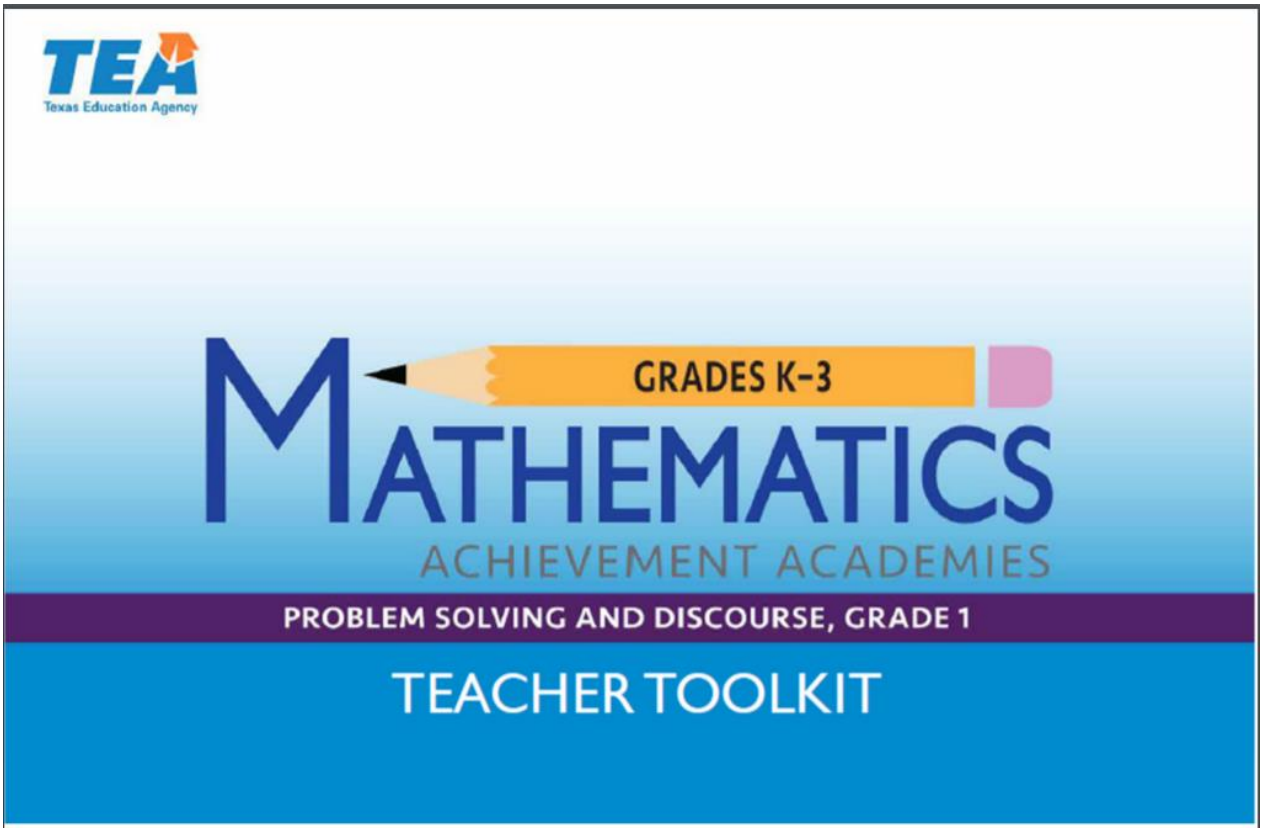



Tool Kit Cards Part II

## Three-Act Tasks

Act 1:

- Provide the context for the inquiry through a picture or video.
- Prompt students to share what they notice about the picture or video.
- Prompt students to generate questions through wonderings.
- Identify the main question to be explored.

Act 2:

- Provide more information to help students answer the identified question.
- Facilitate conversations about reasonable answers.
- Allow students to explore and answer the question.

Act 3:

- Reveal the solution.
- Facilitate follow-up conversations as appropriate.

# Justifying the Solution and Evaluating the Problem-Solving Process

Teacher Actions and Student Actions

The teacher will

- prompt problem solvers to summarize big ideas
- provide scaffolds to help problem solvers use mathematical language to build their justifications
- prompt problem solvers to reflect on their own problem-solving process

so that the problem solvers will

- use their learning in future situations.
- become agents of their own mathematical and linguistic sense making.
- become more proficient in problem solving.

Promoting Sense Making in Problem Solving

Clarifying Student Understandings

Will you elaborate on why your solution answers the question?

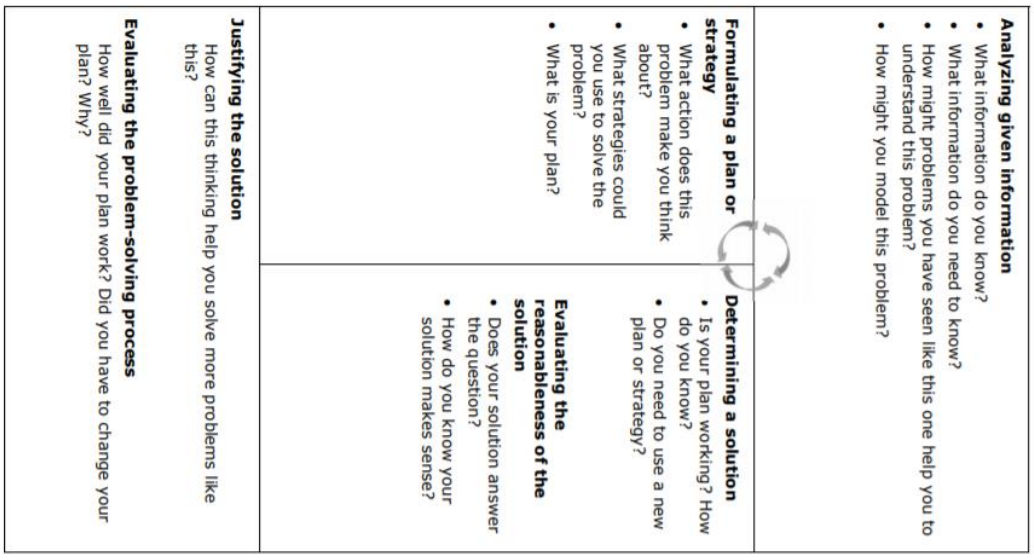
Clarifying Understanding of Classmates

- Who can repeat _____'s thinking about the justifying the solution and evaluating the problem-solving process part of the problem-solving model?
- Will someone say what they just heard about _____'s justification?

Supports for Diverse Learners



## Problem-Solving Prompt



## Proficient Problem Solvers

Analyze situations in mathematical terms.

Engage with problems willingly and persistently.

Consider simple cases of complex situations.

Recognize that some representations share common mathematical structures. Categorize problems into types.

Use flexibility in thinking.



## Exercise Versus Problem

An **exercise** asks a student to practice a familiar skill.

Exercises allow students to

- practice a specific mathematical skill,
- demonstrate what was just learned,
- develop automaticity with a mathematical skill, and
- practice a specific mathematical skill in a context related to real-life experiences.

A **problem** involves the application of previously learned mathematical skills, concepts, and/or procedures to a situation where a solution process is not immediately apparent.

Problems allow students to

- apply a learned mathematical concept or skill where a solution is not obvious,
- demonstrate understanding of multiple mathematical concepts or ideas and their connections to each other,
- enter into a mathematical task with their current mathematical knowledge,
- build upon prior knowledge, and
- build new mathematical knowledge.

## Five Practices for Mathematical Discussions

Anticipating
- What approaches will students most likely use to solve the problem?
- What misconceptions may students demonstrate?
- What responses will support students while they are solving the problem?

Monitoring
- What mathematical ideas are being shown and discussed?
- What mathematical promise do I hear?
- What approaches are students demonstrating that were not anticipated?

Selecting
- Which student works reflect the anticipated approaches to solve the problem?
- Which student works include misconceptions or missteps that will be shared?
- Which student works show the needed mathematical pieces?

Stein, M. K., Engle, R. A., Smith, M. S., & Hughes, E. K. (2008). Orchestrating productive mathematical discussions: Five practices for helping teachers move beyond show and tell. *Mathematical Thinking and Learning, 10, 313–340*.

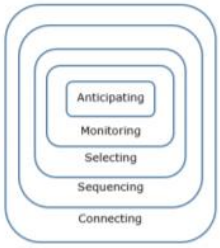


## Five Practices for Mathematical Discussions

Sequencing
- Do I start with the most used strategy and then the lesser used strategy? Why?
- Do I start with the least complex strategy? Why?
- Do I want to use complementary or contrasting strategies? Why?
- In what order will students share their approaches to the problem?

Connecting
- What questions will make the mathematics visible to the students?
- What connections and relationships will students make based on the shared approaches?
- What discussions about accuracy and efficiency can we have?

Each practice is built on the practices embedded within it.




Stein, et al., 2008, 322

## Equity-Based Practices for the Mathematics Classroom

| | |
|---|---|
| Going deep with mathematics | Expect students to analyze, compare, justify, and prove their solutions while providing needed support.<br>Provide tasks that are problems, allowing for multiple representations and solution strategies. |
| Leveraging multiple mathematical competencies | Identify and support mathematical contributions from all students.<br>Present tasks with multiple entry points that allow students to make meaningful contributions to the group's learning. |
| Affirming mathematics learners' identities | Problem solve to promote reasoning and persistence.<br>Learn from mistakes.<br>Encourage students to see themselves as mathematicians. |
| Challenging spaces of marginality | Connect students' knowledge and experiences with mathematics.<br>Increase opportunities for students to ask mathematical questions.<br>Encourage participation by all students and student-to-student interactivity. |
| Drawing on multiple resources of knowledge (math, culture, language, family, community) | Connect to prior mathematical learning.<br>Learn students' knowledge and experiences.<br>Learn from families and communities how to develop students as confident mathematicians.<br>Communicate strengths and needs of students to families to promote learning. |

Aguirre, J., Mayfield-Ingram, K., & Martin, D.B. (2013). *The impact of identity in K-8 mathematics: Rethinking equity-based practices.* Reston, VA: The National Council of Teachers of Mathematics.