Below we highlight how students use specific thinking strategies in Mathematical Problem Solving.[1]

→ thinking about their own thinking

Thinking Strategy	Cognitive Behaviors
Monitoring for Meaning	• Mathematicians are metacognitive as they continually ask themselves, "Does this make sense?" and "Is my answer reasonable?" • Mathematicians use accurate math vocabulary and show their work in clear concise forms so others can follow their thinking without asking questions.
Activating, Using and Building Background Knowledge (schema)	• Use their prior knowledge to generalize about similar problems and to choose problem solving strategies. • Mathematicians add to schema by trying more challenging problems and hearing for others about different problem solving methods.
Asking Questions	• Mathematicians test theories/answers/hypotheses by asking questions about various approaches to a problem. • Mathematicians extend their own thinking by asking themselves questions for which they don't have answers.
Drawing Inferences	• Mathematicians use patterns and relationships to generalize and infer what come next in the problem-solving process. • Mathematicians solve problems in different ways and support their methods through proof, number sentences, pictures, charts, and graphs.
Determining Importance	• Mathematicians gather text information from graphs, charts, and tables. • Mathematicians use key words to decide what information is relevant and irrelevant to a problem.
Creating Sensory Images	• Mathematicians use mental pictures/models of shapes, numbers, and processes to build an understanding of concepts and problems and to experiment with ideas. • Mathematicians visually represent their thinking through drawings, pictures, graphs, models, and charts.
Synthesizing Information	• Mathematicians generalize from patterns they observe. • Mathematicians synthesize math concepts when they use them in real-life applications.

These strategies are tools that "successful" math students use when they are solving math problems.

In what ways are you/can you teach students to use these strategies?

Let me know if you would like more information!

Sheri

[1] Adapted by Pearson/Dole revised Tovani & James Donouhue.

$y = a(x-h)^2 + k$

Planning a Content Area Workshop Lesson

(Based on the Gradual Release of Responsibility, Pearson & Gallagher, 1983)

What are your guiding questions:

What is essential for students to know?

1. Properties of the parent function of a quadratic
2. Effects of ...And be able to do: transformations in a formula on the graph of a quadratic
3. Graph a quadratic by examining its equation

How will you know when they get there? What "evidence" will indicate understanding?

↳ Students can connect properties between a graph, equation, & description of a quadratic

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Mini-Lesson
"I do; You help"

Anchor "Text":

How will you Create a "need to know":
- Show abs value examples. Does quadratic work the same way?

Which comprehension strategy will help students deeply understand content?
- using prior knowledge
- making predictions

How will you model the use of the strategy to help students:

- ❖ Highlight key ideas
- ❖ Negotiate the difficult parts? Model a difficult problem using technology. Annotate.

(Thinking aloud, modeling, demonstrating, sharing personal use of the strategy)

Guided Practice
"We Do it together"

Anchor Text:

What do students do with the information they are reading?

How will students hold their thinking while they read?

on the examples & graph paper

(Inviting participation via whole group experiences)

choose a couple to explain & annotate their thinking

Independent Practice
"You do; I help guide and Confer"

Text ideas:

How will their thinking be used toward a final product to demonstrate understanding?

How will they make their thinking visible and public?

How will independent practice be structured? (small groups, pairs, etc)

pairs

How will you check for understanding and plan for next steps?

- Conferring
- Notes on overhead
- Recording questions
-

Reflection & Assessment
"You do; I watch "

Text sets:

How will students make new insights ,and understandings public?

chart paper examples
silent chalkboard

How will students reflect on how they used comprehension strategies to help them understand (metacognition)?

- Did knowing 11 pattern help you to determine the quadratic pattern?

How will reflection & assessment guide your next instructional steps?

How can sharing be used as a way for peers to learn from each other? What structures will students use to give and receive feedback?

- Think- pair- share
- Quick write
- Exit slip
-

Quadratic

$\rightarrow y = a(x-h)^2 + k$