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Metacognition (reading 3)

Metacognition and Learning Disabilities

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Metacognition and Learning Disabilities

The theme of this chapter is the connection between metacognition and learning disabilities. In pursuing this theme, three questions are addressed. (1) What is the relevance of metacognitive theory and research to the learning disabilities field? (2) Why is the learning disabilities field so receptive to metacognitive theory? (3) What is the impact of metacognitive theory and research on the learning disabilities field? Before addressing these questions, some clarification of concepts, for example, metacognition, learning disabilities, ability deficits, appears to be necessary.

Clarification of Concepts

Metacognition: Definition

Flavell (1976, p. 232) stated that "metacognition refers to one's knowledge concerning one's own cognitive processes and products of anything related to them, e.g., the learning-relevant properties of information or data." Included in that statement are two clusters of activities: Knowledge about cognition and regulation of cognition (Baker & Brown, 1984a).

Knowledge about cognition concerns a person's knowledge about personal cognitive resources, and the compatibility between himself or herself as a learner and the learning situation. Specifically, Flavell (1982) proposes three categories of knowledge about cognition: person variables, task variables and strategy variables. *Person variables* refer to an individual's acquired knowledge and beliefs concerning human beings as cognitive organisms. Thus, an individual may believe she or he is good at processing verbal materials, but poor at spatial materials. She or he may judge himself or herself to be brighter than his or her parents, but realize the parents in turn are brighter than some of their friends. Then there is some universal knowledge that one gains in the course of attaining maturity. For example, the knowledge-intuition that human short-term memory is fallible and of limited capacity (Flavell, 1982). The preceding examples correspond to the three subcategories of person variables proposed by Flavell (1982): Intraindividual, interindividual, and universal.

Knowledge about task variables refers to the individual's learning from experience that different kinds of tasks exert different kinds of information processing demands on us, for example, one's knowledge that learning the gist of a story is much easier than learning it verbatim (Flavell, 1982). Learning the implications of different task demands on us enables us to take account of them, and to incorporate them into our subsequent plans and actions to complete the task successfully.

Strategy variables refer to those strategies for monitoring an individual's cognitive progress. For example, to find the sum of a list of numbers, one simply adds them up. Here, adding is the cognitive strategy used to fulfill the goal. A metacognitive strategy in that situation would be repeating the adding process to ensure the sum is correct. Here the purpose is no longer reaching the goal-that is, deriving a sum (cognitive strategy). Rather, the purpose is to ensure that the goal has been reached through self-checking (metacognitive strategy) (see Flavell, 1982).

Flavell (1982; Havell & Wellman, 1977) emphasizes the interactions among persons, task, and strategy

variables. We develop intuitions about interactions among these variables. For example we become aware of the superiority-inferiority of certain strategies, given our own particular cognitive constitution and the particular task (Flavell, 1982).

The regulation of cognition concerns the self-regulatory mechanisms used by an active learner during an ongoing attempt to solve problems (Brown, 1980; Baker & Brown, in press 1984a, 1984b). The metacognitive activities here include planning, checking, monitoring, testing, revising, and evaluating. Brown (1980) captured the intricate orchestration of these metacognitive activities in the good reader. She wrote that the efficient reader deploys the following activities:

(1)clarifying the purposes of reading, that is, understanding the task demands, both explicit and implicit; (2) identifying the aspects of a message that are important; (3) allocating attention so that concentration can be focused on the major content area rather than trivia; (4) monitoring ongoing activities to determine whether comprehension is occurring; (5) engaging in review and self-interrogation to determine whether goals are being achieved; (6) taking corrective action when failures in comprehension are detected; and (7) recovering from disruptions and distractions-and many more deliberate, planful activities that render reading an efficient information-gathering activity. (Brown, 1980, p. 456)

The two aspects of metacognition: Knowledge about cognition and regulation of cognition are important determinants of successful learning, efficient reading, and effective studying (Brown, 1980; Baker & Brown, 1984a, 1984b). Although they are very closely related, the two aspects of metacognition have different characteristics. Knowledge about cognition is "stable, statable but fallible, and late-developing" (Brown, 1982, p. 6). It is fallible in the sense that a child or an adult may believe herself or himself to know some facts about something, for example, reading, that are untrue. Regulation about cognition, on the other hand, is "relatively unstable, rarely statable and relatively age independent" (Brown, 1982, **p.** 8). The regulating activities stated earlier, are unstable and age independent, in that although used more often by older children and adults, they are not always used by them. Even young children monitor their activities on a simplified task (Patterson, Cosgrove, & O'Brien, 1980). Moreover, adults and fluent readers may only be aware of their regulating activities when they encounter a reading comprehension failure (Anderson, 1980). Thus, active comprehension monitoring is often an unconscious, hence, unstatable experience (Baker & Brown, 1984a, 1984b). The preceding brief introduction to the term metacognition should suffice because other excellent sources are available (cf. Brown, 1978, 1980, 1982; Flavell, 1976, 1982).

Learning Disabilities: Definition

The term *learning disabilities* was originally created to procure recognition and political influence for a particular group of children. These children showed developmental delays in speech and language facilities, problems in visual/auditory perception, problems in visual-motor coordination, and academic difficulties. Yet they had intact intelligence and absence of sensory handicaps, (e.g., blindness-deafness). Hence, they did not fit into the existent categories of exceptionality. Consequently, they did not qualify for special educational services funded by the U.S. federal government (Kirk, 1972; Kirk & Gallagher, 1979). Parent groups lobbied for creating a category of exceptionality for learning-disabled children in order to obtain educational services for them. These parents adopted the term *learning disabilities,"* which was coined by Kirk (1963). Kirk used the term to focus on the learning difficulties of these children, and to deemphasize the etiology of learning disabilities (Cruickshank, 1972; Kirk, 1972).

The characteristics of these learning disabled (LD) children include academic learning difficulties, disorders in receptive and/or expressive language, disorders of perception (e.g., visual/auditory discrimination problems), disorders of motor activity (e.g., hyperactivity, hypoactivity, or incoordination), attentional problems, memory problems, and socioemotional problems (Mercer, 1979; Myers & Hammill, 1982; Wallace & McLoughlin, 1979). Because of their heterogeneity, LD children may either show various combinations of the aforementioned problems, or specific problems in one area-for example, arithmetic. The heterogeneous nature of their problems is such that given two LD children with difficulties in a specific subject (e.g., arithmetic), it is rare that the sources of their difficulties would be identical or that the remedial methods for instructing them

would be identical (Kinsbourne & Caplan, 1979; Myers & Hammill, 1982).

The nature of the academic difficulties in LD students is *selective and* specific (Kinsbourne & Caplan, 1979; Kirk, 1972; Kirk & Gallagher, 1979). Unlike the general learning problems in retardates, the learning disabilities in LD students are located in a more limited/specific area. The source of a student's learning disabilities is psychological process problems. These process problems impede the LD child's normal development in reading, spelling, mathematics, and writing (Kirk, 1972; Kirk & Gallagher, 1979). The formal definition of learning disabilities follows:

"Specific learning disability" means a disorder in one or more of the basic psychological processes involved in understanding or in using language spoken or written, which may manifest itself in an imperfect ability to listen, think, speak, read, write, spell, or to do mathematical calculations. The term includes such conditions as perceptual handicaps, brain injury, minimal brain dysfunction, dyslexia, developmental aphasia. The term does not include children who have learning problems which are primarily the result of visual, hearing, or motor handicaps, of mental retardation, of emotional disturbance, or of environmental, cultural, or economic disadvantage (National Advisory Committee on Handicapped Children [NACHC], 1968).

The preceding definition was incorporated into the recent 1977 U.S. Public Law 94-142. Additionally PL 94-142 states that an assessment team may decide a child has a specific learning disability if-.

1. The child does not achieve commensurate with his or her age and ability levels in one or more of seven specific areas when provided with learning experiences appropriate for the child's age and ability levels.

2. The team finds that a child has a severe discrepancy between achievement and intellectual ability in one or more of the following areas: (1) oral expression, (2) listening comprehension, (3) written expression, (4) basic reading skill, (5) reading comprehension,(6) mathematics calculation, (7) mathematics reasoning.

The definition of learning disabilities has always been problematic to professionals both within the field and without. Among learning disabilities professionals, debates over its formulation have continued from the beginning of the field to the present. Two specific parts of the NACHC (1968) definition have been widely criticized. The first criticism concerns the clause that states learning disabilities cannot occur jointly with other handicaps (e.g., deafness) or cultural or economic disadvantage. Basically the interpretation of this clause is that learning disabilities cannot be the *direct* result of conditions of sensory handicaps and cultural-environmental disadvantage. However, learning disabilities can co-occur with those conditions. For example, the research on the relation between malnutrition and learning (Cravioto, 1972) suggests that learning disabilities can occur in children from impoverished homes where they do not have balanced and nutritious diets. Second, the definition of learning disabilities is obscured by the list of conditions for which the term serves as an umbrella (i.e., "perceptual handicaps, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia"). Other criticisms of the current (PL 94-142) definition concern the word child, which does not provide for LD adolescents and adults, and the phrase, *basic psychological processes.* A detailed discussion of these weaknesses of the current definition of **learning** disabilities can be found in Hammill, Leigh, McNutt, and Larsen (1981).

In an attempt to redress the criticisms on the current official definition of learning disabilities, the National Joint Committee on LD (NJCLD) worked on and eventually produced a new definition of learning disabilities. The representatives for NJCLD consisted of members from each of the following organizations: The American Speech-Language-Hearing Association (ASHA), the Association for Children & Adults with Learning Disabilities (ACLD), the Council for Learning Disabilities (CLD formerly DCLD), the Division for Children with Communication Disorders (DCCD), the International Reading Association (IRA), and,the Orton Dyslexia Society. This new definition states that

Learning disabilities is a generic term that refers to a heterogeneous group of disorders manifested by significant difficulties in the acquisition and use of listening, speaking, reading, writing, reasoning or mathematical abilities. These disorders are intrinsic to the individual and presumed to be due to central nervous system dysfunction. Even though a learning disability may occur concomitantly with other handicapping conditions (e.g., sensory impairment, mental retardation, social and emotional disturbance) or environmental

influences (e.g., cultural differences, insufficient/ inappropriate instruction, psychogenic factors), it is not the direct result of those conditions or influences (National Joint Committee on LD, 1981).

Currently, the preceding definition has been endorsed by the governing boards of all the organizations excepting ACLD. Thus, the proposed new definition of learning disabilities has not yet been accepted by all learning disabilities professionals.

The significant advance of this new definition of learning disabilities over previous ones lies in the removal of the list of inclusive conditions for learning disabilities and in its allowance for co-occurrence of learning disabilities with other handicapping or environmental conditions. However, the deletion of the phrase *basic psychological processes* produces a functional definition of learning disabilities, which may prove insufficient. Some suggestion for the mechanisms/psychological processes responsible for the LD student's academic difficulties needs to be made for theoretical and empirical purposes.

Ability Deficit

Children with learning disabilities are defined in part, as having disorders in one or more of the basic psychological processes needed for school learning (Lerner, 1981; Torgesen, 1977a). Because of this definitional clause, much research effort had been directed at pinpointing the particular disorders in basic psychological processes which are responsible for the child's learning difficulties (Torgesen, 1977a). The findings of earlier learning disabilities research indicated that LD children performed poorly on a wide range of experimental tasks (Torgesen, 1975).

A pertinent observation is that researchers designed tasks that they assumed would directly measure basic psychological processes. Thus, failure on the part of LD children on these tasks led to the inference that these children lacked the particular basic ability-that is, the particular psychological process required for successful task performance (Lerner, 1981; Torgesen, 1977a). For example, if LD children failed **ih** a memory task, they would be seen as demonstrating an *ability deficit* in memory processes. A different way of expressing the same inference would be: The LD children had *process problems* in memory. This kind of inferential perspective, coupled with the LD children's poor performance on a wide variety of experimental tasks, resulted in the creation of a catalogue of discrete ability deficits that purportedly underlie LD children's poor learning (Senf, 1974; Torgesen, 1977a). Eventually labels were used interchangeably by researchers: Ability deficits, process problems, processing dysfunctions, deficits in psychological processing functions (Lerner, 1981, pp. 170-178; Torgesen, 1977a). So pervasive was the deficits perspective that one prominent theory of learning disabilities was based on children's ability deficits in a particular cognitive area. Specifically, the proponents of the perceptual deficits hypothesis of learning disabilities believe that deficient perceptual functions in visual discrimination and visual memory cause learning disabilities (Bender, 1957; Cruickshank, 1972; Frostig, 1966). They considered disordered visual perception, as in persistent letter reversals, to be the root of reading disability. However, this theory has been soundly criticized on theoretical and empirical grounds by Vellutino, Steger, Moyer, Harding, and Miles (1977). Consequently, it no longer holds sway in the LD field.

What Is the Relevance of Metacognitive Theory and Research to the Learning Disabilities Field?

The relevance of metacognitive theory and research to the LD field lies in providing a more complete understanding of academic difficulties/ failures in LD students. It will be shown that the ability-deficits theory of LD students' academic difficulties is inadequate, and the opposing theory of task-analysis insufficient. Metacognitive theory redresses the insufficiency in the task-analysis theory. Together, task-analysis and metacognitive perspectives provide a satisfactory conceptual perspective on the academic difficulties of LD students, by pointing to the twin foci of LD students' instructional needs-namely, cognitive and metacognitive skills.

Contrasting the Ability-Deficits Theory with the Metacognitive Theory

There have been several models of psychological processing proposed to interpret LD. Among these, Kirk and Kirk's (1971) psycholinguistic model is the best known (Lerner, 1981, pp. 170-173). These models represent a particular theoretical orientation in LD-namely, the ability deficits theory. Their basic tenet is that certain children fail to learn well in school because of deficits in processing functions-that is, ability deficits. For example, the theory suggests that children with ability deficits in auditory processing will have difficulty with primarily auditory instructional approaches, such as phonics. For these particular children to learn, the theory suggests special instructional methods are necessary. Specifically, three different instructional plans are espoused by the ability-deficits theory. The first centers on deficit training. The goal here is to develop and build in the LD child those areas in which ability deficits have been diagnosed. Thus, in the case of a child diagn(?sed to have ability deficits in auditory processing, she or he will be given exercises in auditory processing, in the hope of strengthening that area of function. The second instructional plan centers on teaching to the child's preferred modality of strength. The goal here is to capitalize on the child's intact-strong abilities by basing instruction on them, thus circumventing his or her ability deficits. In the case of a child with ability deficits in auditory processing but intact abilities in visual processing, teaching to the intact/strong abilities in reading would mean using a sight method to teach reading. The third instructional plan is simply a combination of the first two.

The Inadequacies of the Ability-Deficits Theory

There are serious problems with the ability-deficits theory and the instructional methods that this theory supports. First and foremost is the lack of a demonstrated relationship between LD students' ability deficits and their academic problems. Without documented empirical relationships between the two, we may not justifiably use ability deficits to explain academic problems in LD students. Although Kirk and Gallagher (1979) alluded to the critical issue under discussion, it appears to have been virtually ignored by practitioners in the LD field. Excepting Torgesen (1984), the same vital issue has seemingly attracted little interest among researchers.

Using comprehension measures in one study and story recall of important thematic ideas in another, Torgesen (1984) found no performance differences among normally achieving children, LD children with normal performance on the digit span of the WISC-R, and LD children with severe problems on the digit span. The results led him to conclude that short-term memory limitations as measured by the digit span on the WISC-R did not impair LD children's listening comprehension of meaningful narrative. Although Torgesen's findings are restricted to memory processes and to his particular methodology, they nevertheless challenge the tacit assumption held by many professionals in LD that LD students' ability deficits necessarily impair their academic learning-performance.

Second, studies on deficit training involving auditory or visual processes indicated little transfer to reading (Myers & Hamill, 1982). The consistent findings of negative transfer suggests that bridging between deficit training on the one hand and the reading tasks on the other, is required. More importantly, and on a broader level, the negative transfer in deficit training studies highlights the simplistic analysis of LD students' academic failures in the ability-deficits theory. By focusing exclusively on the child's ability deficits, the proponents of this theory failed to grasp the complexity of the total learning situation, in which multiple and interactive factors determine the learner's learning outcome (cf. Brown, 1982; Jenkins, 1979). Among these multiple and interactive determinants of successful learning, the student's abilities and/or ability deficits stand as one mere factor.

Jenkins' (1979) tetrahedral model (TM) outlines four basic sources of influence in a learning situation. These include (1) the characteristics of the learner, (2) the nature of the materials to be learned, (3) the criterial task, and (4) learning activities engaged in by the learner. Jenkins' TM of memory was borrowed and modified for use by Bransford (1979). It was subsequently borrowed from Bransford by Brown (1982). Because Brown's modified TM is more suited for the educational scene, it is used here, and is referred to simply as the TM. Figure I depicts the aforementioned four major sources of influence on the outcome of learning in the TM.

The characteristics of the learner refers to the cognitive and strategic repertoires the individual brings to the learning situation. Individual differences in these repertoires affect how the individuals learn (Brown, 1982). The *nature of the materials* to be learned refers to the organizational nature of the materials, materials that

match the readers' prior knowledge and so forth. The nature of the materials to be learned affects the individual's learning outcome. For example, materials that match subjects' prior knowledge are more easily understood by subjects (Anderson, 1982; Brown, 1980). *Criterial task* is the end product in any learning. The efficient learner is aware of this end product; and tailors his or her learning activities accordingly (Baker & Brown, in press-a). The criterial task is what sets the learner's purpose in learning, as well as providing him or her with standards for evaluating his or her learning (Anderson, 1980; Brown, 1980). *Learning activities* refer to the activities the subject engages in while learning. The subject could spontaneously deploy suitable learning activities. She or he could be trained to do so, or even tricked into doing so by means of well-designed incidental orienting tasks. As children grow older, they gradually learn a repertoire of learning activities. With extensive use, these learning activities/strategies become automatic and their deployment unconscious (Brown, 1982). Engaging in appropriate learning activities influences significantly student learning outcome. For example, failure to categorize items into discrete categories of food, clothing, furniture, and vehicles impaired LD children's recall. Unobstrusively prompting them to put related items into suitable categories remarkably improved their recall (Wong, 1978).

The literature in cognitive psychology and developmental psychology

CHARACTERISTICS OF

THE LEARNER

Skills

Knowledge

Attitudes

and so fortli

LEARNING ACTIVITIES CRITERIAL TASKS

Attention Recognition

Rehearsal Recall

Elaboration Transfer

and so fortli Problem Solving

and so fortli

NATURE OF THE

MATERIALS

Modality

(visual, linguistic, etc.)

Physical Structure

Psychological Structure

Conceptual Difficulty

Sequencing of Materials

and so fortli

FIGURE 1. A. L. Brown's adaptation of Jenkins's (I 979) tetrahedral model of memory experiments. Reprinted with the permission of the publishers of Human Development, S. Karger Publishers, Inc.

has shown us clearly how each of the sources/factors labelled in the TM governs the likelihood of a student's successful learning. To demonstrate the point that the individual factors in the TM are important determinants of learning, some of the research on learner's learning activities is described. Learner's learning activities are chosen because this factor is in line with cognitive psychology's current emphasis on the learner's own role in his or her learning. The following research by Bransford and his colleagues focused on a particular learning atctivity, namely, learner's selfquestioning activities.

Recently, Bransford, Stein, Vye, Franks, Auble, Mezynski, and Perfetto (1982) conducted three sets of studies. In their first set, they found that less-successful fifth graders could not write continuations to sentences that would make the events depicted in the individual sentences match particular types of men. For example, the sentence, "The tall man bought some crackers," appears to contain arbitrary information. To make the attribute of tallness in the man relevant to the event of buying crackers, a continuation or an elaboration of the sentence could have been "from the top shelf." Less-successful fifth graders wrote meaningful continuations such as "from the store" to the previous sentence. Only successful fifth graders produced elaborations that clarified the significance of the various attributes of the men in respective sentences (Stein, Bransford, Franks, Owings, Vye, & McGraw, 1982). Stein et al. called the elaborations produced by successful students, precise elaborations.

In analyzing the performance of less-successful students, Stein et al. (1982) reasoned that these students failed to generate relevant elaborations because they did not ask themselves the significance of the given attributes of the men. Referring to the preceding example, they did not ask themselves, "Why does it have to be a tall man who bought some crackers? Why not a short man?" In an earlier paper, Bransford, Stein, Shelton, and Owings (1981) observed that successful fifth graders spontaneously generated self-questions and evaluations in studying passages on boomerangs and rings around the moon. They used self-questions to activate their prior knowledge, which facilitated their comprehension and studying (Bransford et al., 1981). Thus self-questioning appears to be instrumental in activating one's prior knowledge.

Stein et al. (1982) also showed that training less-successful students to ask themselves relevant questions to activate prior knowledge helped them generate successfully precise continuations to given sentences. Specifically, Stein et al.'s training focused on making the students aware that they needed to clarify and make significant the attribute of each man to the corresponding event in the sentence. Training also increased sentence recall in less-successful students. Thus, the work of Bransford et al. (1981, 1982) highlighted the role of the learner's strategy of active self-questioning in sentence comprehension and retention.

Using children from Grades 5 to 7, Wong and Sawatsky (1984) have recently replicated the results in the first set of studies in the series of studies reported by Bransford et al. (1982). Unlike Stein et al., however, Wong and Sawatsky found that even average readers needed training in activating relevant prior knowledge through self-questioning. Specifically, Wong and Sawatsky gave good, average, and poor readers 12 sentences on which to write continuations/elaborations. They instructed the children that they should write continuations that would help them understand and remember which man did what particular action in the sentences. The investigators found 8/15 average readers and*13/15* poor readers could not generate precise elaborations. They then trained all of them systematically to ask a series of questions designed to help them write precise elaborations to the respective sentences.

The training used by Wong and Sawatsky differed from that used by Bransford et al. (in press). In the case of Bransford et al., the individual child was prompted to ask himself or herself questions that would facilitate seeing the arbitrary relationship between "tall man" and "buying crackers." The experimenter would ask, "Is

there any more reason to mention that a kind man bought milk than a tall man? a mean man?" This prepared the child -for the next step, which was to prompt him or her to activate prior knowledge that would make the relationship between "tallness" and "buying crackers" less arbitrary. For example, the experimenter would ask, "Why might a tall man be buying crackers?" The last step was prompting the child to evaluate the self-generated elaboration. The purpose here was to help the child check the precision of the elaboration generated. Wong and Sawatsky's training procedure reflects the influence of Meichenbaum's (1977) cognitive behavior modification. The investigators modelled a set of five self-questions and answers for the individual child. These were (1) What do I have to do? (Write a continuation of this sentence.) (2) What kind of a continuation? (One that makes me understand why this kind of man did *that* action in the sentence.) (3) How do I begin? (Think: What do I know about being tall? being bald? being strong, etc.? Why would a tall man do that action?) (4) Check my continuation. (Does it really make it clear why that kind of man did that action?) (5) I give myself a pat on the back. (I did it. I wrote a good continuation.) These questions and answers were typed clearly on an index card measuring 20.3 cm (8 inches) x 12.8 cm (5 inches). This cue card was present throughout the two separate individualized training sessions, each lasting about 20-30 minutes. The trainer modelled the self-questions and answers for the child for the first two practice sentences. Thereafter the child was prompted only when necessary. Few children needed much help. Each child practiced the questions and answers for 10 sentences. To ensure that the children were generating the questions during training, each child had to verbalize his or her thoughts while attempting to write an elaboration for a practice sentence. The practice sentences were taken from the pretest of 12, on which all of the trainees had failed miserably to write precise elaborations.

Training was very effective. On the posttest of 12 new sentences, all trained children produced precise elaborations. The following example gives some flavor of the kind of precise elaborations the children generated after training. Given the sentence "The strong man helped the woman," one child gave this elaboration, "out of the ditch." He did so with alacrity. Moreover, training increased the children's recall substantially. The results in Wong and Sawatsky therefore replicated those in the first set of studies of Bransford et al. (1982). Together, these two sets of results underscore the important effects of learning strategies generated by learners themselves on the learning outcome. Specifically, self-questioning has been shown to be an important learning strategy learners must use to activate relevant prior knowledge in order to comprehend and retain new information.

The influence of knowledge of criterial task on students' performances and perception of the ease/difficulty in task learning was shown by Wong, Wong, and LeMare (1982). In two experiments involving normally achieving and LD children, Wong, Wong, and LeMare (1982) investigated the hypothesis that poor comprehension and recall in LD children might stem from vague perception of the criterion tasks, and that provision of clear knowledge of criterion tasks would enhance their performance. This performance enhancement comes from students focusing on relevant parts of the task, in light of knowledge of criterion task.

Fifty-seven children (28 normally achieving; 29 LD) participated in the first experiment. The children were randomly assigned to treatment and control conditions, staying for both comprehension and recall tasks. Treatment referred to knowledge of criterion task. In the comprehension task, children given knowledge of criterion task were told explicitly to attend to preparagraph questions in the two expository passages because they modelled test questions the children would receive later. In the recall task, the children in the treatment condition were told to study the two expository passages for subsequent recall. Within the comprehension and recall tasks, the passages were counterbalanced in presentation.

The results in the comprehension task substantiated the hypothesis under investigation. Wong, Wong, and LeMare (1982) found that both normally achieving and LD children given knowledge of criterion task correctly answered more questions than their respective counterparts in the control condition. However, the results in the recall task did not indicate reliable differences between treatment and control groups. The investigators attributed this outcome to the imprecision in the instructions given to the treatment groups. It is recalled that these children were simply told to expect a recall test. Unlike the comprehension task, they were not guided on which parts of the text to focus on in studying.

Post experimental interview confirmed the investigators' analysis of the recall data. Children in the treatment

condition viewed the recall task as being harder than the comprehension task, whereas the opposite view was held by children in the control condition. The treatment groups of normally achieving and LD children received very specific focusing preparagraph questions in the comprehension task, and the subsequent test items were equally specific. Thus they tended to perceive the task demands matched the test. In the recall task, however, the instruction was very global-namely, that they would get a recall test. Because they did not know which parts of the passages the experimenter wanted them to focus on, the children in the treatment condition reported they studied the entire passages. Consequently, they felt the processing Ioad was too heavy. To them, the recall task was understandably harder.

As for children in the control condition, they felt the nondirective instruction in the recall task matches the demands of the free recall test. But they thought the specific comprehension test questions did not match the global instructions they were given in the reading comprehension task. It is recalled that they were, simplv told to read for understanding. Consequently, they felt the comprehension task was harder.

In a follow-up experiment involving 20 normally achieving and 20 LD children, Wong, Wong, and LeMare (1982) improved the methodology in the recall task. They instructed the children in the treatment condition to study the passages for subsequent recall, and to attend specifically to certain important parts of the passages in their study. The children in the control condition were simply told to study the passages for subsequent recall. The results clearly indicated that given explicit knowledge of criterion task, both normally achieving and LD children recalled substantially more of the passages than their respective control groups. In sum, Wong, Wong, and LeMare (1982) showed that the explicit knowledge of criterion task induced appropriate studying activities in children. The children were able to focus their attention on relevant contents in the passages, because of knowledge of criterion task.

Equally important influences on a student's successful learning are exerted by the interactions between the factors in the TM. Miyake and Norman's (1979) study illustrates the interactive influences between the nature of the materials to be learned (in this case, conceptual difficulty) and learning activities employed by students. Miyake and Norman (1979) investigated the effects of prior knowledge on student's questioning behavior. They used two groups of college students: one group was ignorant of computers and text editors; the other group was given sufficient training in the use of a text editor. The criterion in training was the students' editing one text unaided. Subsequently both groups were instructed to learn to operate a different text editor by following either an easy, nontechnical manual or a hard, technical manual. The students were further instructed to think out loud their thoughts and questions as they tackled the new text editor. Miyake and Norman (1979) found an interesting interaction in their study: Novice students in computer science asked more questions on the easy manual but very few on the hard manual. The reverse pattern of questioning was obtained for the trained students. Miyake and Norman interpreted the findings to suggest that to ask a question, you have to have an optimal amount of prior knowledge for the *particular* subject matter at hand. Because educators have long stressed the importance of cultivating questioning behaviors to facilitate learning in students, Miyake and Norman's findings imply that teachers should attend to students' existent prior knowledge as a concomitant condition in teaching students to generate questions. The preceding study of Miyake and Norman (1979) presents a mere glimpse into the web of interactions of various parameters underlying successful learning.

Against the backdrop of the dynamic portrayal of the interactional nature of learning given by Jenkins (1979) and Brown (1980), it is difficult to accept ability deficits as the sole determinant of an LD student's state of learning. For example, knowledge deficiencies, strategic deficits, and their interactions appear to pose as equally important sources/factors as ability deficits in influencing LD students' academic success (Hagen & Barclay, 1981). I submit that a more profitable way of addressing LD students' ability deficits is to investigate how they interact with those four basic sources of variables that influence importantly the student's learning outcome.

Metacognition and the Tetrahedral Model

One impetus responsible for the development of metacognitive theory and research is that within a learning situation, it is insufficient for any individual to have background knowledge or learning strategies. Equally important, if not moreso, the individual must be able to use) his or her background and strategic knowledge

effectively during learning (Brown, 1980). If an individual is unaware of his or her strategic repertoire, she or he would be unlikely to deploy suitable strategies flexibly and precisely in tune with task demands. Occasionally, children and adults fail to use appropriate strategies for learning despite having them in their repertoire of strategies (Brown, 1980). The term *production deficiencies* has been applied to those occasions by Flavell (1976).

Thus efficient learning does not consist merely of acquiring the necessary background knowledge and strategic knowledge. It consists also of sufficient use and control of the background knowledge and strategies available to the individual (Brown, 1980). For the learner to be able to use and control his or her appropriate background and strategic knowledge, she or he needs metacognitive skills (Baker & Brown, 1984a; Brown, 1980).

It is recalled that metacognition refers to the awareness of knowledge and control/regulation of knowledge (Baker & Brown, 1984a, 1984b). The distinction between cognition and metacognition is the "distinction between knowledge and the understanding of knowledge in terms of *awareness and. appropriate use"* (Brown, 1980, p. 453, emphasis added). Metacognitive skills are those that have been attributed to an executive process in numerous theories of human memory and artificial intelligence. These metacognitive skills include "predicting, checking, monitoring, reality testing, and coordination and control of deliberate attempts to study, learn, or solve problems" (Brown, 1980, **p.** 454). These are the essential characteristics of efficient thinking in a broad range of learning situations, including efficient reading and effective studying (Anderson, 1980; Baker & Brown, 1984a; Brown, 1980). The following example gives some flavor of how fluent readers/good students deploy metacognitive strategies in their reading. Given a reading assignment, good students seek to understand both the explicit and the implicit task demands of the criterial task. They are also aware of the strengths and limitations of their repertoires in the background and strategic knowledge regarding the given task. Their understanding of the task demands, together with their awareness of their own background knowledge and strategic repertoires result in their deployment of suitable reading strategies. These reading strategies are goal oriented (i.e., on target vis-A-vis the criterial task) and flexibly employed. For example, if instructed to read for pleasure, better readers would scan or read faster than if instructed to read for more detailed information (Forrest-Pressley & Waller, 1980). Moreover, they monitor, regulate, and evaluate their reading progress against the standards of the criterial task. When they make good progress in reading comprehension, good students continue reading. However, when they encounter comprehension difficulties, good students would slow down, focus their attention on the parts of the text that present difficulties, or backtrack in their reading (Anderson, 1980; Brown, 1980; Whimbey & Whimbey, 1975). These debugging strategies are also flexibly employed. Good students appear to use a cost benefit analysis approach in their debugging of comprehension difficulties. Sometimes, for the sake of economy in effort, rather than backtracking they may decide to continue reading for clues to enlighten a previous comprehension difficulty (Anderson, 1980).

The preceding description shows how fluent readers/good students *consciously and deliberately* coordinate their efforts in reading. The skills they have mobilized in coordinating and regulating their efforts in reading are metacognitive skills. What they have coordinated and regulated are (1) their own knowledge, (2) their own learning activities, and (3) the criterial task. These are factors depicted in the TM. Thus, it can be seen that metacognitive skills are essential in effective coordination of the various factors in the TM that significantly affect the success of learning outcomes.

Advantages of a Metacognitive Perspective over the Ability-Deficits Theory *of Learning Disabled Students'Academic Difficulties*

In light of the criticisms of the ability-deficits- theory, the advantages of a metacognitive perspective to understanding LD students' academic difficulties are readily discernable. First, it is recalled that the relationship between LD students' ability deficits and their academic failures has yet to be researched and established. In contrast, it has been shown that efficient reading and effective studying require important metacognitive skills.(Baker & Brown, 1984a, 1984b; Brown, 1980). Baker and Brown (1984a) have presented excellent summaries on the research literature on metacognitive skills in reading. Hence, only a brief mention is made of findings in metacognitive research that support the point under discussion.

In general, studies found that younger and poorer readers are less aware of reading as a process of extracting meaning. Because they are less aware of the purpose of reading, it is less likely that they will read for meaning. Indeed, younger and poorer readers perceive reading as a decoding process (cf. Clay, 1973; Forrest-Pressley & Waller, 1980; Myers & Paris, 1978; Reid, 1966; Strang & Rogers, 1965). Young children are also poor at detecting ambiguity-inconsistency in oral and/or written messages (Markman, 1977, 1979). However, providing them with explicit standards for evaluating their comprehension substantially increased children's comprehension monitoring (Markman & Gorin, 1981). Regarding reading strategies, Smith (1967) found that good readers adjusted reading behaviors according to reading purposes-reading for general impressions versus reading for details. Poor readers showed no differential adjustment in reading behaviors. Moreover, poor readers used no debugging strategies **in** resolving comprehension difficulties (Strang & Rogers, 1965). However, Olshavsky (1976-1977) found no differences in good and poor readers' comprehension monitoring. She found both groups could use context cues, inferential reasoning, and rereading as strategies for resolving comprehension difficulties. In sum, older and better readers have more metacognitive skills than younger and poorer readers. These differential metacognitive skills explain a sizeable portion of their different reading skills. The remaining portion is likely explained by poorer decoding skills in younger and poorer readers.

Second, it is recalled that deficit training in the LD children had consistently failed to induce transfer to reading (Myers & Hammill, 1982). In contrast, instructional research inculcating various cognitive and metacognitive strategies in LD students, poor readers, and students with lower verbal ability significantly improved their reading comprehension and summarization skills (Andre & Anderson, 1978-1979; Garner, Hare, Alexander, Haynes, & Winograd, 1982; Palinscar, 1982; Wong & Jones, 1982). Compared to the ability-deficits theory, instructional research ensuing from a metacognitive perspective clearly elucidates substantially more of our understanding of LD students' academic failures.

Third, multiple and interactive factors underlie successful learning. Moreover, metacognitive skills play a crucial role in coordinating those factors (Bransford, 1979; Brown, 1982; Jenkins, 1979). Within the complex and dynamic learning situation,the LD students' ability deficits constitute merely one factor. It is therefore difficult to accept ability deficits as the sole determinant of LD students' learning outcome. Other factors such as knowledge and strategic repertoires, knowledge of criterion tasks and their interactions should receive equal focus in influencing LD students' successful learning (Hagen & Barclay, 1981).

Contrasting the Academic-Skills Mastery Theory with the Metacognitive Perspective

The academic-skills mastery theory has been proposed as an alternative to the ability-deficits theory. Proponents of this theory reject the idea that prerequisite abilities and ability deficits cause students' academic failure. Instead, they consider school failures to reflect skills deficits. Hence, they suggest educators should focus on teaching the academic skills a child needs to learn, and not concentrate on the child's ability deficits (Lerner, 1981, pp. 173-176; Wallace & McLoughlin, 1979; Ysseldyke, 1978; Ysseldyke & Salvia, 1974).

The teaching approach espoused by this theory consists of analyzing the academic task in terms of the underlying skills needed to accomplish the task-that is, performing a task analysis (Bateman, 1971). The subskills from the task analysis are sequenced logically according to certain criteria, for example, teaching concrete subskills before teaching more abstract subskills; teaching subskills with less memory load before teaching those with heavier memory load. The child is tested to ascertain which subskills from the task analysis are possessed and which ones must be acquired. Teaching consists of getting the child to acquire subskills that are not yet learned, or learned but not yet mastered (Lerner, 1981, pp. 173-176).

The skills-mastery theory has been criticized on two grounds. First, there is the question of whether learning is composed of a series of separate and discrete skills. The crux of the matter is the view that the whole is greater than the sum of its parts (Lerner, 1981, p. 175). Second, the skills mastery theory assumes that a hierarchy of subskills in reading has already been empirically substantiated, rather than being a topic of continuing research.

But the Achilles' heel in the skills-mastery theory is its neglect of the importance of the understanding of knowledge in terms of awareness and appropriate use (Brown, 1980, 1982). Acquisition of knowledge/skills is insufficient. One must also be aware of what one does and does not know, and one must regulate the use of one's knowledge appropriately (Baker & Brown, 1984a, 1984b; Brown, 1980; Hagen & Barclay, 1981). Such selfawareness and self-regulation are the individual's metacognition. Clearly, a metacognitive perspective overcomes this very problem of understanding knowledge in terms of awareness and appropriate use, which remains a thorny problem in the skills-mastery theory. It complements the task analysis theory. Together, they provide a satisfactory conceptual framework for analyzing academic difficulties in LD students.

Why Is the Learning Disabiliticis Fielid So Receptive to Metacognitive Theory?

Prior to the development of metacognitive theory, there were research findings in LD that support a strategic-deficits rather than an ability-deficits explanation of LD children's poor task performance. The research findings come from two areas: research on LD children's selective attention and research on their memory processes. In essence, investigators initially found that LD children performed more poorly than non-LD children. However, brief training on using a task-appropriate strategy in aid of learning typically resulted in substantially improved performances in the LD children. Because of the remarkable ease in inducing performance improvements in LD children, researchers concluded that the LD children's initially poorer performance reflects their failure to apply spontaneously a strategy that already exists in their strategic repertoire. This strategic-deficits view culminates in the conceptualization of the LD student as a maladaptive learner, someone who does not participate actively in his or her own learning through the use of efficient strategies, who lacks self-awareness and awareness of task demands, or who may use strategies inappropriate for the given task (Torgesen, 1977a). Moreover, Torgesen (1977a) alludes to meta variables and motivational variables as the underlying explanatory mechanisms of LD children's inactivity in learning. Consequently, when metacognitive theory arrived on the scene in cognitive psychology, supporters of the maladaptive learner framework readily embraced and incorporated it into that framework. In the following section, the research supporting a strategic-deficits rather than an ability-deficits explanation of LD children's poor task performance is summarized.

Research on Selective Attention

The work by Hallahan and his associates on selective attention constitutes one major source of support for the hypothesis that LD students fail spontaneously to employ suitable strategies in the learning/experimental setting (Dawson, Hallahan, Reeve & Ball, 1979; Tarver, Hallahan, Cohen & Kauffman, 1977; Tarver, Hallahan, Katfifan & Ball, 1976). Basically, these investigators found deficient selective attention and verbal rehearsal in their LD subjects.

Using Hagen's Central Incidental Learning Task, Tarver et al. (1976) investigated the development of verbal rehearsal strategies and selective attention in 8- to 13-year-old LD children. Central information was designated by the experimenter as the material to be remembered. Tarver et al. found that LD children remembered substantially less central information than a group of the same-aged nondisabled peers. There were no reliable differences between the groups in recall of incidental information. These results suggest deficient selective attention in the LD group (Hagen & Barclay, 1981). The results also suggest that LD children are slow to develop efficient encoding strategies such as verbal rehearsal. This lack of verbal rehearsal in the LD children was inferred from their failure to show primary effects in the recall (Tarver et al., 1976, 1977).

However, in a second experiment, when LD children were induced to rehearse, substantial improvement in recall of central information was obtained in the older children (Tarver et al., 1977). Similar positive effects on LD children's selective-attention performance were obtained by Dawson et al. (1979), who instructed their LD subjects on the use of a verbal-rehearsal strategy in the serial recall task. Such improvement in performance

subsequent to a brief instruction in the use of a specific task strategy suggests that failure to apply spontaneously the relevant strategy may explain the originally deficient task performance in the LD subjects, (Torgesen, 1977a). ,

Tarver et al. (1977) again found deficient selective attention in LD boys. Moreover, strong support for the hypothesis of developmental lag in verbal rehearsal strategies was obtained on data pooled from two studies (Tarver et al., 1976, 1977). The investigators suggest that the lag in verbal rehearsal strategies underlies the lag in selective attention.

Another study by Hallahan, Tarver, Kauffman, and Graybeal (1978) investigated the effects of incentives on the selective-attention performance of LD children. They found that positive reinforcement (delivery of pennies) led to increased selective attention in LD children. Moreover, an analysis of the subjects' recall at different serial positions led the investigators to conclude that the superior selective attention of the group that was reinforced for recall had been mediated by their adoption of a verbal-rehearsal strategy. This conclusion suggests that incentives induced LD children to apply a strategy that was already existent in their strategic repertoire. Alternatively, the conclusion suggests that in the course of the experiment, the LD children came to develop the task-appropriate strategy. Hallahan et al.'s conclusion that positive reinforcement for recall resulted in the use of more efficient strategies by LD children is consistent with the results from a study by Haines and Torgesen (1979) in which rehearsal was directly observed. Haines and Torgesen found second-grade children with reading problems rehearsed more when they were rewarded for recall than when they were not.

Although the preceding findings by Hallahan et al. (1978) are interesting, they should be taken cautiously. This is because a follow-up study by Dawson et al. (1979) using LD children, and another by Gelabert, Torgesen, Dice, and Murphy (1980) using non-LD children found no effects of incentives on the use of verbal rehearsal to facilitate selective attention memory.

Nevertheless, excepting replication problems over Hallahan et al. (1978), the findings on LD children's selective-attention abilities have been very consistent. The interpretation of these findings is that LD children have a strategic deficit.

At this time, it appears that the most parsimonious explanation for the LD child's tendency to have problems in attending to relevant cues and ignoring irrelevant cues is his inability to bring to the task a specific learning strategy .... Apparently then, it is not so much the LD child's inability to attend selectively that is his basic problem so much as it is his inability to analyze the task in terms of the best strategies needed for performing it. (Hallahan & Reeve, 1980, p. 32)

Research on Memory Processes

The following summaries of research on memory processes supports the hypothesis that LD children engage in less-efficient strategies in memorizing meaningful and nonmeaningful materials (Torgesen & Kail, 1980).

Torgesen (1977b) asked fourth-grade children of different reading levels to study 24 pictures of common objects that could be grouped into four categories. During a 2-min study period, the children were encouraged to move the pictures, and/or to do anything which they thought would help them remember the pictures better. Torgesen found that good readers were more likely to organize the material into categories during the study period, and recalled more pictures. A brief training in using categorizations as a mnemonic strategy eliminated recall differences between the two groups of good and poor readers. The finding that poor readers were less likely than good readers to capitalize on categorical relationships among stimuli in studying for recall, had also been replicated by Torgesen, Murphy, and Ivey (1979) and by Wong (1978).

Another study by Torgesen and Goldman (1977) also supports a strategic-deficits explanation of poor readers' poor recall performance. Torgesen and Goldman (1977) found that good readers in the second grade recalled sequences of familiar stimuli better, and rehearsed them more than did children with reading problems. They

also found that when children were told to name the stimuli aloud as they were presented, differences between groups in both recall and rehearsal disappeared.

On the basis of processes assumed to be operative in immediate free recall, Bauer reasons that if elaborative encoding is deficient in LD children, the primacy effect in immediate free recall would be lower in LD than in non-LD children. Similarly, in delayed free recall, both primacy and recency effects would be lower in LD children. These predictions were substantiated (Bauer, 1977, 1979). Torgesen (1971;) also reported that LD children in his study had fewer observable lip movements than nondisabled children while trying to retain verbal information. This confirms Bauer's hypothesis that LD children are less likely to use elaborative strategies to retain information.

More recently, Newman and Hagen (1981) investigated the effects of instruction on both serial and free recall in LD children. The children ranged in age from 7 to 13 years and were divided by age into a younger and an older group. Neither group was found to produce spontaneously, a verbal-rehearsal strategy. However, the serial recall of the older group, was somewhat higher than that found for the younger children. Moreover, neither group produced an effective organizational routine on the free recall task, in which categorizable items were used. Interestingly, with instructions the older children's clustering and recall improved. But the performance of the younger children was not affected by the training. Conceivably, the instructions were not powerful enough to elicit an effective mnemonic in the younger children. Alternatively, these younger children had a mediational deficiency. Newman **and** Hagen (1981) concluded that the children were not actively involved in learning (Torgesen,1977a).

Taken together, the preceding studies on memorization processes in children argue against an ability-deficits explanation of poor recall in LD children. Rather, the results suggest that deficient use of active elaborative strategies (e.g., rehearsal and/or organization) among LD children was responsible for their inferior recall. This strategic-deficits interpretation is supported by the ease with which LD children's performance level wasraised to the level of non-LD children.

The preceding strategic-deficits perspective of memorization processes in LD children led Torgesen (1977a) to conceptualize them as maladaptive/inactive learners. Specifically, within a learning situation, LD children are seen as failing to deploy appropriate learning strategies that would be in tune with task demands. Such a strategic deficit does not necessarily mean that LD children lack the particular learning strategy in their store of strategic knowledge. That minimal prompting could induce them to apply the task-appropriate strategy suggests otherwise (Torgesen, 1977b; Torgesen & Goldman, 1977; Torgesen et al., 1979; Wong, 1978). What the LD children's strategic deficits suggest is their lack of awareness of task demands, the lack of awareness of what they do or do not know regarding strategies, and their lack of awareness of which learning strategy to deploy in order to match the task demands. 'In short, LD children's strategic deficits reflect their lack of metacognitive skills. Clearly, the research highlighting both the maladaptive learner framework and the strategic deficits in LD children are in accord with what metacognition conceptually embodies (awareness and self-regulation). Understandably supporters of the inactive learner framework are very receptive to meta-

cognitive theory.

What is the Impact of Metacognitive Theory and Research on the Learning Disabilities Field?

The impact of metacognitive theory and research on the LD field can be seen in the research on and remediation of LD students. Concerning research, there is a budding area of research into the metacognitive processes of LD students, and intervention studies designed to increase metacognitive skills in LD students. Concerning remediation, there is growing awareness of the importance of building self-monitoring behaviors into individualized instructional programs of basic skills training, such as phonics instruction, addition-subtraction facts, and so forth.

impact of Research on Metacognitive Skills in Learning Disabled Students

Research on metacognitive skills in LD students generally falls into two lines of inquiry. The first line of inquiry focuses on metacognitive processes in LD students, for example, meta-attention, metamemory. The second line of inquiry focuses on intervention-ways to improve metacognitive skills in LD students. Studies on LD students' metacognitive processes consistently indicated metacognitive deficiencies in LD children. The intervention studies indicated that LD students profited from attempts at increasing their sensitivity to important textual units, and at increasing their metacomprehension. They also profited from training in other important comprehension strategies. The beneficial effects of the various interventions were manifested in LD students' improved -readingcomprehension. However, attempts at increasing LD children's predictive accuracy in spelling performance had been less successful.

Meta-attention in LD and non-LD children was investigated by Loper, Hallahan, and Ianna (1982). These investigators compared the performances of two age groups of LD and non-LD children on a specially designed meta-attentional task. This meta-attentional task comprised six cards on which line drawings depicted either positive or negative situations for three attentional variables: interest, reward, or noise level. Verbal descriptions accompanied each card. For example, for the card depicting a smiling boy, the verbal descriptions were "Imagine a child who is very interested in what he is doing." The six cards (three positive situations and three negative situations) were variously paired with each other to form 12 forced-choice items. The descriptions for each card were repeated for each item, and the children were asked to decide, "Which of these two children do you think will better pay attention?"

The results indicated that regardless of educational status, older children scored higher on the interest variable and scored lower on the reward variable than younger children. Interestingly, the meta-attentional task did not differentiate between LD and non-LD children. Moreover, among the LD children, no significant relationships were found between reading achievement and performance on the meta-attentional task. However, among non-LD children, a significant relationship was found between reading achievement and interest. A significant but inverse relationship was found between reading achievement and reward. These findings among non-LD children suggested that they had a mature understanding of the relationship between two meta-attention variables (interest and reward) and reading achievement.

In Study 2 Loper et al. (1982) explored the possibility that successful remediation would effect more synchrony of meta-attention and academic achievement in LD children. Fifty-four LD children were given (1) the meta-attentional task used in Study 1, and (2) the pre- and posttest in reading in the fall and subsequent spring, respectively.

The LD children were divided into two groups: high-gain and low gain groups, by subtracting fall reading achievement from spring reading achievement. The reading scores of the high-gain and low-gain groups differed only at posttest. The results indicated no significant correlations between meta-attentional scores and reading achievement for either group at pretest. At posttest however, the high-gain LD group showed a significant correlation between reading achievement and interest, and a significant but inverse correlation between reading achievement and reward. For the low-gain group, similar findings were not obtained.

The findings in Loper et al. (1982) indicated that non-LDchildren had a mature understanding of the relationship between attention and reading achievement. As they grew older, they appeared to realize that intrinsic motivation (interest) weighs more in reading achievement than does extrinsic motivation (monetic reward). The awareness/understanding of such a relationship was not shown in LD children of comparable age. However, those LD children who achieved substantial remedial progress did show the same awareness or mature understanding of the relationship between meta-attention and reading achievement.

Knowledge about memory and memory processes-metamemory in good and poor readers were investigated by Torgesen (1979). Adapting questions devised, originally by Kreutzer, Leonard, and Flavell (I 97 5), Torgesen asked the children seven questions in a fixed order. These questions concerned (1) the child's awareness of his or her own memory capacity as a rememberer; (2) the knowledge that relearning what one has previously learned yields savings in remembering over learning something entirely new; (3) the differential ease in retention between immediate and delayed recall; and (4) the knowledge of mnemonic and retrieval strategies. Torgesen (1979) found that the most reliable differences between good and poor readers involved the number of different solutions generated to three metamemory questions on mnemonic and

retrieval strategies. Examples of the three questions were: "How could you be really certain that you didn't forget to bring your present along to school in the morning (for the school Christmas party)?" "How would you go about finding a lost jacket (at school)?" "Suppose your friend has a dog and you ask him how old he is. He tells you he got his dog as a puppy one Christmas but can't remember which Christmas. What things could he do to help him remember which Christmas he got his dog?" Moreover, Torgesen (1979) found that more good readers described using verbal rehearsal as a mnemonic strategy if they could not write down what they had to remember. Good readers consistently were able to provide a wider range of solutions to the memory problems than poor readers. Torgesen (1979) interpreted his findings to indicate that rather than being limited to their capacity to learn to read, many reading-disabled children may have difficulty in management of their capacities.

Strategic behaviors in selecting retrieval cues in gifted, average, and LD children were investigated in a study by Wong (1982). Specifically, the study investigated whether LD children differed from gifted and average children in their organization and self-checking in selecting retrieval cues that would aid a subsequent story recall.

Within each educational category, there were 10 children, each from Grades 5, 6, and 7. The stimulus was a Japanese folk story called "How to Fool a Cat," originally used by Smiley, Oaken, Worthen, Campione, and Brown (1977), and previously parsed into pausal units-idea units. The children were randomly divided into treatment and control conditions and were seen in groups of three. Those in the treatment condition were read the story, as they simultaneously followed it on their own copies of the story. Subsequently they recalled it by writing it down. Verbatim recall was not mandatory and spelling errors were waived. After recall, each child received the story typed on small index cards, one idea unit of the story per card. The children read the whole story again on the individual cards. Then they were asked to select 12 cards representing 12 idea units that they would like to have as retrieval cues if they were asked to remember the story.

The children in the control condition received the same treatment except that they did not experience story recall prior to cue selection. The manipulation of the variable of prior recall was to see if it would induce more choice of important idea units as retrieval cues. Three categories of behavior were used to analyze the patterns of cue selection in the children. The first was organization/planfulness in search behavior, operationally defined by the child's demonstration of some form of systematic search behavior, for example, a verbalized plan prior to cue selection, or a nonverbalized plan that was clearly observable in its effects on the child's cue-selection behavior (described subsequently). The second was exhaustiveness of cue selection. The focus here was whether or not the child examined the whole pile of cards in his or her selective search. The third concerned presence of self-checking behavior. The focus here was whether or not the child checked through the 12 cards she or he selected as retrieval cues.

The results indicated that LD children lacked self-checking and tended to be less thorough or exhaustive in their cue selection. Both gifted and average children, however, spontaneously engaged in an exhaustive search for retrieval cues and in self-checking behaviors. Interestingly, contrary to expectations, LD children did operate with some form of plan in their search behavior. It consisted of examining carefully each of the idea units. Gifted children, on the other hand, tended predominantly to operate by a nonverbalized plan in their cue selection. They were observed to scan rapidly the contents of the idea units on the cards, simultaneously making two piles of them. One pile was bulky, containing discarded cards. The other pile was noticeably smaller, containing the potential retrieval cues. To this smaller pile, gifted children returned when they finished with the last card. They then carefully examined this smaller pile, eliminating unwanted cards. Finally, they checked through the contents of the retrieval cues, and counted them to ensure they numbered 12.

Doubtless, the LD children's laborious reading of each card reflected their lack of reading fluency. Nevertheless, their decoding problem does not obfuscate the qualitative differences between the organization/planfulness of LD children's cue selection and the aforementioned cue selection of gifted children. However, there were no substantial differences between the organization/planfulness in cue selection of (1) average and LD children; and (2) average and gifted children. In light of the latter findings, a feasible interpretation of the data on planfulness in cue selection is that compared to gifted children, LD children appeared to operate with a less efficient plan. The results also indicated that compared to gifted and average

children, LD children lacked self-checking and were less exhaustive in selecting retrieval cues. Lastly, prior experience in recall resulted in all the children choosing significantly more idea units rated to be the most important. Devoid of such experience, the children chose significantly more idea units rated to be less important. Although gifted children chose more items of 4-point importance as retrieval cues than average and LD children, the latter groups of children benefitted equally from the experience of prior recall. Their patterns of recall of important and unimportant idea units were similar.

In three studies, Gerber (1982) investigated the accuracy of predicting one's spelling performance in LD and non-LD children. The task consisted of a 14-word, written spelling test. In the first two studies, the children spelled words illustrative of various phonetic features such as vowels, doubled consonants, and so forth. These words were high in familiarity but low in frequency of occurrence in elementary curriculum materials. In the third study, the words in the spelling test were chosen from those above each child's testing ceiling on a standardized spelling test. This procedure was used to equate difficulty items for all the children. Also, in the third study, half of the LD and non-LD children were taught verbally self-guided proofreading and self-correction procedures. Specifically, children were taught to imitate overtly those questions designed to focus attention on potentially proofreading information.

The results of the first study showed that the LD children were aware of their deficient skills in spelling. They predicted fewer correct spellings than the non-LD children. However, LD children seriously overestimated their spelling ability, in that less than 20% of all their spellings were accurate. In contrast, even the youngest non-LD children tended to underestimate their skill. More than 82% of all spellings produced by the nonLD children were correct.

Equally seriously, the LD children also underestimated their likely errors. Again the non-LD children were very accurate in predicting what they could not spell correctly. The results of the second study replicated those of the first. The results of the third study indicated that (excepting for older LD children) all LD and non-LD children overestimated their ability to spell correctly and underestimated the likelihood that they would spell incorrectly. Interestingly, non-LD children also overestimated their spelling ability. It is recalled that the children were given difficult words on which to, predict their spelling performance. These words were the ones selected from those that each child previously could not spell on a standardized spelling test. Lastly, training in self-monitoring produced little effect in prediction accuracy for any group. However, training improved older LD and non-LD students' quality of errors. These children produced better approximations to conventional spellings than their untrained counterparts.

Sensitivity to important textual information is an important metacognitive skill in reading and studying (Brown, 1980; Smiley, Oaken, Worthen, Campione, & Brown, 1977; Winograd, 1982). Smiley et al. (1977) found that Grade 7 poor readers in Title 1-funded remedial educational services did not recall as many idea units judged to be thematically most important. From the authors' description, some or all of these children may fall in the LD category. One possible explanation for the authors' findings may be the children's insufficient awareness of important idea units in the passage. If this were the case, focusing LD children's attention on important idea units through preparagraph questions should increase their retention of those units. Reasoning thus, Wong (1979) tested the preceding hypothesis.

Thirty LD and 30 non-LD children were randomly divided evenly into two groups: questions and no-questions conditions. In the questions condition, the experimenter read a Japanese folk story, "Dragon's Tears", to the children as they follow the printed story visually on their individual copies. The experimenter read aloud each preparagraph question before reading the respective paragraphs. These preparagraph questions were also typed on the children's copies of the story. Immediately after the experimenter finished reading the story, the children were asked to write out their recall of it. In the no-questions condition, the children received the same treatment, except that there were no preparagraph questions on their copies of the story.

The results indicated clearly facilitative effects of preparagraph questions on story retention for LD children only. Their recall was comparable to that of non-LD children in the same treatment condition. Moreover, for the LD children, the facilitative effects of questions were very specific. Questions substantially increase their recall of idea units rated to be thematically most important. LD children in the no-questions condition recalled

the least of story idea units. Regarding non-LD children, the effects of preparagraph questions on their story retention were unremarkable.

These results were taken to suggest that LD children lack awareness/ sensitivity to story elements that are most important. Not being sensitive to important elements would result in an inability to focus attention or to engage in active comprehension and study efforts on those elements (Winograd, 1982). Consequently, retention would suffer. The results indicated that directing LD children to important textual elements through preparagraph questions helped them overcome their metacognitive deficiency. Consequently their recall of thematically most-important story elements improved. On the other hand, non-LD children did not profit from preparagraph questions. The results suggested that they had already developed the metacognitive skill of being sensitive to important textual elements (Hare & Borchardt, 1982; Winograd, 1982; Wong, 1979). ,

Another metacognitive skill pertinent to efficient reading and studying is the awareness of one's state of reading comprehension-metacomprehension. Failure to monitor one's state of reading comprehension may have serious consequences. One may assume one has understood the text when in fact one has not. Or, one may not deploy needed debugging strategies to deal with comprehension difficulties (Baker, 1979). It is possible that insufficient self-monitoring of one's state of reading comprehension may be one causal factor in reading comprehension problems in LD students.

To investigate the preceding hypothesis, Wong and Jones (1982) compared the performances on several variables of LD and non-LD students who received self-monitoring training and those without training. Specifically, Wong and Jones (1982) trained LD and non-LD students on monitoring their comprehension of main ideas through self-questioning. The self-questioning training focused on the students' purpose-setting in reading, on identifying the main ideas in the paragraphs, on changing the identified information into questions, on checking that the questions were targeted on the main ideas, and on an integrative review at the end of reading the given passage.

The self-questioning training spanned 2 days. Prior to the phase of self-questioning training, the children were taught to mastery level, the concept of a main idea. Subsequent to the self-questioning training, the students were given 4 days of testing involving new passages. The results clearly showed that training substantially increased LD students' awareness of important textual units, as well as their ability to formulate good questions involving those units. Moreover, training facilitated their reading comprehension. However, the training effects on non-LD students were less substantial. Training did not increase substantially their awareness of important textual units or their reading comprehension.

Wong and Jones (1982) interpreted their findings toindicate that insufficient awareness of one's state of reading comprehension-insufficient metacomprehension-is one cause of LD students' poor reading comprehension. Training LD students to self-monitor systematically their reading comprehension appears to have been an effective solution to their problem.

Palincsar (1982) improved reading comprehension in seven LD students by teaching them specific cognitive and metacognitive strategies. These students had adequate decoding skills, but deficient reading comprehension skills. In 18 successive daily sessions, Palincsar (1982) individually taught them summarizing (a cognitive skill); detecting textual anomalies (a metacognitive skill), and two kinds of questioning: (1) to predict what authors might discuss next in the passage, a metacognitive skill; and (2) to construct questions teachers might ask in testing their knowledge of the text, a task involving both cognitive and metacognitive skills. Palincsar used modelling and corrective feedback to teach the four strategies.

The results clearly indicated that teaching LD students those four cognitive and metacognitive strategies substantially improved their reading comprehension scores on the daily criterion tests. The LD students' improvement in reading comprehension was well maintained during maintenance test and follow-up tests. Moreover, moderate gains were observed in transfer measured by classroom probes.

Palincsar (1982) replicated her first study in a second experiment, in which 21 poor comprehenders from Grades 6 to 8 were taught the same four strategies in small groups ranging from 4 to 8 students. Five experienced teachers were trained in using reciprocal teaching to teach the four strategies of questioning,

predicting, summarizing, and clarifying (detecting anomalies). Teaching spanned successive daily sessions ranging from 16 to 20 sessions. Similar positive effects on students' reading comprehension were obtained during intervention, maintenance, and follow-up. Because no probes were given in the classroom, generalization of training to students' classroom performance was not obtained. However, results on transfer measures designed by Palincsar paralleled results in her first study.

Summary

The results of research on metacognition in LD students support a metacognitive perspective of LD students' poor task performance and academic difficulties. This additional metacognitive perspective is particularly important in light of the ambiguous, empirically untested role of ability deficits in explaining LD students' academic difficulties. The impact of a metacognitive dimension on remediation in the learning disabilities field is described in the next section.

Impact on Learning Disabilities Remediation

The impact of the metacognitive theory and research on the learning disabilities field is also evident in the development of specific prescriptive approaches in remediation. There is the cognitive-strategies approach developed by Alley and Deshler (1979). They design specific remedial procedures and curricula consistent with their particular framework. A prototypical example of their work is the COPS error-monitoring strategy used in teaching LD adolescents to monitor errors in their written assignment. COPS stands for capitalization, overall appearance, punctuation, and spelling. Similarly, the 5-step self-questioning procedure used in Wong and Jones's (1982) study induced systematic self-monitoring in LD adolescents and consequently enhanced their reading comprehension. The self-questions in Wong and Jones's study were (1) "What are you studying this passage for?" (So you can answer some questions you will be given later); (2) "Find the main idea or main ideas in the paragraph, and underline it"; (3) "Think of a question on the main idea you have underlined. Remember what a good question should be like." (Look at the prompt you are given); (4) "Learn the answer to your question"; (5) "Always look back at the questions and.answers to see how each successive question and answer adds more information to you." There are also the strategic intervention studies by Hallhan, Lloyd, Kosiewicz, Kauffman, and Graves (1979) and Hallahan, Lloyd, Kosiewicz, and Kneedler (1979), in each of which an LD boy was trained to monitor his own attentional or on-task behavior.

It appears that metacognition has generated a new orientation in remedial instruction of LD students in which self-monitoring procedures appear to receive equal emphasis as basic skills building. Implicit in this remedial orientation is the adoption of the basic tenet in cognitive psychology-namely, the centrality of the students' active participation in and responsibility for his or her learning (Brown, 1980; Wittrock, 1980). More important but unmentioned is the reason for training LD students self-monitoring skills. That LD students must improve in their academic deficiencies is indisputable. But this statement glosses over the relevance for self-monitoring training. The point is that we need to improve not only LD students' academic skills, but also the extent that they could function as autonomously as their normally achieving peers. To attain such a remedial criterion for LD students typically lacking in autonomy, we must include a self-monitoring component within any remedial program for them. In designing self-monitoring training, learning disabilities researchers and practitioners can draw on the theory and research in cognitive behavior modification (Meichenbaum, 1977; Meichenbaum & Asarnow, 1978).

Criticisms of a Metacognitive Perspective of Learning Disabilities

This section addresses two frequently made criticisms of the usefulness of a metacognitive perspective of learning disabilities. The first is that a metacognitive perspective does not explain ubiquitous decoding problems in LD students. The second is that one's knowledge of an appropriate strategy does not guarantee its

use.

The first criticism is that a metacognitive perspective may apply only to LD students' difficulties in higher-order cognitive tasks such as reading comprehension. However, regarding LD students' more basic decoding difficulties, a metacognitive perspective is of little use. For their decoding difficulties, training in more basic skills rather than in metacognitive strategies appears more appropriate (Baker, 1982; Torgesen, 1982).

It is erroneous to assume that metacognition plays a role in reading comprehension and studying, but not in basic skills such as decoding. Such an assumption neglects the research on metalinguistic awareness. Metalinguistic awareness is the ability to reflect on the phonemic, syntactic, and semantic aspects of one's language (Baker, 1982). While difficulties with syntactic and semantic aspects of language contribute mainly to comprehension problems, difficulties with the phonemic aspect of language contribute to decoding problems. The manifestation of deficiency in phonemic awareness comprises the child's difficulties in analyzing phonemes in words. Put differently, the child has difficulties segmenting words into their component sounds (Fox & Routh, 1976; Hook & Johnson, 1978).

LD children have problems in all three aspects of language-phonemic, syntactic, and semantic (Hook & Johnson, 1978). Their problems in phonemic segmentation interfere with the process of phonological recoding (Shankweiler, Liberman, Mark, Fowler & Fischer, 1979). Their phonemic segmentation problems also interfere with the establishment of grapheme-phoneme correspondences (Snowling, 1980). The two skills of phonological recording and the establishment of grapheme-phoneme correspondences are vital to beginning reading (Baker, 1982).

There is some research that suggests that training children to segment and blend words promotes their learning to read. Olofsson and Lundberg (1982) successfully trained kindergarten children to segment and blend two phoneme and three-phoneme words. Their training program contained an orderly sequence of seven steps that were graduated in difficulty. The instructional steps began with recognition of rhymes and nonsense words, then segmentation of words into syllables, locating initial phonemes of words, and eventually ending in segmenting two- and three-phoneme words into individual phonemes and blending phonemes into words. .

Williams (1980) designed and conducted a 2-year training and evaluation program for LD children in the classroom setting. The program components included skills in phonemic analysis, blending, and decoding. Initially, the LD children were taught to analyze syllables and short words into phonemes and then to blend the phonemes into syllables and words. When mastery was reached in phonemic analysis and synthesis, the children were taught to decode.

The results were impressive because effects of training and transfer were observed. The LD children who successfully completed the training program could decode regularly spelled one-syllable and multisyllabic words and nonsense combinations, regardless of whether or not they had previously seen the particular combination of letters. The results of Olofsson and Lundberg (unpublished manuscript) and Williams (1980) support the view that phonemic awareness promotes the child's learning to read.

In sum, it can be seen that metacognition contributes to the child's learning to read, in the form of phonemic awareness. Hence, the role of metacognition may not be restricted to LD students' higher-cognitive functions. However, this is not to say that metacognitive deficits underlie all the heterogeneous reading problems of LD children, for example, reading problems that may arise from slower processing speed (Maisto & Sipe, 1980). Indeed a metacognitive intervention would have little effect on reading problems caused by structural problems, be they slower processing speed (Maisto & Sipe, 1980) or severe memory problems (Torgesen & Houck, 1980). For reading-disabled children with such structural problems, one would be hard put to develop effective remedial programs.

A second criticism is that attempts to find a one-to-one correspondence between metacognition and appropriate action in any domain have met with little success (Cavanaugh & Perlmutter, 1982). Specifically, research interest in metamemory stems partly from the assumption that what the child knows about memory mediates his or her actions/strategies in memory tasks. Yet existent research has shown little correlation between

memory knowledge and memory behavior. For example, children who know that categorized lists are easier than uncategorized lists may not significantly categorize items as an aid to recall (Salatas & Havell, 1976). Similarly, children may describe appropriate study strategies, yet fail to use them (Garner & Reis, 1981).

The existent research certainly questions the effects of the individual's metacognition in directing/governing his or her appropriate use of knowledge. Yet it may be argued that it is naive to expect a perfect correlation between metacognition and appropriate action in a particular domain. There may well be other variables in the individual's perception or conception that may outweigh his or her awareness of an appropriate strategy or route of action. One such variable is effort (e.g., Wellman, Collins, & Glieberman, 1981). Wellman et al. (1981) found effort was a powerful variable in young children's estimates of memory performance. Specifically, for preschoolers, the amount of to-be-remembered information plays a lesser role in their conception/estimation of memory performance, whereas how hard the rememberer tries plays a weighty role.

Wellman et al. think that the young child's concern with effort may explain previous findings in Yussen and Levy's (1975) study, in which preschoolers persisted in predicting future success on the same task, despite having experienced failure with recall for 9 or 10 items. Wellman et al. consider those young children's performance to be very understandable if they were introducing effort as a relevant variable, predicting that they could increase their effort and, therefore, increase recall.

Another variable that affects the correlation between metacognition and appropriate strategy is the individual's cost-plus analysis in using the appropriate strategy. Anderson (1980) pointed out that students may not use an appropriate studying strategy if they consider that the benefits do not match the time/effort involved in using it.

Thus the criticism that existent research does not substantiate the assumed relationship between metamemory and memory performance reflects our simplistic conception of that relationship. As Wellman et al. succinctly stated, "an understanding of how metamemory influences memory performance awaits an understanding of the child's overall conception of information processing, as reflected in an understanding of the combined influences of many variables" (Wellman et al., 1981, p. 1317). Wellman et al.'s statement applies equally to other meta domains.

Future Directions

This section focuses on questions in metacognition and learning disabilities for future research. However, before discussing these research questions, it appears appropriate to consider the issues underlying such research. The basic issues appear to be twofold: (1) precisely how do existent metacognitive problems affect LD children's academic learning and performance, and (2) what prescriptive implications for their instruction/ remediation can be drawn from an understanding of the influences of their, metacognitive problems (cf. Baker & Brown, 1984a, 1984b; Brown, 1980; Brown & Palincsar, 1982; Forrest-Pressley & Waller, 1982).

Regarding future research directions, the first question concerns instructional research in learning disabilities. It appears that researchers are forging ahead with instructional research, designed to increase cognitive and metacognitive functions in LD students. The instructional foci ranged from handwriting and spelling to reading comprehension (Gerber, 1982; Kosiewicz, Hallahan, Lloyd, & Graves, 1982; Palincsar, 1982; Wong & Jones, 1982). However, the benefits in inculcating various strategies in LD students may be short-termed without more attention being paid to increasing the students' knowledge base in Conjunction with teaching them the appropriate learning strategy or strategies (Chi, 1981; Voss, 1982) and observing the effects of increased knowledge on the learned strategies. For example, in Palincsar's (1982) study, LD students were taught questioning strategies, summarization skills, and detecting inconsistencies. The training increased their reading comprehension skills, and transfer to the content area of social studies was observed. It would be instructive to research the effects of increased social studies knowledge on the trained LD students' use of learned strategies. Specifically, as the academic year continued, and the LD students gained in content knowledge of social studies, which of the strategies (questioning, summarization, and detecting anomalies)

becomes most used, or evolves into more sophisticated forms?

The point is, there is an intricate relationship between the use of any cognitive and metacognitive strategy and the amount and structure of the content knowledge to which the strategy is to be used (Chi, 1981). Hence, it is insufficient for learning-disabilities researchers and practitioners to focus exclusively on strategy training. In their design of instructional research, they must attend equally and concurrently to the LD students' acquisition of knowledge in the *specific content area* to which they want the LD students to apply the learned strategy or strategies. Understanding the effects of knowledge on LD students' strategy use is therefore an important issue for future research in learning disabilities.

A second question that may interest researchers concerns investigations of metacognitive processes in LD students. The research on LD students' metacognitive processes, for example, metattention and metamemory, suggests that LD children's metattentional functions resemble those of younger children, rather than those of their peers, and that they. showed less rehearsal strategies in memorization. This information has been instructive. A logical extension of such research appears to be investigations on variables that promote LD children's metacognitive development.

Flavell (1982) has given some thoughts to variables/sources that contribute to metacognitive developments. He contemplates two sources: (1) cognitive-developmental changes in the child (e.g., the child's increase in planning capacity), and (2) experiences the child might have that could promote metacognitive development (e.g., classroom teachers modelling self-monitoring in reading comprehension by questioning and attentionfocusing, Schallert & Kleinman, 1979; and parents teaching self-regulatory behaviors to their children, Wertsch, 1978).

Let us illustrate one way of researching the kinds of experiences that could promote LD children's metacognitive development. It is recalled that younger and poorer readers typically are less aware of the purpose of reading. To them, reading is a decoding process, rather than a process of extracting meaning from what is read (cf. Forrest-Pressley & Waller, 1980; Myers & Paris, 1978). A relevant research question here would be whether or not successful remediation of LD children's decoding problem would promote their awareness that reading is much more than decoding. The congruity of this research question is clarified by the remedial practice of teachers and reading-disabled children. In remedial instruction of LD children with reading problems, teachers very often provide exercises in passage/story reading jointly with drills in phonics. As the LD children gain in decoding fluency and apply their improved skill in reading exercises or in repeated reading (Samiiels, 1982), would they develop the metacognition to read for understanding?

A third question for interested researchers concerns the literature indicating that younger and poorer readers do not monitor their listening and/or reading comprehension as well as older and better readers. Specifically, younger and poorer readers more often accepted as correct, sentences that are grammatically incorrect (Forrest-Pressley & Waller, 1982). However, even good readers in Grade 6 do not always detect inconsistencies in paragraphs (Markman, 1979, 1977; Paris & Myers, 1981).

The pertinent question here concerns the parameters of the poor reader's difficulty in monitoring his or her own listening/reading comprehension (Forrest-Pressley & Waller, 1982). We are only beginning to piece together bits of information toward understanding the complexity of children's comprehension monitoring. Thus far, there is evidence indicating that very young children (age 3 years) would demonstrate comprehension monitoring, given a task involving familiar play activities (Revelle & Karabenick, 1981). Similarly good comprehension monitoring in 6-year-olds was obtained by decreasing the complexity of task demands (Patterson, O'Brien, Kister, Carter, & Kotsonis, 1981). Moreover, standards for evaluating given texts and explicit information on text inconsistency resulted in older children's success in detecting falsehoods or inconsistencies (Markman, 1979; Markman & Gorin, 1981). Further, knowledge of language concepts related to reading (e.g., words and sentences) is related to the child's monitoring of words and sentences (Forrest-Pressley & Waller, 1982). Forrest-Pressley and Waller suggest that such knowledge may be a necessary prerequisite in the poor reader's ability to monitor his or her reading errors and to remediate them. Wong and Jones (1982) indicate the importance of teaching LD students the concept of a main idea prior to teaching them self-monitoring skills in reading comprehension. The results of an earlier study by Wong (1979) suggested that LD children might well be deficient in the knowledge of a main idea.

One parameter governing children's monitoring of reading comprehension or detection of inconsistency appears to be very little understood. This concerns how children and adults successfully reconcile inconsistent information through their own reasoning (Baker & Anderson, 1982; Collins, Brown & Larkin, 1977; Markman & Gorin, 1981; Winograd & Johnson, 1980). Because of this idiosyncratic tendency in children and adults, one may not conclude that a person's (e.g., a child's) failure to mention an inconsistency in the text indicates his or her failure in detecting it. This point bears emphasis in light of evidence that older children detected more inconsistencies when explicitly instructed to locate them (Markman, 1979) or given explicit standards for evaluating what they were reading (Markman & Gorin, 1981).

The preceding brief review highlights the respective roles of certain parameters in children's cognitive monitoring. To understand more fully the processes of cognitive monitoring, we need to research, aside from other parameters, the role of relevant self-questions (cf. Andre & Anderson, 1978-1979; Bransford et al., 1981, 1982; Stein & Bransford, 1979), information processing style of poor readers (Garner, 1981), the bridge between detection of comprehension failure and appropriate debugging strategy (Anderson, 1980; Brown, 1980). and the use of debugging strategies (e.g., look-backs) (Alessi, Anderson, & Goetz, 1979; Garner, in press; Garner & Reis, 1981).

Epilogue

I In this chapter, the connection between metacognition and learning disabilities has been explicated. Essentially, metacognitive theory and research contribute importantly to the advancement of the learning disabilities field theoretically, empirically, and in remedial instruction. We have analyzed the inadequacies in two dominant theoretical approaches in learning disabilities, namely, the ability deficits and the task-analysis approaches, and shown how metacognitive theory redresses their insufficiencies. The task-analysis approach, complemented by a metacognitive dimension, currently provides the most satisfactory conceptualization of LD students' academic difficulties.

Metacognitive theory and research has stimulated research on LD students' metacognitive processes and instructional research to enhance their metacognition. In future research, we may profitably concentrate on researching conditions that promote metacognitive development in LD students, and on intervention research that focuses on increasing LD students' content knowledge concurrently with training them on the use of strategies relevant to that content area.

Lastly, metacognitive theory entails equal emphasis on self-regulatory training and basic skills training in the remedial programs of LD students. In the final analysis, the proposal and significance of an additional metacognitive dimension in learning disabilities stem from the possibilities of an increased and more comprehensive understanding of the reasons underlying LD students' academic failures. And through more thorough understanding of their academic failures, we might achieve substantially more effective remediation.

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