Metacognition and Cognitive Monitoring

A New Area of Cognitive–Developmental Inquiry

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Preschool and elementary school children were asked to study a set of items until they were sure they could recall them perfectly (Flavell, Friedrichs, & Hoyt, 1970). The older subjects studied for a while, said they were ready, and usually were, that is, they showed perfect recall. The younger children studied for a while, said they were ready, and usually were not. In another study, elementary school children were asked to help the experimenter evaluate the communicative adequacy of verbal instructions, indicating any omissions and obscurities (Markman, 1977). Although the instructions were riddled with blatant omissions and obscurities, the younger subjects were surprisingly poor at detecting them. They incorrectly thought they had understood and could follow the instructions, much as their counterparts in the study by Flavell et al. (1970) incorrectly thought they had memorized and could recall the items.

Results such as these have suggested that young children are quite limited in their knowledge and cognition about cognitive phenomena, or in their *metacognition,* and do relatively little monitoring of their own memory, comprehension, and other cognitive enterprises (see, e.g., Brown, 1978; Flavell, 1978; Flavell & Wellman, 1977; Kreutzer, Leonard, & Flavell, 1975; Flavell, Note 1, Note 2, Note 3; Markman, Note 4). Investigators have recently concluded that metacognition plays an important role in oral communication of information, oral persuasion, oral comprehension, reading comprehension, writing, language acquisition, attention, memory, problem solving, social cognition, and various types of self-control and self-instruction; there are also clear indications that ideas about metacognition are beginning to make contact with similar ideas in the areas of social learning theory, cognitive behavior modification, personalty development, and education (Flavell, Note 1, Note 2, Note 3). Thus, the nature and development of metacognition and of cognitive monitoring/regulation is currently emerging as an interesting and promising new area of investigation. What might there be for a child or adolescent to learn in this area? That is, what adultlike knowledge and behavior might constitute the developmental target here, toward which the child gradually progresses? The following model is my attempt to answer this question. For further details about the model see my papers on the subject (Flavell, Note 2, Note 3).

A Model of Cognitive Monitoring

I believe that the monitoring of a wide variety of cognitive enterprises occurs through the actions of and interactions among four classes of phenomena: (a) *metacognitive knowledge,* (b) *metacognitive experiences,* (c) *goals* (or *tasks*), and (d) *actions* (or *strategies*). Metacognitive knowledge is that segment of your (a child's, an adult's) stored world knowledge that has to do with people as cognitive creatures and with their diverse cognitive tasks, goals, actions, and experiences. An example would be a child's acquired belief that unlike many of her friends, she is better at arithmetic than at spelling. Metacognitive experiences are any conscious cognitive or affective experiences that accompany and pertain to any intellectual enterprise. An example would be the sudden feeling that you do not understand something another person just said. I assume that metacognitive knowledge and metacognitive experiences differ from other kinds only in their content and function, not in their form or quality. Goals (or tasks)

The preparation of this essay was supported by National Institute of Child Health and Human Development Grant NDMH 10429.

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0003-066X/79/3410-0906$00.75

refer to the objectives of a cognitive enterprise. Actions (or strategies) refer to the cognitions or other behaviors employed to achieve them. Below, I pay particular attention to the nature and functions of metacognitive knowledge and metacognitive experiences, with goals and actions discussed in the course of describing these first two.

METACOGNITIVE KNOWLEDGE

Metacognitive knowledge consists primarily of knowledge or beliefs about what factors or variables act and interact in what ways to affect the course and outcome of cognitive enterprises. There are three major categories of these factors or variables—*person, task,* and *strategy.*

The person category encompasses everything that you could come to believe about the nature of yourself and other people as cognitive processors. It can be further subcategorized into beliefs about intraindividual differences, interindividual differences, and universals of cognition. Examples of the first and second subcategories would be, respectively, your belief (a) that you can learn most things better by listening than by reading, and (b) that one of your friends is more socially sensitive than another. The following are possible examples of beliefs about universal properties of cognition that the children might gradually acquire. They could learn that there are various degrees and kinds of understanding (attending, remembering, communicating, problem solving, etc.). You may not understand some person or thing you hear, see, or read about if you do not attend closely—and also, sometimes, even if you do attend closely. Moreover, you can fail to understand something or someone in two different ways: (a) by not achieving any coherent representation at all, or (b) by understanding incorrectly, that is, misunderstanding. The growing individual will also learn that it can sometimes be difficult to determine how well you know or remember a social or nonsocial object of cognition, for example, whether you know it well enough to reach some social or nonsocial goal involving that object. There is the further insight that how well you understand something now may not be an accurate predictor of how well you will understand it later. For instance, you may forget later what you can easily bring to mind now, and you may remember later what you cannot bring to mind now. I think such tacit beliefs may play important roles in the cognitive enterprises of older children and adults the world over and that the acquisition of these beliefs would be interesting to study.

One subcategory of the task category concerns the information available to you during a cognitive enterprise. It could be abundant or meager, familiar or unfamiliar, redundant or densely packed, well or poorly organized, delivered in this manner or at that pace, interesting or dull, trustworthy or untrustworthy, and so on. The metacognitive knowledge in this subcategory is an understanding of what such variations imply for how the cognitive enterprise should best be managed and how successful you are likely to be in achieving its goal. To take a social–cognitive example, the child needs to learn that the quantity and quality of available information can sometimes be insufficient to warrant confident judgments about what another person is really like. Another subcategory includes metacognitive knowledge about task demands or goals. The child will come to know that some cognitive enterprises are more demanding and difficult than others, even given the same available information. For example, it is easier to recall the gist of a story than its exact wording.

As for the strategy category, there is a great deal of knowledge that could be acquired concerning what strategies are likely to be effective in achieving what subgoals and goals in what sorts of cognitive undertakings. The child may come to believe, for example, that one good way to learn and retain many bodies of information is to pay particular attention to the main points and try to repeat them to yourself in your own words. As is shown below, it is possible to acquire metacognitive strategies as well as cognitive ones.

Finally, most metacognitive knowledge actually concerns interactions or combinations among two or three of these three types of variables. To illustrate a combination involving all three, you might believe that you (unlike your brother) should use Strategy A (rather than Strategy B) in Task X (as contrasted with Task Y).

Several things follow from the assumption, made above, that metacognitive knowledge is not fundamentally different from other knowledge stored in long-term memory. Thus, a segment of it may be activated as the result of a deliberate, conscious memory search, for example, for an effective strategy. On the other hand, and no doubt more commonly, the segment may be activated unintentionally and automatically by retrieval cues in the task situation. However activated, it may and probably often does influence the course of the

cognitive enterprise without itself entering consciousness. Alternatively, it may become or give rise to a conscious experience (called a metacognitive experience in the present model of cognitive monitoring). Finally, and again like any other body of knowledge children acquire, it can be inaccurate, can fail to be activated when needed, can fail to have much or any influence when activated, and can fail to have a beneficial or adaptive effect when influential. I believe that metacognitive knowledge can have a number of concrete and important effects on the cognitive enterprises of children and adults. It can lead you to select, evaluate, revise, and abandon cognitive tasks, goals, and strategies in light of their relationships with one another and with your own abilities and interests with respect to that enterprise. Similarly, it can lead to any of a wide variety of metacognitive experiences concerning self, tasks, goals, and strategies, and can also help you interpret the meaning and behavioral implications of these metacognitive experiences.

METACOGNITIVE EXPERIENCES

Metacognitive experiences can be brief or lengthy in duration, simple or complex in content. To illustrate, you may experience a momentary sense of puzzlement that you subsequently ignore, or you may wonder for some time whether you really understand what another person is up to. These experiences can also occur at any time before, after, or during a cognitive enterprise. For instance, you may feel that you are liable to fail in some upcoming enterprise, or that you did very well indeed in some previous one. Many metacognitive experiences have to do with where you are in an enterprise and what sort of progress you are making or are likely to make: You believe/feel that you have almost memorized those instructions, are not adequately communicating how you feel to your friend, are suddenly stymied in your attempt to understand something you are reading, have just begun to solve what you sense will be an easy problem, and so forth.

My present guess is that metacognitive experiences are especially likely to occur in situations that stimulate a lot of careful, highly conscious thinking: in a job or school task that expressly demands that kind of thinking; in novel roles or situations, where every major step you take requires planning beforehand and evaluation afterwards; where decisions and actions are at once weighty and risky; where high affective arousal or other inhibitors of reflective thinking are absent (cf. Langer, 1978). Such situations provide many opportunities for thoughts and feelings about your own thinking to arise and, in many cases, call for the kind of quality control that metacognitive experiences can help supply.

Some metacognitive experiences are best described as items of metacognitive knowledge that have entered consciousness. As one example, while wrestling with some stubborn problem, you suddenly recall another problem very like it that you solved thus and so. Some metacognitive experiences clearly cannot be described that way, however. For instance, the feeling that you are still far from your goal is not in itself a segment of metacognitive knowledge, although what you make of that feeling and what you do about it would undoubtedly be informed and guided by your metacognitive knowledge. Thus, metacognitive knowledge and metacognitive experiences form partially overlapping sets: Some experiences have such knowledge as their content and some do not; some knowledge may become conscious and comprise such experiences and some may never do so.

Metacognitive experiences can have very important effects on cognitive goals or tasks, metacognitive knowledge, and cognitive actions or strategies. First, they can lead you to establish new goals and to revise or abandon old ones. Experiences of puzzlement or failure can have any of these effects, for example.

Second, metacognitive experiences can affect your metacognitive knowledge base by adding to it, deleting from it, or revising it. You can observe relationships among goals, means, metacognitive experiences, and task outcomes and—Piagetian fashion—assimilate these observations to your existing metacognitive knowledge and accommodate the knowledge to the observations. Although metacognitive knowledge can undoubtedly undergo at least some modification without metacognitive experiences, I suspect that these experiences play a major role in its development during childhood and adolescence.

Finally, metacognitive experiences can activate strategies aimed at either of two types of goals—cognitive or metacognitive. As an example of the former, you sense (metacognitive experience) that you do not yet know a certain chapter in your text well enough to pass tomorrow's exam, so you read it through once more (cognitive strategy, aimed at the straightforward cognitive goal of

simply improving your knowledge). As an example of the latter, you wonder (metacognitive experience) if you understand the chapter well enough to pass tomorrow's exam, so you try to find out by asking yourself questions about it and noting how well you are able to answer them (metacognitive strategy, aimed at the metacognitive goal of assessing your knowledge, and thereby, of generating another metacognitive experience). Cognitive strategies are invoked to *make* cognitive progress, metacognitive strategies to *monitor* it. However, it is possible in some cases for the same strategy to be invoked for either purpose and also, regardless of why it was invoked, for it to achieve both goals. For instance, you could have asked yourself questions about the chapter with the deliberate aim of improving your knowledge rather than monitoring it, and even if your aim had been to monitor rather than to improve it, an improvement in your knowledge as well as an assessment of its quality would likely result. I am arguing, then, that your store of metacognitive knowledge is apt to contain knowledge of metacognitive strategies as well as of cognitive ones. Skimming a set of directions to get a rough idea of how hard they are going to be to follow or remember is a metacognitive strategy. Another is to paraphrase aloud what someone has just told you to see if she will agree that that is, in fact, just what she meant. A third is to add a column of figures a second time to ensure that your total is accurate.

Recall that according to this model, the monitoring of cognitive enterprises proceeds through the actions of and interactions among metacognitive knowledge, metacognitive experiences, goals/tasks, and actions/strategies. A hypothetical but true-to-life example of this dynamic interplay at work might be a useful way of concluding this summary of the model. Let us begin at the point where some self-imposed or externally imposed task and goal are established. Your existing metacognitive knowledge concerning this class of goals leads to the conscious metacognitive experience that this goal will be difficult to achieve. That metacognitive experience, combined with additional metacognitive knowledge, causes you to select and use the cognitive strategy of asking questions of knowledgeable other people. Their answers to your questions trigger additional metacognitive experiences about how the endeavor is faring. These experiences, again informed and guided by pertinent metacognitive knowledge, instigate the metacognitive strategies of surveying all that you have learned to see if it fits together into a coherent whole, if it seems plausible and consistent with your prior knowledge and expectations, and if it provides an avenue to the goal. This survey turns up difficulties on one or more of these points, with the consequent activation by metacognitive knowledge and experiences of the same or different cognitive and/or metacognitive strategies, and so the interplay continues until the enterprise comes to an end.

Developmental and Educational Implications

This model suggests the existence of a number of possible developments that researchers might find it worthwhile to investigate (Flavell, Note 3). In the case of universals (person category of metacognitive knowledge), for instance, children might at first distinguish only between understanding and not understanding things; they might know only that inputs sometimes lead them to feel puzzled, confused, unable to act, uncertain about what is intended or meant, and that they sometimes lead to the absence of these feelings, to a clear representation of something, to a definite sense of what they should do next. The distinction, within the latter state, between accurate or real understanding and inaccurate or illusory understanding may only be acquired after this initial, more basic differentiation has been made. The acquisition of the second distinction may then pave the way for still more sophisticated metacognitive knowledge in this area; possible examples include the recognition that accuracy of understanding can sometimes be hard to attain and to assess, and knowledge of some of the person variables that can decrease accuracy, such as personal biases, intense affect, and mental or physical illness. Additional developmental hypotheses can be derived from other parts of the model. Here as elsewhere (see Gelman, 1979, this issue), it will naturally be very important to try to discover the early competencies that serve as building blocks for subsequent acquisitions rather than merely cataloging the young child's metacognitive lacks and inadequacies. We also need to try to explain development in this area as well as to describe it, but there is little to say about explanatory factors at present (Flavell, Note 1).

For those with educational interests who would rather assist development than describe and explain it, I think there is a very great deal that is

worth assisting in this area. It is certainly true that some basic preliminary questions need answers. For example, how much good does cognitive monitoring actually do us in various types of cognitive enterprises? Also, might it not even do more harm than good, especially if used in excess or nonselectively? Think of the feckless obsessive, paralyzed by incessant critical evaluation of his own judgments and decisions.

Such questions suggest legitimate caveats about educational interventions in this area. Lack of hard evidence notwithstanding, however, I am absolutely convinced that there is, overall, far too little rather than enough or too much cognitive monitoring in this world. This is true for adults as well as for children, but it is especially true for children. For example, I find it hard to believe that children who do more cognitive monitoring would not learn better both in and out of school than children who do less. I also think that increasing the quantity and quality of children's metacognitive knowledge and monitoring skills through systematic training may be feasible as well as desirable (Flavell, Note 2). To illustrate what may be feasible here, Brown, Campione, and Barclay (Note 5) trained educable retarded children (mental age = 8 years) in self-testing strategies for assessing and checking their readiness to recall errorlessly by rote a list of unrelated words—the same type of cognitive monitoring task that was described in the first sentence of this article. One year later, the subjects spontaneously used these metacognitive strategies when confronted with the same task and, even more impressively, appeared to apply modifications of these strategies effectively to the quite different memory task of recalling the gist of prose passages. Brown, Campione, and others (e.g., Baker, Note 6) at the University of Illinois Center for Research in Reading are currently doing research ultimately aimed at finding out how children may be effectively taught to monitor their comprehension, especially while reading. Psychologists in other laboratories have also begun to do research on similar problems (e.g., Meichenbaum & Asarnow, 1979; Forrest & Barron, Note 7).

I can also at least imagine trying to teach children and adolescents to monitor their cognition in communication and other social settings (cf. Flavell, Note 2). In many real-life situations, the monitoring problem is not to determine how well you understand what a message means but to determine how much you ought to believe it or do what it says to do. I am thinking of the persuasive appeals the young receive from all quarters to smoke, drink, take drugs, commit aggressive or criminal acts, have casual sex without contraceptives, have or not have the casual babies that often result, quit school, and become unthinking followers of this year's flaky cults, sects, and movements. (Feel free to revise this list in accordance with your own values and prejudices.) Perhaps it is stretching the meanings of metacognition and cognitive monitoring too far to include the critical appraisal of message source, quality of appeal, and probable consequences needed to cope with these inputs sensibly, but I do not think so. It is at least conceivable that the ideas currently brewing in this area could someday be parlayed into a method of teaching children (and adults) to make wise and thoughtful life decisions as well as to comprehend and learn better in formal educational settings.

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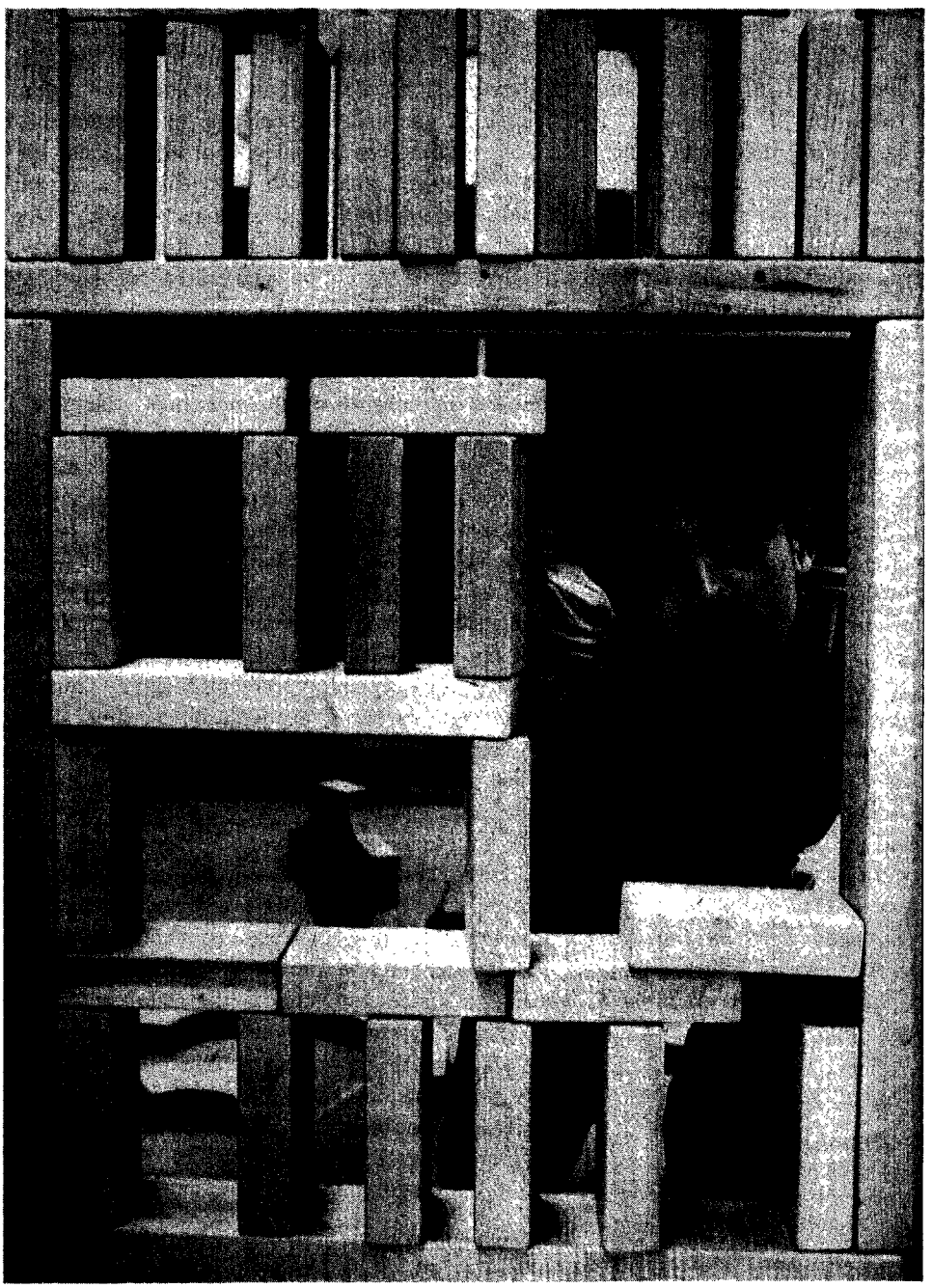

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