 5 Practices for Orchestrating Productive Mathematics Discussions. *National Council of Teachers of Mathematics*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# Learning & Teaching Practices

## Standards of Mathematical Practices

1. Make sense of problems and persevere in solving them
2. Reason abstractly and quantitatively
3. Construct viable arguments and critique the reasoning of others
4. Model with mathematics
5. Use appropriate tools strategically
6. Attend to precision
7. Look for and make use of structure
8. Look for and express regularity in repeated reasoning

## Eight Mathematics Teaching Practices

1. Establish mathematics goals to focus learning.
2. Implement tasks that promote reasoning and problem solving.
3. Use and connect mathematical representations.
4. Facilitate meaningful mathematical discourse.
5. Pose purposeful questions.
6. Build procedural fluency from conceptual understanding.
7. Support productive struggle in learning mathematics.
8. Elicit and use evidence of student thinking.

# Instructional Routines in Mathematics

- **Notice & Wonder** can support students in making sense of problems and reasoning. (https://www.nctm.org/Classroom-Resources/Problems-of-the-Week/Extras/I-Notice-I-Wonder/)
- **Think-Pair-Share** can support constructing viable arguments and critique the reasoning of others.
- **Connect-Extend-Challenge** can support students connecting prior knowledge to new mathematical concepts.
- **Claim-Support-Question** can support constructing viable arguments and look for and make use of structure.
- **See-Think-Wonder** can support looking for and express regularity in repeated reasoning.

# Resources


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# Share

- Share instructional routines and resources you use that are supportive of effective mathematics teaching and learning.