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Developing Minds
A Resource Book for Teaching Thinking

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3rd Edition

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3RD EDITION

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terns and understand assumptions and biases underlying particular positions; attain a credible, concise, and convincing style of presentation or argument.

- **Creative thinking:** Using basic thinking processes to develop or invent novel, aesthetic, constructive ideas or products from percepts as well as concepts. Stresses the initiative aspects of thinking as much as the rational. Emphasis is on using known information or material to generate the possible, as well as to elaborate on the thinker's original perspective or design.

These complex processes obviously draw on and expand the underlying essential skills. Certain of the essential skills may be more significant to one complex process than another, but current research has not clarified such relationships. What seems most important to developing effective thinkers is building on an appropriate foundation. Learners should develop early competence, and then in middle or junior high school be introduced to the more complex processes in specific content matter that is closely related to the use of such skills.

Middle school or early junior high school is an appropriate time for beginning instruction about higher-order skills or complex thinking processes. The adolescent learner's growing cognitive capacities are ripe for the challenges of more complex thinking (Presseisen, 1982). Elementary students can benefit from early exposure to varied thinking processes and different modes of presentation, but they probably can approach more complex sequences only as they gain experience and apply similar skills in multiple content areas. In Chapter 7 of this volume, Beyer suggests that an effective thinking skills curriculum will introduce only a limited number of skills at a particular grade level, will teach these across all appropriate content areas, and will vary the modes and content of presentation. Subsequent grades should enlarge the thinking skills base and provide additional, and more elaborate, applications of skills already introduced.

Some complex thinking processes may be more relevant to certain subject areas than to others. For example, problem-solving skills seem ideal for mathematics or science instruction. Decision making might be especially useful for social studies and vocational studies; critical thinking might be more relevant for the debate team, language arts class, and courses in democracy or American government. Creative thinking might enhance all subjects but be particularly meaningful in art, music, or literature programs. Most important, the goals of the specific complex process and the objectives for learning in a given subject area should be parallel and reinforcing.

Figure 9.2 presents a suggested model of complex thinking processes, noting the essential skills that underlie each. This model is not necessarily comprehensive; potential additions might be examined in terms of how they compare to these four complex processes, the underlying skills, and the ultimate outcomes. Kuhn's (1999) recent work, for example, elaborates extensively on critical thinking.

METACOGNITION AND THINKING

A useful taxonomy of thinking must somehow account for metacognitive aspects of the current thinking skills movement. According to Flavell (1976, p. 232), " 'metacognition' refers to one's knowledge concerning one's own cognitive processes and products." Learners must actively monitor their use of thinking processes and regulate them according to their cognitive objectives. Henle (1966) considers such regulation the essence of autonomous self-education. Costa (1991) sug-

—Figure 9.2—

A Model of Complex Thinking Skills

	Problem Solving	Decision Making	Critical Thinking	Creative Thinking
Task:	Resolve a known difficulty	Choose the best alternative	Understand particular meanings	Create novel or aesthetic ideas or products
Essential Skills Emphasized:	Transforming Conclusions	Classifying Relationships	Relationships Transforming Conclusions	Qualifying Relationships Transforming
Yields:	Solution Generalization (potentially)	Assessment	Sound reasons Proof Theory	New meanings Pleasing products

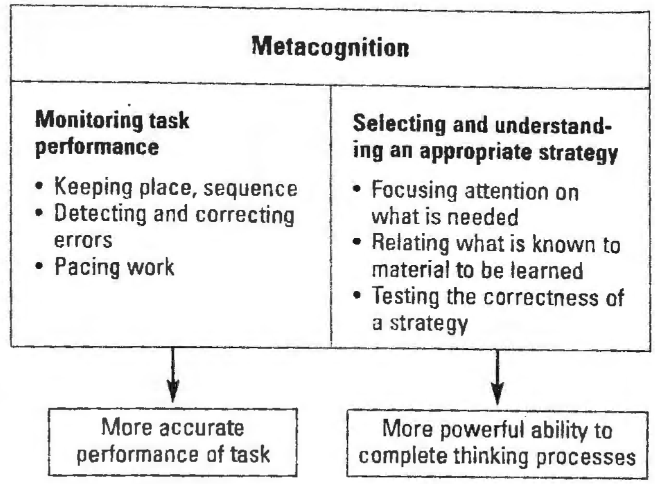
gests that this ability to "know what we know and what we don't know" is a uniquely human trait, but not necessarily one that all adults acquire. He proposes metacognitive skills as a key attribute of formula thinking or higher-process skills instruction, and stresses that the teacher's classroom methodology must constructively deal with metacognition. Other researchers maintain that metacognitive skills are also significant factors in developing subject-skilled performers.

One of the most salient characteristics of metacognition is that it involves growing consciousness. One becomes more aware of the thinking processes themselves and their specific procedures, as well as more conscious of oneself as a thinker and performer. As learners acquire understanding of what the various thinking processes are, they can better understand and apply them. Thus, some researchers, such as Beyer and Feuerstein, suggest that, initially, thinking skills be taught directly and in relatively content-free situations.

Metacognitive thinking has two main dimensions. The first is task-oriented and relates to monitoring the actual performance of a skill. The second dimension is strategic: It involves selecting a strategy appropriate to the circumstances and seeking feedback to affirm or alter that choice. Figure 9.3 illustrates these dimensions of metacognition.

—Figure 9.3—

A Model of Metacognitive Thinking Skills



Monitoring task performance requires learners to be aware of their own activities. Students cannot tell if they are at the right place if they do not know the assigned task, the directions for completing it, and the sequence of steps they should follow. They might be advised to discriminate subgoals of a task and relate them to ultimate objectives. In a mathematics reading problem involving averaging, for example, students might identify addition as the first step and division as the second step in determining the answer. Detecting errors while working may involve checking or proofreading, rereading passages, or recalculating or retranslating material. Allocating time for specific tasks and checking coverage in qualitative dimensions ("Is my outline extensive enough?") are aspects of pacing the completion of an assignment. The metacognitive thesis is that any and all of these behaviors can enhance performance of the task. Often these same behaviors are also characteristic of sound study skills.

With regard to selecting appropriate strategies to work by, metacognitive theory suggests that the first order of learning is to recognize the particular problem and determine what information is needed to resolve it and where to obtain such data. Through such consideration, the student comes to recognize the limitations of the learning and the ultimate boundaries of the solution being sought. Sternberg (1984) considers these the "executive processes" of sound reasoning. Flavell (1976, p. 234) refers to the various aspects of information retrieval in learning to think—remembering, monitoring, and updating information—and draws parallels between classroom learning and experiences involving thinking in the world outside school. Henle (1966, p. 57) suggests that recognizing what is understood and to what degree ultimately helps learners come to terms with the power of their own thoughts. Consider, for example, the importance of knowing the difference between a wild guess, an informed guess, a hypothesis, an intuition, and a fact. Finally, testing the accuracy of a strategy means applying various evaluative criteria and determining if, in fact, the right approach is being employed. The learner has an opportunity to assess the initial selection of strategy, as well as to develop insight into a potentially better choice. The result is a more holistic understanding of strategy and the development of fluency or competence in a particular strategy. From the metacognitive viewpoint, the thinker becomes more autonomous as these strategic skills are developed and refined.

CONATION AND THE IMPORTANCE OF AFFECT AND ENVIRONMENT

Recent research has emphasized the influence of the more affective aspects of thinking on students' cognitive performance (see, for example, McCombs & Marzano, 1989). What researchers call "conation"—an inclination to think clearly and to develop and consistently use rational attitudes and practices—may be crucial to the fostering of thoughtful learners. Metacognitive understanding assumes a relationship between skill and will that enables a problem solver to stick to a

...: how do we learn? How and why do mental disorders occur? What happens when part of the brain is damaged? Such resources as Richard Restak's book *The Brain* (1984); Nancy Margulies's and Robert Sylwester's teaching kits, *Discover Your Brain* (1998), and Margulies's comic book series, *Inside Brian's Brain* (1997); Kapil Gupta's *Human Brain Coloring Workbook* (1997); and Rebecca Treays's *Understanding Your Brain* (1995) would be helpful.

METACOGNITION

Being conscious of our own thinking and problem solving during the acts of thinking and problem solving is known as metacognition. It is a uniquely human ability occurring in the neo-cortex of the brain. Interestingly, it has been found that good problem solvers employ metacognition—planning a course of action before beginning a task, monitoring themselves during execution of a plan, backing up or adjusting a plan consciously, and evaluating themselves upon completion.

Metacognition in the classroom might be characterized by having discussions with students about what is going on inside their heads while thinking is occurring; comparing different students' approaches to problem solving and decision making; identifying what is known, what needs to be known, and how to produce that knowledge; or having students think aloud while problem solving.

Metacognition instruction would include learning how to learn; how to study for a test; and how to use strategies of question asking before, during, and after reading. It might include helping students become acquainted with their own and other's learning styles; the intelligences in which they excel; their own learning preferences such as visual, auditory, or kinesthetic; and strategies that can help them in situations that do not match their best learning modalities.

GREAT THINKERS

Students should be exposed to others—scientists, artists, composers, anthropologists, philosophers—who solve problems well and whose products of creative and critical thought have left a significant and lasting impact on society: Confucius, Marie Curie, Charles Darwin, Emily Dickinson, Thomas Edison, Albert Einstein, Benjamin Franklin, Mahatma Gandhi, Vincent van Gogh, Langston Hughes, Wolfgang Mozart, Isaac Newton, Louis Pasteur, and Leonardo da Vinci. Their logic, creativity, perseverance, and risk-taking are models of the types of behavior we wish to instill in our youth.

It would be desirable if students would respect these traits in people with whom they interact—not only in such noteworthy scientists, artists, and historians. Ideally, students will learn to appreciate the productive, efficient thinking and problem solving shown by mechanics who use efficient and precise ways of repairing automobiles; parents who manage their impulsivity when emotionally overwrought; entrepreneurs who seek creative ways to offer innovative services and products; and, yes, even teachers who plan, monitor, evaluate, and strive to perfect their instructional skills.

EPISTEMIC COGNITION

Epistemology is the study of how knowledge is produced and the methods of inquiry of the various disciplines of science, anthropology, psychology, art, drama, poetry, economics, history, and so on. It might include discussions of questions such as:

- How do the work processes of scientists and artists differ?
- What are the processes by which scientific truths are discovered and proven?
- What are the processes of inquiry used by anthropologists as they live with and study a culture?
- What goes on inside a maestro's mind as she conducts an orchestra?
- What was it about Mozart's genius that allowed him to "hear" a total musical composition before writing it down?
- What is that process by which poets create?
- Why can't we use processes of scientific inquiry to solve social problems?

Epistemic cognition is the study and comparison of the methods of the great artists, scientists, and scholars, and the differential processes of investigation, inquiry, and creativity that underlie their productivity.

For an example of how the Michigan State Assessment of Educational Performance approaches epistemic cognition, see Figure 57.1.

Matthew Lipman's program, *Philosophy for Children* (1991), is especially well suited for this approach. Other resources include David Perkins's book *The Mind's Best Work* (Harvard University Press, 1981); Carol Madigan and Ann Elwood's book *Brainstorms and Thunderbolts: How Creative Genius Works* (Macmillan Publishers, 1983); and Howard Gardner's book *Art, Mind, and Brain* (Basic Books, 1982).

—*Figure 60.4*—
Instructions That Teach Meaning

Instead of Saying:
"For our field trip, remember to bring spending money, comfortable shoes, and a warm jacket."
"The bell has rung; it's time to go home. Clear off your desks quietly and line up at the door."
"Get 52 cups, 26 scissors, and 78 sheets of paper to cover the desks."
"Remember to write your name in the upper right-hand corner of your paper."

Say:
"What must we remember to bring with us on the field trip?"
"The bell has rung. What must we do to get ready to go home?"
"Everyone will need two paper cups, a pair of scissors, and three sheets of paper. The desktops will need to be protected. Can you figure out what you'll need to do?"
"So that I can easily tell who the paper belongs to, what must you remember to do?"

—*Figure 60.5*—
Avoiding Generalizations

When You Hear:
"He *never* listens to me."
"*Everybody* has one."
"*Things* go better with . . ."
"Things *go* better with . . ."
"Things go *better* with . . ."
"You *shouldn't* do that . . ."
"The *parents* . . . "
"I want them to *understand* . . . "
"This cereal is *more nutritious*."
"*They* won't let me . . ."
"*The administrators* . . ."

Say:
"Never? Never, ever?"
"Everybody? Who, exactly?"
"Which things, specifically?"
"Go? Go how, specifically?"
"Better than what?"
"What would happen if you did?"
"Which parents?"
"What exactly will they be doing if they understand?"
"More nutritious than what?"
"Who are they?"
"Which administrators?"

come aware of the effects of their behavior on others, and to become more empathetic by sensing verbal and nonverbal cues from others.

GIVING DIRECTIONS

When giving directions, teachers often spoonfeed students by providing so much information that they can comply without having to infer meaning (Figure 60.4). Instead, teachers can ask questions that require students to analyze a task, identify what is needed to complete the task, and then perform the task.

PROBING FOR SPECIFICITY

Oral language is rife with omissions, vagueness, and generalizations. It is conceptual rather than operational; value laden; and sometimes deceptive. To encourage careful thinking, teachers should try to get students to define terms, be specific about actions, make precise comparisons, and use accurate descriptors (Laborde, 1984). They should be alert to vague or unspecified terms, which fall into several categories:

- Universals, including *always, never, all, everybody*.
- Vague actions, such as *know about, understand, appreciate*.
- Comparisons, such as *better, newer, cheaper, more nutritious*.
- Unreferenced pronouns, such as *they, them, we*.
- Unspecified groups, such as *teachers, parents, things*.
- Assumed rules or traditions, including *ought, should*, or *must*.

Critical thinkers are characterized by their ability to use specific terminology, to refrain from overgeneralization, and to support their assumptions with valid data (Ennis, 1985) (Figure 60.5).

DEVELOPING METACOGNITION

Thinking about thinking begets more thinking (Costa, 1984). When teachers ask children to describe the thought processes they are using, the data they need, and the plans they are formulating, students learn to think about their own thinking—to metacogitate. Whimbey (1985) refers to this as "talk aloud problem solving" (Figure 60.6).

—Figure 60.6—

Thinking About Thinking

When Children Say:
"The answer is 43 pounds, seven ounces."
"I don't know how to solve this problem."
"I'm ready to begin."
"We're memorizing our poems."
"I like the large one best."
"I'm finished."

Say:
"Describe the steps you took to arrive at that answer."
"What can you do to get started?"
"Describe your plan of action."
"What do you do when you memorize?"
"What criteria are you using to make your choice?"
"How do you know you're correct?"

—Figure 60.7—

Linguistic Cues

Relationship	Description	Example of Linguistic Cue
Addition	Two ideas go together in some way.	"He is intelligent *and* he is kind."
Comparison	Common attributes are shared.	"Shawn *and* Sarah *both* play the violin."
Contrast	Two ideas don't go together.	"He is healthy, *but* he doesn't exercise."
Sequence	One event happens before, during, or after another event.	"He went home, *then* he went to the library, checked out some books, and returned to school."
Causality	One event occurs as a result of another.	"*Because* no one was home, he went to the gym."

As teachers require students to describe what's going on "inside their heads," students become aware of their thinking processes. Similarly, as they listen to their classmates describing their metacognitive processes, they develop flexibility of thought and an appreciation for the variety of ways to solve the same problem. Teachers, too, may share their thinking by making their inner dialogue external. Verbalizing questions they are asking themselves about ways to solve problems, and sharing their lesson plans and how they check their own accuracy, are ways teachers can model their metacognitive processes to students.

Analyzing the Logic of Language

Effective thinking can be fostered by having students analyze the logic implied by linguistic expressions. Certain words and phrases—linguistic cues—indicate logical relationships between ideas (Figure 60.7).

By examining these linguistic cues (*and, or, but, after, because*), students can learn to identify related ideas in a sentence between the ideas (*addition, comparison, contrast, sequence, or causality*).

How to Grow Intelligent Behavior

Teaching students to be alert to the cognitive processes embedded in written and spoken language can help them become aware of their own language and thought. It can help them decode the syntactic, semantic, and rhetorical signals found in all languages; and it can help them integrate the complex interaction of language, thought, and action (Marzano & Hutchins, 1985). By asking questions, selecting terms, clarifying ideas and processes, providing data, and withholding value judgments, teachers can stimulate and enhance the thinking of their students.

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(Who is we?) "Everybody has one." (Who is everybody?) Thus, clarifying causes students to operationally define their terminology and to examine the premise on which their thinking is based. It is desirable that, as a result of such clarifying, students become more specific and qualifying in their terminology.

For older children, above age 11 or so, it appears helpful to invite them to clarify their problem-solving processes. Causing them to describe their thinking while they are thinking seems to beget more thinking. Some examples: inviting students to talk aloud as they are solving a problem; discussing what is going on in their heads when they confront an unfamiliar word while reading; or what steps they are going through in deciding whether to buy some item at the store. After solving a problem, the teacher can invite a 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 in this way helps students reexamine their own problem-solving processes, identify their own errors, and self-correct. The teacher might ask a question such as: "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

Having students assume the roles of other persons causes them to consciously maintain in their heads the attributes and characteristics of those persons. Dramatization serves as a hypothesis or prediction of how that person would react in a certain situation. This role-playing also contributes to the reduction of ego-centered perceptions.

11. Journal Keeping

Writing and illustrating a personal log or a diary throughout an experience over a period of time causes the student to synthesize thoughts and actions and to translate them into symbolic form. The record also provides an opportunity to revisit initial perceptions, to compare the 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 would be making videotape or audiotape recordings of actions and performances over time.)

12. Modeling

Of all the instructional techniques suggested, the one with the probability of greatest influence on students is that of teacher modeling. Since students learn best by imitating the significant adults around them, the teacher who publicly demonstrates metacognition will probably produce students who metacogitate. Indicators of teachers' public metacognitive behavior might include:

- Sharing their planning by describing their goals and objectives and giving reasons for their actions.
- Making human errors but then being seen to recover 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 value system.
- Being able to self-disclose by using adjectives 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 persevering more 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 realizing 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.

These days, educators are putting greater emphasis on teaching for thinking. Metacognition is an attribute of the "educated intellect." It must be included if thinking is to become a durable reality for the future.

COOPERATION'S IMPACT ON COGNITION AND METACOGNITION

Working cooperatively can have profound effects on students (Johnson & Johnson, 1989). During the past century, researchers have conducted over 900 studies that indicate that cooperative learning experiences promote higher achievement than do competitive and individualistic learning. In addition to aiding students' mastery and retention of material, cooperative efforts can improve achievement in the use of reasoning strategies used to complete the assignment, the generation of new ideas and solutions (process gain), and the transfer of what they learn in one situation to another situation (group-to-individual transfer). Cooperative learning is superior to competitive and individualistic learning in situations where the task is more conceptual, more problem solving is required, higher-lever reasoning and critical thinking are desirable, more creative answers are needed, more long-term retention is desired, and the application of what is learned is greater.

Many of the studies relating cooperative learning experiences and achievement have focused on quality of reasoning strategy, level of cognitive reasoning, and metacognitive strategies (Johnson & Johnson, 1989). In studies where students could solve tasks using either higher- or lower-level reasoning strategies, a more frequent discovery and use of higher-level reasoning strategies occurred within the cooperative than within competitive or individualistic learning situations. In a categorization and retrieval task, for example, 1st grade students were instructed to memorize 12 nouns during the instructional session and then to complete several retrieval tasks during the testing session the following day. The nouns were given in random order and students were told to (1) order the nouns in a way that makes sense and aids memorization and (2) memorize the words. Three of the words were fruits, three were animals, three were clothing, and three were toys. Eight of the nine cooperative groups discovered and used all four categories, and only one student in the competitive and individualistic conditions did so. Even the highest-achieving students failed to use the category search strategy in the competitive and individualistic conditions. Studies on both Piaget's cognitive development and Kohlberg's moral development theories have indicated that cooperative learning promotes the transition to higher-level cognitive and moral reasoning more frequently than competitive or individualistic experiences. The research confirms their theories (Johnson & Johnson, 1989).

WHY COOPERATION AFFECTS COGNITION AND METACOGNITION

Cooperative learning promotes higher-level cognitive and metacognitive reasoning for a number of reasons. First, the expectation that one will have to summarize, explain, and teach what one is learning impacts the strategies used. The way students conceptualize material and organize it cognitively is different when they are learning material to teach to others than when they are learning material for their own benefit (Murray, 1983). When learning material that they will teach to collaborators, students use higher-level strategies more frequently than when they learn the material for their own use.

Second, the discussion within cooperative learning situations promotes more frequent oral summarizing, explaining, and elaborating of what one knows (Johnson & Johnson, 1989). These processes are necessary for the storage of information into the memory (through further encoding and networking) and the long-term retention of the information. Such oral rehearsal provides a review that seems to consolidate and strengthen what students know and to provide relevant feedback about the degree to which they have achieved mastery and understanding. In one of the earliest studies on this subject, Johnson (1971b) found that a person's understanding of and level of reasoning about an issue were enhanced by the combination of explaining one's knowledge, and summarizing and paraphrasing the other person's knowledge and perspective. Subsequently, vocalizing what they learned was more strongly related to achievement than was listening to other group members vocalize (Johnson, Johnson, Roy, & Zaidman, 1985). Summarizing the main concepts and principles students were learning increased achievement and retention (Yager, Johnson, and Johnson, 1985). Both explaining relevant information and disagreeing with another group member were positively related to individual achievement (Vasquez, Johnson, & Johnson, 1993). These and other studies support the conclusion that one formulates meaning through the process of conveying it. It is while students are orally summarizing, explaining, and elaborating that they cognitively organize and systematize the concepts and information they are discussing.

Third, heterogeneity among group members nourishes cooperative learning groups. As students accommodate themselves to each other's different perspectives, strategies, and approaches to completing assignments, divergent thinking and creative thinking is stimulated. The exchange of ideas and perspectives among students from various achievement levels, physical abilities, genders, and cultural and ethnic backgrounds enriches learning experiences.

Fourth, in most cooperative learning situations students with incomplete information interact with others who have different perspectives and facts. Cooperative experiences have been found to promote greater perspective-taking ability than did competitive or individualistic experiences, and perspective taking resulted in better understanding and retention of others' information, reasoning, and perspectives (Johnson, 1971a; Johnson & Johnson, 1989). This evidence indicates that having information available does not ensure that someone will use it. Utilization depends on students' ability to understand others' perspectives.

Fifth, the members of cooperative learning groups externalize their ideas and reasoning for critical examination. As a result, considerable peer monitoring and regulation of one's thinking and reasoning tend to occur. Group-mates stimulate and focus the exploration of ideas. In comparison, individuals working by themselves more frequently get lost in lengthy and aimless wild goose chases. Individuals generally have difficulty monitoring their own cognitive activity. Within a cooperative group, however, each member can monitor the reasoning of other members and help enhance their understanding of the issue or material. In essence, the cooperative experience serves as a training ground for metacognitive skills to develop that are transferable to individual learning.

Sixth, group members may give each other feedback concerning the quality and relevance of contributions and how to improve one's reasoning or performance. Typically, group members give personalized process feedback (as opposed to normal feedback) as part of the ongoing interaction. In cooperative learning groups, fellow group members give feedback, which they discuss face-to-face in ways that make clear the personal implications.

Finally, involved participation in cooperative learning groups inevitably produces controversy—conflicts among the ideas, opinions, conclusions, theories, and information of members (Johnson & Johnson, 1995). This intellectual conflict promotes higher-level reasoning and metacognitive activity.

Controversy's Impact on Cognition and Metacognition

Engaging in constructive controversy profoundly affects students' cognitive and metacognitive reasoning (Johnson & Johnson, 1989, 1995). During the past 30 years, researchers have conducted more than 40 studies that indicate constructive controversy produced higher achievement and retention than did concurrence seeking, debate, and individualistic learning. Controversy tends to result in higher-quality decisions and solutions to complex problems for which students can plausibly develop different viewpoints, even when one or both sides presents erroneous information.

Participants in academic controversies use more complex and higher-level reasoning strategies, recall more correct information, are better able to transfer learning to new situations, and are better able to generalize the principles they learned to a wider variety of situations. Controversy increases the exchange of expertise; the number, quality, and range of ideas; the use of more varied strategies; the ability to develop syntheses combining diverse perspectives; the quality and quantity of creative insights; and the number of imaginative and novel solutions. Controversy results in greater task involvement (the quality and quantity of the physical and psychological energy that individuals invest in their efforts to achieve), greater emotional involvement in and commitment to solving the problem, more feelings of stimulation and enjoyment, and more positive attitudes toward the task and the experience. Cognitive development theorists have posited that repeated interpersonal controversies, where individuals are forced again and again to recognize the perspectives of others, promote (a) cognitive and moral development, (b) the ability to think logically, and (c) the reduction of egocentric reasoning.

Finally, controversy promotes greater liking and social support among participants than does debate, concurrence-seeking, no controversy, or individualistic efforts. Controversy tends to result in higher academic self-esteem and greater perspective-taking accuracy. Controversy relies on "argumentative clash" to develop, clarify, expand, and elaborate one's thinking about the issues being considered.

Why Controversy Affects Cognition and Metacognition

Constructive controversy results in higher-level cognitive and metacognitive reasoning when participants use a four-step process (Johnson & Johnson, 1995). This process involves reaching a conclusion about the issue, becoming uncertain about the correctness of one's views (called epistemic curiosity) when challenged by a person representing an opposing position, actively searching for more information and reconceptualizing one's knowledge in an attempt to resolve the uncertainty, and reaching a new and refined conclusion. This process can be used as many times as needed.