

# Mediating the Metacognitive

Students can learn to understand and articulate their mental processes if teachers specifically encourage thinking about thinking.

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**T**ry to solve this problem in your head:  
How much is one half of two plus two?

Did you hear yourself talking to yourself? Did you have to decide if you should take one half of the first two or if you should sum the two's first?

If you caught yourself having an inner dialogue inside your brain, and if you had to evaluate your own decision-making/problem-solving processes, you were experiencing *metacognition*. Metacognition is our ability to know what we know and what we don't know. It occurs in the cerebral cortex and is thought by some neurologists to be uniquely human.

Metacognition is our ability to plan a strategy for producing what information is needed, to be conscious of our own steps and strategies during the act of problem solving, and to reflect on and evaluate the productivity of our own thinking. While inner language, thought to be a prerequisite, begins in most children around age five, metacognition—a key attribute of formal thought—flowers at about age eleven. Interestingly, not all humans achieve the level of formal operations (Chiabetta, 1976). And, as Luria, the Russian psychologist found, not all adults metacognate (Whimbey and Whimbey, 1976).

Students often follow instructions or tasks *without* wondering why they are doing what they are doing. They seldom question themselves about

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their own learning strategies or evaluate the efficiency of their own performance. Some children have virtually no idea of what they are doing when they perform a task and are often unable to explain their strategies for solving problems (Sternberg and Wagner, 1982). There is much evidence, however, to demonstrate that those who persevere in problem solving; who think critically, flexibly, and insightfully; and who can consciously apply their intellectual skills are those who possess well-developed metacognitive abilities (Bloom and Broder, 1950; Brown, 1978; Whimbey, 1980). Such people also effectively manage their intellectual resources. These resources include: (1) basic perceptual-motor skills; (2) language, beliefs, knowledge of content, and memory processes; and (3) purposeful and voluntary strategies intended to achieve a desired outcome (Aspen Systems, 1982).

If we wish to develop intelligent behavior as a significant outcome of education, instructional strategies purposefully intended to develop children's metacognitive abilities must be infused into our teaching methods, staff development, and supervisory processes (Costa, 1981). Interestingly, *direct* instruction in metacognition may *not* be beneficial. When strategies of problem solving are imposed rather than generated by the students themselves, their performance may be impaired. Conversely, when students experience the need for problem-solving strategies, induce their own, discuss them, and practice them to the degree that they become spontaneous and unconscious, their metacognition seems to improve (Sternberg and Wagner, 1982). The trick, therefore, is to teach metacognitive skills without creating an even greater burden on students' ability to attend.

Probably the major component of metacognition is developing a plan of action and then maintaining that plan in mind over time. Planning a strategy before embarking on a course of action assists us in keeping track of the steps in the sequence of planned behavior at the conscious awareness level for the duration of the activity. It facilitates making temporal and comparative judgments; assessing readiness for more or different activities; and monitoring our interpretations, perceptions, decisions, and behaviors. An example of this is what superior teachers do daily: develop a teaching strategy for a lesson, keep that strategy in mind throughout the instruction, then reflect upon the strategy to evaluate its effectiveness in producing the desired student outcomes.

Rigney (1980) identified the following self-monitoring skills as necessary for successful performance on intellectual tasks:

- Keeping one's place in a long sequence of operations.
- Knowing that a subgoal has been obtained.
- Detecting errors and recovering from those errors either by making a quick fix or by retreating to the last known correct operation.

Such monitoring involves both looking ahead and looking back. Looking ahead includes:

- Learning the structure of a sequence of operations.
- Identifying areas where errors are likely.
- Choosing a strategy that will reduce the possibility of error and will provide easy recovery.

● Identifying the kinds of feedback that will be available at various points and evaluating the usefulness of these kinds of feedback.

Looking back includes:

- Detecting errors previously made.

- Keeping a history of what has been done so far and therefore what should come next.

- Assessing the reasonableness of the present immediate outcome of task performance.

A simple example of this might be drawn from a reading task. It is a common experience while reading a passage to have our minds wander from the words. We see the words, but no meaning is being produced. Suddenly we realize that we are not concentrating and that we've lost contact with the meaning of the text. We recover by returning to the passage to find the place, matching it with the last thought we remember, once having found it, we read on with connectedness. This inner awareness and the strategy of recovery are components of metacognition.

### Strategies for Enhancing Metacognition<sup>1</sup>

Teachers can use a variety of strategies to enhance metacognition, independent of grade level and subject area.

1. *Planning Strategy.* Prior to any learning activity, teachers should point out strategies and steps for attacking problems, rules to remember, and directions to follow. Time constraints, purposes, and ground rules under which students must operate should be identified and internalized. Making these guidelines explicit helps students keep them in mind during the lesson and gives them a way to evaluate their performance afterwards.

*During* the activity, teachers can invite students to share their progress, thought processes, and perceptions of their own behavior. Asking students to indicate where they are in their strategy, to describe their trail of thinking up to that point, and to define alterna-

tive problem-solving pathways they intend to pursue next helps them become aware of their own behavior. It also provides teachers with a diagnostic cognitive map of students' thinking, which can be used to give more individualized assistance.

Then, *after* the learning activity, teachers can invite students to evaluate how well the rules were obeyed, how productive the strategies were, whether the instructions were followed correctly, and whether alternative, more efficient strategies could be used in the future.

I know a kindergarten teacher who begins and ends each day with a class meeting. During the morning, children make plans for the day. They decide upon what learning tasks to accomplish and how to accomplish them. They allocate classroom space, assign roles, and develop criteria for appropriate conduct. Throughout the day the teacher calls attention to the plans and ground rules made that morning and invites students to compare what they are doing with what was agreed. Then, before dismissal, another class meeting is held to reflect on, evaluate, and plan further strategies and criteria.

2. *Generating Questions.* Regardless of the subject area, it is useful for students to pose study questions for themselves prior to and during their reading of textual material. This self-generation of questions facilitates comprehension and encourages students to pause frequently and think about whether, for instance, they know main characters or events, if they are grasping the concept, if they can relate it to what they already know, if they can give other examples, and whether they can use the main idea to explain other ideas or predict what may come next. They must then de-

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cide what strategic action to take to remove any obstacles to their comprehension. All of this helps students become more self-aware and to take conscious control of their own studying (Sanacore, 1984).

3. *Choosing Consciously.* Teachers can promote metacognition by helping students explore the consequences of their choices and decisions prior to and during the act of deciding. Students will then be able to perceive causal relationships among their choice, their actions, and the results they achieved. Providing nonjudgmental feedback to students about the effects of their behaviors and decisions on others and on their environment helps them become aware of their own behaviors. For example, a teacher's statement, "I want you to know that the noise you're making with your pencil is disturbing me," will better contribute to metacognitive development than the command, "John, stop tapping your pencil!"

4. *Evaluating with Multiple Criteria.* Teachers can enhance metacognition by causing students to reflect upon and categorize their actions according to two or more sets of evaluative criteria. An example would be to invite students to distinguish what was done that was helpful and hindering; what they liked and didn't like; or what were pluses and minuses of the activity. Thus, students must keep the criteria in mind, apply them to multiple classification systems, and justify their reasons accordingly.

5. *Taking Credit.* Teachers may cause students to identify what they have done well and invite them to seek feedback from their peers. The teacher might ask, "What have you done that you're proud of?" and "How would you like to be recognized for doing that?" (Name on the board, hug, pat on the back, handshake, applause from the group, and so on.) Students



Senior Megan Dull

will become more conscious of their own behavior and apply a set of internal criteria for those behaviors that they consider good.

6. *Outlawing "I Can't."* Teachers can inform students that their excuses—"I can't"; "I don't know how to ..."; or "I'm too slow to ..."—are unacceptable behaviors in the classroom. Instead, students should be asked to identify what information is required, what materials are needed, or what skills are lacking in their ability to perform the desired behavior. This helps students identify the boundaries between what they know and what they need to know. It develops a perseverant attitude and enhances the student's ability to create strategies that will produce needed data.

**"Metacognition is our ability to know what we know and what we don't know."**

7. *Paraphrasing or Reflecting Back Students' Ideas.* Some examples of paraphrasing, building upon, extending, and using students' ideas might be to say: "What you're telling me is . . ."; "What I hear in your plan are the following steps . . ."; or "Let's work with Peter's strategy for a moment." Inviting students to restate, translate, compare, and paraphrase each other's ideas causes them to become not only better listeners of other's thinking, but better listeners to their own thinking as well.

8. *Labeling Students' Behaviors.* When teachers place labels on students' cognitive processes, students become conscious of their own actions: "What I see you doing is making out a plan of action for . . ."; "What you are doing is called an experiment"; "You're being very helpful to Mark by sharing your paints. That's an example of cooperation."

9. *Clarifying Students' Terminology.* Students often use hollow, vague, and nonspecific terminology. For example, in making value judgments, students might say, "It's not fair," "He's too strict," "It's no good." Teachers need to clarify these values: What's too strict? What would be more fair?

Students sometimes use nominalizations: "They're mean to me." Who are *they*? "We had to do that." Who is *we*? "Everybody has one." Who is *everybody*? Asking such clarifying questions causes students to operationally define their terminology and to examine the premise on which their thinking is based.

It is also helpful to clarify students' problem-solving processes. Causing students to describe their thinking while they are thinking seems to beget more thinking. Teachers can invite students to talk aloud as they are solving a problem; discuss what is going on in their heads, for example, when they decode an unfamiliar word while

reading; or ask what steps they are going through in deciding whether to buy something.

After a problem is solved, teachers can invite clarification of the processes used: "Sarah, you figured out that the answer was 44; Shawn says the answer is 33. Let's hear how you came up with 44; retrace your steps for us." Clarifying helps students to reexamine their own problem-solving processes, to identify their errors, and to self-correct. The teacher might ask, "How much is three plus four?" The student may reply "12." Rather than merely correcting the student, the teacher may choose to clarify: "Gina, how did you arrive at that answer?" "Well, I multiplied four and three and got . . . Oh, I see, I multiplied instead of added."

10. *Role Playing and Simulations.* Role playing can promote metacognition because when students assume the roles of other persons, they consciously maintain the attributes and characteristics of that person. Dramatization serves as a hypothesis or prediction of how that person would react in a certain situation. Taking on another role contributes to the reduction of ego-centered perceptions.

11. *Journal Keeping.* Writing and illustrating a personal log or a diary throughout an experience causes students to synthesize thoughts and actions and to translate them to symbolic form. The record also provides an opportunity to revisit initial perceptions, to compare changes in those perceptions with the addition of more data, to chart the processes of strategic thinking and decision making, to identify the blind alleys and pathways taken, and to recall the successes and the tragedies of experimentation. (A variation on writing journals is making video and/or audio tape recordings of actions and performances.)

12. *Modeling.* Of all the instruction-

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al techniques suggested, the one with the probability of greatest influence on students is that of teacher modeling. Since students learn best by imitating the adults around them, the teacher who publicly demonstrates metacognition will probably produce students who metacognate. Some indicators of teachers' public metacognitive behavior might be: sharing their planning—describing their goals and objectives and giving reasons for their actions; making human errors and then illustrating recovery from those errors by getting back on track; admitting they do not know an answer but designing ways to produce an answer; seeking feedback and evaluation of their actions from others; having a clearly stated value system and making decisions consistent with that system; being able to self-disclose—using objectives that describe their own strengths and weaknesses; demonstrating understanding and empathy by listening to and accurately describing the ideas and feelings of others.

### Evaluating Growth in Metacognitive Abilities

We can determine if students are becoming more aware of their own thinking as they are able to describe what goes on in their heads when they are thinking. When asked, they can list the steps and tell where they are in the

sequence of a problem-solving strategy. They can trace the pathways and dead ends they took on the road to a problem solution. They can describe what data are lacking and their plans for producing those data.

We should see students becoming more perseverant when the solution to a problem is not immediately apparent. This means that they have systematic methods of analyzing a problem, knowing ways to begin, knowing what steps must be performed and when they are accurate or are in error. We should see students taking more pride in their efforts; becoming self-correcting, striving for craftsmanship and accuracy in their products, and becoming more autonomous in their problem-solving abilities.

Teaching for thinking is becoming the great educational discovery for the 80s. Metacognition is an indicator of the "educated intellect" and must be included in the curriculum if thinking is to become a durable reality for the 90s and beyond. □

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