

Metacognitive Strategies Grades K-12

Metacognition refers to higher order thinking that involves active control over the cognitive processes engaged in learning (Montague, 1997). Activities such as planning how to approach a given learning task, monitoring comprehension, and evaluating progress toward the completion of a task are metacognitive in nature. Metacognitive strategies include mnemonic devices, problem-solving routines, self-monitoring skills, and the use of graphic organizers. Graphic organizers are designed to assist students in representing patterns, interpreting data, and analyzing information relevant to problem-solving.

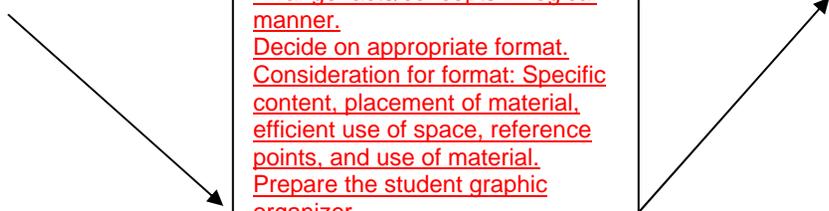
The introduction of metacognitive strategy instruction into lessons in algebraic thinking should not be considered an addition to the required content, but rather an array of research-based tools developed to facilitate the understanding, retention, and utilization of required course content. Metacognitive strategies allow a teacher to teach students how to think about what they are doing and learning. As developing learners, students should be taught these strategies in order to realize how they learn best. Metacognitive strategies are not only related to teaching algebraic thinking. These strategies can be used in all areas and subjects.

There are several metacognition tools included in this section. The following table shows a listing of some of the strategies with a short description of each.

METACOGNITION TOOLS

<u>Strategy / Usage</u>	<u>Examples</u>						
<p>Mnemonic Devices</p> <p>(Nagel, Schumaker, & Deshler, 1986)</p> <p>Strategies that students and teachers can create to help students remember content. The verbal information promotes recall of unfamiliar information and content.</p>	<p>FIRST is a mnemonic device for creating mnemonics.</p> <p>F - Form a word (Example: FIRST) I - Insert extra letters to form a mnemonic. (If needed) R - Rearrange the first letters to form a mnemonic word. S - Shape a sentence to form a mnemonic. T - Try combinations of the first four steps to create a mnemonic</p> <p>Please Excuse My Dear Aunt Sally or PEMDAS to remember the order of operations</p> <p>Parenthesis, Exponent, Multiplication & Division (left to right), Addition & Subtraction (left to right)</p>						
<p>Prior Knowledge Prompt</p> <p>Relates new learning to existing knowledge.</p>	<p>K-W-L promotes learning by helping students retrieve relevant information and learn with awareness. (Ogle, 1986)</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;">(K)</td> <td style="text-align: center;">(W)</td> <td style="text-align: center;">(L)</td> </tr> <tr> <td style="height: 20px;"></td> <td style="height: 20px;"></td> <td style="height: 20px;"></td> </tr> </table> <p>How to use: <u>Before introduction of a topic, students write down and discuss, what they know (k) (or think they know) and what they want (w) to learn about the topic.</u></p> <p>During the study, the teacher responds to and/or corrects any of the information originally discussed about the topic and students record what they learned (L).</p>	(K)	(W)	(L)			
(K)	(W)	(L)					

<u>Strategy / Usage</u>	<u>Examples</u>
<p>Problem Solving</p> <p>Strategies provide steps to follow in solving problems. It is very common to use a mnemonic to outline the steps to solve a problem.</p>	<p>FAST is a mnemonic device for basic problem solving. Find what you're solving for. Ask yourself, "What are the parts of the problem?" Set up the numbers. Take down the sign.</p> <p>CAP is mnemonic device for solving basic one-variable algebra equations Combine like terms. Ask yourself, "How can I isolate the variable?" Put the value of the variable in the initial equation and check if the equation is balance.</p> <p>STAR Strategy (adapted from the Strategic Math Series (Mercer & Miller, 1991) includes six elements in each lesson: provide an advanced organizer, describe and model, conduct guided practice, conduct independent practice, give post-test, and provide feedback.</p> <p>Search the word problem A) read the problem carefully B) Ask yourself questions: "What facts do I know?" "What do I need to find?" C) Write down facts</p> <p>Translate the words into an equation in picture form A) Choose a variable B) Identify the operation(s) C) Represent the problem with Algebra Lab Gear (concrete application) Draw a picture of the representation (semi concrete application) Write an algebraic equation (abstract application)</p> <p>Answer the problem Review the problem A) Reread the problem B) Ask question, "Does the answer make sense? Why?" C) Check Answer</p>

<u>Strategy / Usage</u>	<u>Examples</u>
<p>Graphic/visual organizers</p> <p>Visual, pictorial displays of information purposefully arranged in a meaningful way. The common attribute underlying the various graphic organizers is the visual-spatial arrangement of information linking words or statements that are connected in a meaningful way.</p>	<div data-bbox="669 289 1029 792" style="border: 1px solid black; padding: 5px;"> <p><u>Purpose:</u> <u>Graphic/visual organizers are visual, pictorial displays of information purposefully arranged in a meaningful way. The common attribute underlying the various graphic organizers is the visual-spatial arrangement of information linking words or statements that are connected in a meaningful way.</u></p> </div> <div data-bbox="1029 625 1434 1149" style="border: 1px solid black; padding: 5px;"> <p><u>How to use:</u> <u>Select the material to be included in the graphic organizer.</u> <u>Determine the facts or concepts to be learned.</u> <u>Arrange facts/concepts in logical manner.</u> <u>Decide on appropriate format.</u> <u>Consideration for format: Specific content, placement of material, efficient use of space, reference points, and use of material.</u> <u>Prepare the student graphic organizer.</u></p> </div> <div data-bbox="1434 289 1770 792" style="border: 1px solid black; padding: 5px;"> <p><u>Possible Adaptations:</u> <u>Use only pictures for students in primary grades.</u></p> <p><u>Students construct their own graphic organizers.</u></p> </div> 

**Cooperative Learning
Interactive Structures**
(Kagan, 1994)

Students work in groups for a purpose assigned by the teacher. These activities allow students who differed in achievement, gender, race, and/or ethnicity to work together and learn from each other. There are FIVE critical elements for cooperative learning groups:

1. positive interdependence
2. individual accountability
3. group processing
4. social skills
5. face-to-face interaction.

- ❖ Implementation of Cooperative Learning
- ❖ Decide on the size and the members of each group. (Heterogeneous groups).
- ❖ Arrange the room for teacher monitoring and student face-to-face interactions without disruptions to other groups.
- ❖ Plan instructional materials to promote positive interdependence.
- ❖ Assign roles to ensure interdependence and accountability to each member.
- ❖ Explain the academic task.
- ❖ Structure and provide feedback towards positive social skills.
- ❖ Structure individual accountability (quizzes, verbal responses, etc.).
- ❖ Explain criteria for success.
- ❖ Monitor and reinforce appropriate and specified behaviors.
- ❖ Provide task assistance, as needed, to the entire group.
- ❖ Intervene to teach collaborative skills.
- ❖ Provide closure to the lesson.

Provide for a group processing activity to evaluate and discuss the activity.
Evaluate quality and quantity of assignment and group functioning.

Advanced Organizer

(Ausabel, Novak, & Hanesian, 1978)

Call students' attention to the benefits that they should receive from engaging in a task, and help them establish a categories or sets to use when guiding their responses. The use of an advance organizer has shown to provide overview information and a cognitive map for students to organize their incoming information.

Examples of Advance Organizers:

- ❖ Inform the students of the use of an advance organizer.
- ❖ Identify the major topics and tasks.
- ❖ Provide an organizational framework.
- ❖ Clarify the action to be taken/completed.
- ❖ Provide background information.
- ❖ State concepts to be learned.
- ❖ Clarify concepts to be learned.
- ❖ Motivate students to learn through establishing relevance.
- ❖ Introduce and identify new vocabulary.
- ❖ State general outcomes and objectives to be mastered.

Further research completed at the Center for Research on Learning (1993) found that students with disabilities must be cued to the use of the organizer before its use if the instructional strategy is to have maximum benefit. Refer to Content Enhancement Routines on page 33 of this section.

Content Enhancement Routines and Strategic Instruction Model

Based on the selection of powerful teaching devices that are implemented collaboratively with students through the use of specific outcome-focused teaching routines. Devices are used to create powerful teaching routines for presenting content to groups.

Concept Enhancement Routines:

Content Enhancement Routines are teaching devices and routines that are developed and used with the following explicit goals:

- ❖ Meeting the needs of both the group and the individual.
- ❖ Maintaining the integrity of the content.
- ❖ Selecting the critical features of the content.
- ❖ Transforming the content in ways that promote student learning.
- ❖ Carrying out instruction in a partnership with students.

Examples of Content Enhancement Routines:

- ❖ Concept Mastery
- ❖ Framing
- ❖ Vocabulary LINCing
- ❖ Unit Organizer
- ❖ Concept Anchoring
- ❖ Course Organizer
- ❖ Lesson Organizer
- ❖ Survey
- ❖ Concept Comparison
- ❖ Clarifying
- ❖ Recall Enhancement

For more information on the routines or how to obtain professional development contact:

<http://www.ku-crl.org/htmlfiles/cecurriculum/cedescription.html>

<http://www.ku-crl.org/htmlfiles/cecurriculum/ce.html>

<http://reach.ucf.edu/~CENTRAL>

www.fdlrs.com

Creating Independence through Student owned Strategies (CRISS) Program

Students learn to become strategic thinkers and learners when teachers teach the process of learning directly through explanation and modeling.

Most students do not know how to learn. Teachers have to show them how. When introducing a new strategy, teachers need to take the stage. They show, tell, model, demonstrate and explain not only the content, but also the process of active learning. As the student learns, there is a **gradual** release of responsibility from the teacher to the student. The first part is an *explanation* of what the strategy is and why students use it to improve their comprehension and retention. If the students do not know why they are performing an activity, they rarely repeat the behavior on their own. The second part is *modeling* or a demonstration and discussion of the procedures for doing the strategy. During this part, teachers model or ask students to model how to do a particular task. They discuss, demonstrate and think aloud while modeling. After the teacher has modeled a particular strategy, students have opportunities to practice with guidance and feedback. Moreover, students are encouraged to talk about strategies they find to be personally effective. For more information please contact: <http://www.northstar.k12.ak.us/federal/CRISSindex.htm>