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LEARNING TO LEARN: ON TRAINING STUDENTS TO LEARN FROM TEXTS

Ann L. Brown, Joseph C. Campione,
and Jeanne D. Day

University of Illinois at Urbana-Champaign

November 1980

Center for the Study of Reading

UNIVERSITY OF ILLINOIS
AT URBANA-CHAMPAIGN
51 Gerty Drive
Champaign, Illinois 61820

The National Institute of Education
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Washington, D.C. 20208

BOLT BERANEK AND NEWMAN INC.
50 Moulton Street
Cambridge, Massachusetts 02138

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Jeanne Day is now at the University of Notre Dame.

Abstract

Mechanism for training students to devise their own strategies for learning are discussed. Training students to use strategies that fail to appraise the study of the utility of their action fail to inculcate the necessary self-awareness, whereas studies where students are both informed of the outcome of their action and instructed in self corrective procedures were much more successful at securing desirable effects of training.

Learning to Learn:
On Training Students to Learn from Texts

The general theme of this paper is how we can devise instructional routines to help students learn to learn. The dominant questions that have motivated training studies in developmental psychology are: Can we improve upon students' spontaneous performance and, further, can we enhance their ability to perform future tasks of the same kind? There are several possible outcomes of training studies aimed at improving students' academic performance. Such studies can fail, of course, in that they may result in no worthwhile changes in students' performance. They can succeed by adding substantially to the students' knowledge, or they can succeed by instructing students in ways to enhance their own knowledge--i.e., by promoting learning-to-learn activities. It is this third outcome that we think is most desirable and that we will consider in this paper.

In order to ensure that we share a common vocabulary, we would like to begin by introducing distinctions among three interrelated types of knowledge that influence students' current state of learning and their ability to profit from instruction. These three types of knowledge are strategic, content or factual, and metacognitive information (Brown, 1975; Chi, in press). Strategic knowledge refers to the repertoire of rules, procedures, tricks, routines, etc. for making learning a more efficient activity (Brown, 1975). Content or factual knowledge refers to information that learners have concerning the subject domain under consideration and their general knowledge of the world (Anderson, 1977; Brown, 1975, and in press; Chi, in press). Metacognitive knowledge refers to the information that learners have concerning the state of their own knowledge base and the task demands they are facing (Brown, 1975, and in press; Flavell & Wellman, 1977).

In principle, training studies can aim at improving all three kinds of knowledge, but in actual fact it is easier to effect change in some domains than in others, as we shall see. The majority of the developmental training studies have concentrated on deliberate strategies of learning, or strategies for promoting recall of information, mainly because of the relative ease of effecting improvement in this domain. But rote recall, although valuable, is not the only desirable outcome of learning activities. Often we want to enhance students' ability to understand the significance of the material they are learning rather than to improve their ability to recall it. Activities that promote recall need not necessarily be optimal for promoting other learning products (Bransford, 1979; Brown, in press; Nitsch, 1977). But because of the dominance of deliberate memory strategies in training research, we will begin with a brief consideration of this literature and then proceed to discuss training aimed at bringing students to understand the significance of learning strategies, particularly in relation to school tasks such as studying texts.

Strategies of Rote Recall

The most commonly studied strategies of rote recall are rehearsal, categorization and elaboration (Brown, 1974; Campione & Brown, 1977). We cannot ignore the knowledge base even when dealing with these simple strategies. For example, although it is not always so, rehearsal can be an activity carried out on material that has no inherent meaning. It can be, and often is, a brute force approach that does not demand any understanding of the significance of the material being processed. The learner is required merely to repeat segments of material until they can be rote-recalled. Categorization as a strategy to enhance recall demands that any categorical organization inherent in the material be familiar to the learner --i.e., be available in the knowledge base, and be used to design a plan for learning. Elaboration is a strategy whereby the learner imposes meaning or organization on material to render it more comprehensible--for example, by embedding unrelated pairs of items into meaningful stories. Thus, even with these simple rote recall strategies, the child's knowledge base is involved to some extent (Brown, 1975; Chi, in press).

The degree to which active transformation of the material is required, and the degree to which it is necessary to refine strategies, or even combine elements of different strategies, determines age of initial use and developmental trajectories. In general, however, the emergence of strategies such as these tends to be dependent on the degree and recency of formal schooling (Brown, 1977). In schooled populations, these strategies emerge in a recognizable form between 5 and 7 years of age and continue to be tuned and refined throughout the school years. Also common to the developmental course of these strategies is an intermediate stage, called a production deficiency, where the child does not produce the strategy spontaneously, but can be prompted or instructed to do so quite readily. Training studies in developmental research were initially aimed at examining the intermediate stage of production deficiencies for theoretical reasons that need not concern us here. In some cases, however, the aim was to help the slow-learning child produce strategies that he would rarely come to produce spontaneously (Brown, 1974; Brown & Campione, 1978), and it is these "instructional" studies that we will consider next.

Training Rote Recall Strategies

What form do these training studies take? To simplify a very extensive literature, there are three types of training that have been attempted. The first group, and by far the most heavily populated, is the blind training study. By this we mean that the students are not active conspirators in the training process. They are induced to use the strategy, or tricked into deep processing activities, without a concurrent understanding of the significance of that activity. For example, the child is taught to use a cumulative rehearsal strategy by initially copying an adult, but he is not told explicitly why he is acting this way, or that it helps performance, or that it is an activity appropriate to a certain class of memory situations (Brown, 1974). In the task of free recall of categorizable materials, the child can be tricked into using the categorical structure by clever incidental orienting instructions (Murphy & Brown, 1975), or the material can be blocked into categories for the learner (Gerjuoy & Spitz, 1966), or recall can be cued by category name (Green, 1974), but the child does not know why, or even if, this helps recall. In elaboration tasks, the child can be induced to provide an elaborated encoding of a pair of unrelated items (e.g., by asking him _why_-questions such as: "Why is the soap hiding under the jacket?", etc.) but the child is not informed that this activity can be an effective learning strategy (Turnure, Buium, & Thurlow, 1976). All of these tricks lead to enhanced recall because the learner is producing an appropriate activity. They fail, however, to result in maintenance or generalization of the strategy--i.e., the child neither uses the activity subsequently of his own volition, nor transfers the activity to similar learning situations. This is scarcely surprising, as the significance of the activity was never made clear to the learner.

An intermediate level of instruction, _informed training_, is where the child is both induced to use a strategy and also given some information concerning the significance of that activity. For example, it is possible to teach children to rehearse and then give feedback concerning their improved performance (Kennedy & Miller, 1976), or to teach them to rehearse on more than one rehearsal task; i.e., they may be trained in multiple contexts so that they can see the utility of the strategy (Belmont, Butterfield, & Borkowski, 1978). In the categorization task, students may be given practice in putting items into categories _and_ informed that this will help them remember, _and_ cued by category on retrieval failure; that is, a whole package designed to show children a learning strategy that works

(Burger, Blackman, Holmes, & Zetlin, 1978; Ringel & Springer, 1980). These training packages result in both improved performance on the training task and maintenance of the activity by the child when faced with subsequent similar problems. There is some evidence of generalization, but so far the evidence has been very weak, and the transfer very near--i.e., the generalization task is very similar to the training task (Brown & Campione, 1978, and in press).

The third level of instruction, self-control training, is the situation in which the child is not only instructed in the use of a strategy but is also explicitly instructed in how to employ, monitor, check and evaluate that strategy. The number of studies that have employed this combination are few, but preliminary results do indicate that the strategy-plus-control training packages are the most successful at inducing not only enhanced performance but also transfer of training to appropriate settings (Brown & Campione, in press). We will illustrate this type of training with a successful study from our laboratory (Brown, Campione, & Barclay, 1979).

Recall-Readiness Training Study

We were interested in teaching mildly retarded grade school children the simple skill of checking to see if they knew material sufficiently well to be tested. This is an essential prerequisite for effective studying and one that young children have difficulty understanding (Flavell, Friedrichs, & Hoyt, 1970). So we devised a simple task where we could make the self-checking demands of such studying activities quite explicit. The hope was that with the essential elements made clear in a simple situation, we could look for transfer to more complex, school-like learning tasks.

The simple training task consisted of presenting the students with a list of pictures equal to 1 1/2 times their span for picture lists. The pictures were presented in a series of windows, and could be viewed when each window was pressed. Only one picture was visible at a time, but the students could investigate the windows in any order and as frequently as they wished. They were also told to ring a bell when they felt they were ready to be tested for recall. Performance was initially poor, even though the children were free to study for as long as they liked.

During the training portion of the study, children were taught strategies which could be used to facilitate their learning of the lists, along with the overseeing or monitoring of those strategies. The latter aspect of training was accomplished by employing strategies which included a self-testing component and by telling the children to monitor their state of learning. For example, in a rehearsal condition, the subjects were told to break the list down into manageable subsets (three items) and rehearse those subsets separately. They were also instructed to continue rehearsing the subsets until they were sure they could recall all of the items. Note that one can only continue to rehearse all the items if one can remember them well enough to produce them for rehearsal. Thus, in this situation, rehearsal serves both to facilitate learning and to provide a check on the state of that learning. Anticipation was another trained strategy which included self-testing features. Here the children were instructed to try to remember the name of a picture before they pressed the window. Children in a final condition, labeling, served as a control group; they were told to go through the list repeatedly labeling each item as they exposed it. In all conditions, the students were told to continue the trained activity until they were sure they were ready to recall all the picture names.

There were two groups of trainees; the older children were approximately 11 years old with mental ages of 8 years. The younger children were 9 years old (MA = 6). Consider first the older children. Those taught the strategies involving a self-testing component improved their performance significantly (from 58% correct to almost perfect accuracy), whereas those in the control condition did not. These effects were extremely durable, lasting over a series of posttests, the last test occurring one year after the training had ended.

The younger children (MA = 6, CA = 9) did not benefit so much from training. They improved their performance significantly above baseline only on the first posttest, which was prompted; i.e., the experimenter told the children to continue using the strategy they had been taught. In the absence of such prompts, they did not differ significantly from baseline. Note that the younger and older children did not differ on original learning but did differ in how readily they responded to training. Tests of original competence provide only part of the picture, for the degree to which students can profit from training is also essential information for diagnosis of their "zone of potential development" (Brown, in press; Brown & French, 1979; Vygotsky, 1978)--i.e., how well they can operate in any domain given support.

The tendency for the younger children to abandon a trained strategy when not explicitly instructed to continue in its use is quite dramatically illustrated in the maintenance tests that took place one year after original learning. On the first two days of testing, the children were not prompted to use a strategy, and they performed at baseline levels. On the third day the experimenter told them to "try to remember when we did this game before: --remember that you said the picture names over and over (rehearsal), or remember that you tried to guess the picture names before you pressed the windows (anticipation)." These mild prompts resulted in a big improvement in performance (their accuracy increased from 60% to 90%). This improvement was not maintained on the final, unprompted test, where the students returned to their 60% accuracy level. This is a dramatic illustration of a common problem that bedevils would-be trainers of slow-learning children: Such children tend not to use even the skills they have available to them (Brown, in press; Brown & Campione, in press).

The picture was much more optimistic for the older children, and therefore we decided to investigate whether they had learned any general features about self-testing and monitoring on the simple laboratory task that they could transfer to a more school-like situation, learning the gist of prose passages. The students (previously trained in gist recall procedures) were seen for 6 days. On each day they studied two stories commensurate with their reading ability. When it was clear that the children could read all the words, they were instructed to continue studying until they were ready to attempt recall. The trained students (in the anticipation and rehearsal groups) outperformed a pair of control groups (label and naive control) on four measures: (a) the total amount recalled, (b) pattern of recall as a function of textual importance, (c) time spent studying, and (d) observations of overt strategy use (such as lip movement, looking away, self-testing, etc.). Training on a very simple self-checking task did transfer to the school-like task of studying texts. Thus, an effective technique for inducing the rudiments of mature studying behavior is to (a) simplify the task so that the basic rules can be demonstrated, (b) train an appropriate learning strategy, _and_ (c) train the self-monitoring of that strategy.

General Prescription for Training Rote Recall Strategies

The outcome of the past decade of work on training children to acquire and use a repertoire of basic study skills is that we can describe the essential steps of a successful training program (Brown & Campione, 1978, and in press). We do not have space to go into the steps in detail, or to do justice to the literatures that support these assumptions. Detailed treatments of each point can be found in the references following each point. But the points can be understood without the background literature, and indeed, the cynical may question why a literature was needed to arrive at such self-evident truths! The eight steps are: (a) train an instructionally relevant skill (Resnick & Glaser, 1976); (b) train the skill on a simple analogue of the target task and then fade in more complex procedures (Brown, Campione, & Barclay, 1979); (c) gear training to the starting competence of the learner (Brown, 1979; Brown & DeLoache, 1978;

Siegler, in press); (d) invest in careful task analyses of both the training vehicle and the transfer task so that the exact locus of training or transfer failures may be diagnosed (Belmont & Butterfield, 1977; Campione & Brown, 1974, 1977); (e) provide direct feedback concerning the effectiveness of strategy use (Brown & Campione, 1978; Kennedy & Miller, 1976; Ringel & Springer, 1980); (f) provide direct instruction concerning the range of applicability of the strategy and the need for generalization (Brown, 1978); (g) provide training in multiple contexts so that the range of applicability can be demonstrated (Belmont, Butterfield, & Borkowski, 1978; Brown, 1978); (h) provide direct instruction in self-management skills, or the self-regulation and monitoring of strategy selection and deployment (Brown & Campione, 1978, and in press; Brown, Campione, & Barclay, 1979).

There are two general points underlying this prescription: (a) The children should be fully informed participants in the training enterprise; i.e., they should be made to understand why they should be strategic and when it is necessary to be so; (b) the children should be trained in the self-management of the strategies they must deploy. Of course, the degree of explicit training needed will depend on the starting competence of the children and their general speed of learning. For slower children, or those with little prior knowledge, it might be necessary to make each step explicit. This is usually the case with mentally retarded students (Brown, 1974, 1978; Campione & Brown, 1977). Brighter, better-informed students tend to show some spontaneous transfer, and therefore it is often not necessary to make explicit the need for transfer, etc. The degree to which it is necessary to make each step explicit is a measure of the child's zone of potential development or region of sensitivity to instruction (see Brown & French, 1979, for a discussion of this Vygotskian concept).

Coming to Understand the Significance of One's Activities

Recall of information is often demanded in schools, both verbatim recall, as in vocabulary tests, and gist recall, as when the student is required to reconstruct the essential meaning of a text. Developing strategies that aid recall of information is therefore a worthwhile activity. But recall of information is not the only desirable outcome of learning, and strategies that promote recall of information are not always the most appropriate for enhancing other learning outcomes. For example, Nitsch (1977) found that different kinds of practice were needed to ensure that learners could remember the definition of concepts, as opposed to ensuring that they could readily understand new instances of the concepts. Students were trained in the meaning of concepts such as to crinch: to make someone angry by performing an inappropriate act, or to minge: to gang up on a person or thing. Training the use of a concept in a common context led to rapid rote learning of the definition of that concept but did not result in ready transfer to new contexts or a generalized concept of "crinch" or "minge." Training the use of a concept in a variety of contexts led to slower learning of the definition but much broader generalization. Students in the latter condition took longer to learn the definitions but were much better able to understand novel instances. A similar finding was reported by Mayer and Greeno (1972) concerning the appropriate training for students learning the binomial distribution. Repeated practice in using the formula or rule led to very accurate performance on subsequent problems of exactly the same form as training, whereas training aimed at explaining the significance of the components of the formula led to somewhat less accurate rule use but far better performance on alternate statements of the problem class, such as word problems.

Thus, in order to design appropriate training we need to analyze the question, Training for what? And similarly, in order to become really effective learners, children must analyze the learning situation for themselves; i.e., they must learn how to understand the significance of their activities and the particular demands of the task they are facing (Bransford, 1979; Brown, in press). Effective learning involves four main considerations: (a) The activities engaged in by the learner, (b) characteristics of the learner, including his capacity and state of prior knowledge, (c) the nature of the materials to be learned (pictures, stories, expository texts, maps, etc.), and (d) the criterial task (rote verbatim recall, gist recall, understanding novel instances of a concept, noting inconsistencies, following instructions, etc.).

In order for the psychologist or educator to devise a training program, it is necessary to consider all four aspects of the learning situation. For example, consider learning from texts. Any strategy (learning activity) one might adopt should be influenced by the inherent structure of the text (its syntactic, semantic, and structural complexity, its adherence to good form, etc.), the extent to which the text's informational content is compatible with existing knowledge (characteristics of the learner), and the test to which the learning must be put (criterial task, i.e., gist recall, resolving ambiguities, acquiring basic concepts, understanding instructions, etc.). As psychologists interested in understanding and promoting learning, we must appreciate the complex interactions implicit in any learning situation. We would like to argue further that this is exactly what the student must do. In order to become expert learners, students must develop some of the same insights into the demands of the learning situation as the psychologist. They must learn about their own cognitive characteristics, their available learning strategies, the demands of various learning tasks and the inherent structure of the material. They must tailor their activities finely to the competing demands of all these forces in order to become flexible and effective learners. In other words, they must learn how to learn (Bransford, Stein, Shelton, & Owings, 1980; Brown, in press).

We have argued that the effective learner is one who understands the significance of learning for different purposes, one who at least implicitly considers the four points of the tetrahedron as part of the learning context. As instructors, then, our task is to devise training routines that will help the student to develop this profile of learning, to appreciate the importance of the tetrahedral model. In principle, training can be aimed at all four points; in fact, the majority of studies have aimed at training strategies or rules for prose processing. There is a very good reason for this. If one has an adequate task analysis of the rules or strategies involved in any one task, it is relatively easy to impart this knowledge to students. It is not so easy, for example, to remedy a deficient knowledge base. We will return to this point later. Here we will illustrate strategy training with a series of studies concerned with inculcating basic rules for summarizing texts.

Training Strategies for Summarization

The ability to provide an adequate summary is a useful tool for understanding and studying texts. For example, an essential element of effective studying is the ability to estimate one's readiness to be tested, and we dealt earlier with simple procedures for ensuring at least a primitive form of self-testing (Brown, Campione, & Barclay, 1979). A commonly reported sophisticated method of testing one's level of comprehension and retention and, therefore, one's preparedness for a test, is to attempt to summarize the material one has been reading. This is quite a difficult task for immature learners. After considering many examples of childrens' failures and experts' successes when summarizing texts, we identified six basic rules that are essential to summarization (Brown & Day, Note 1), operations that are very similar to the macrorules described by Kintsch and van Dijk (1978) as basic operations involved in comprehending and remembering prose.

Two of the six rules involve the deletion of unnecessary material. One should obviously delete material that is trivial, and even grade-school children are quite adept at this if the content of the material is familiar (Brown & Day, Note 1). One should also delete material that is important but redundant. Two of the rules of summarization involve the substitution of a superordinate term or event for a list of items or actions. For example, if a text contains a list such as, cats, dogs, goldfish, gerbils and parrots, one can substitute the term pets. Similarly, one can substitute a superordinate action for a list of subcomponents of that action, e.g., John went to London, for: John left the house, John went to the train station, John bought a ticket, etc. etc. These rules are roughly comparable to Kintsch and van Dijk's generalization rules. The two remaining rules have to do with providing a summary of the main constituent unit of text, the paragraph. The first rule is: Select a topic sentence, if any, for this is the author's summary of the paragraph. The second rule is: If there is no topic sentence, invent your own. These operations are roughly equivalent to Kintsch and van Dijk's integration and construction rules.

These operations are used freely by experts when summarizing texts (Brown & Day, Note 1), but do less sophisticated readers realize that these basic rules can be applied? To examine the developmental progression associated with the use of the basic rules, we examined the ability of children from grades 5, 7, and 10, and various college students to use the rules while summarizing. We used specially constructed texts that enabled us to predict when each rule should be applied, or at least would be applied by experts (college rhetoric teachers). Even the youngest children were able to use the two deletion rules with above 90% accuracy, showing that they understood the basic idea behind a summary--get rid of unnecessary material. On the more complex rules, however, developmental differences were apparent. Students became increasingly adept at using the topic sentence rules, with college students performing extremely well. However, the most difficult rule, invention, was rarely used by fifth graders, used on only a third of appropriate occasions by tenth graders and on only half of the occasions when it was appropriate even by college students. Experts, college rhetoric teachers, used the invention rule in almost every permissible case. But junior college students (remedial studiers) performed like seventh graders, having great difficulty with the invention rule and using only the deletion rules effectively.

We explained this developmental progression in terms of the degree of cognitive intervention needed to apply each rule. The easier deletion rules require that information in the text be omitted, and the intermediate topic sentence rule requires that the main sentence contained in a paragraph be identified. But the more difficult invention rule requires that learners supply a synopsis in their own words, i.e., add information rather than just delete, select, or manipulate sentences already provided. It is these processes of invention that are the essence of good summarization, that are used with facility by experts, and that are most difficult for novice learners.

Encouragingly, these rules can be taught. In a recent doctoral thesis, Day (1980) trained junior college students to apply the basic rules and to check that they were using the rules appropriately. The students were divided into two groups: "normal" students with no reading or writing problems identified, and remedial students who, although of normal reading ability, were diagnosed as having writing problems. (A third group of students, with both reading and writing problems, was examined, but their data have not yet been analyzed.)

Within each of the two groups, there were four instructional conditions that varied in how explicit the training was: (a) Self-Management: The students were given general encouragement to write a good summary, to capture the main ideas, to dispense with trivia and all unnecessary words--but they were not told rules for achieving this end. (b) Rules: The students were given explicit instructions and modelling in the use of the rules. For example, they were given various colored pencils and shown how to delete redundant information in red, delete trivial information in blue, write in superordinates for any lists, underline topic sentences if provided, and write in a topic sentence if needed. Then, they were to use the remaining information to write a summary. (c) Rules Plus Self-Management: The students in the third group were given both the general self-management instructions of Group I and the rules instruction of Group II, but they were left to integrate the two sets of information for themselves. (d) Control of the Rules: The fourth and most explicit training condition involved training in the rules, as in condition 2, and additional explicit training in the control of these rules; i.e., the students were shown how to check that they had a topic sentence for each paragraph (either underlined or written in), how to check that all redundancies had been deleted, all trivia erased, etc., and how to check that any lists of items had been replaced with superordinates. The integration of the rules and appropriate self-control routines were explicitly modelled for the students. The amount of time spent in training and practice was the same for each group.

We will give only some selected outcomes, as the data are still being analyzed. The pretest data showed no effect of initial level of competence of the students and replicated our original junior college data (Brown & Day, Note 1). All students deleted appropriately (with above 90% accuracy), but they had much more difficulty with the topic sentence rules of selection and invention (25% and 15%, respectively).

The posttest data for the select and invent topic sentence rules revealed clear effects of ability level and degree of training. Consider first the select topic sentence data. All training had an effect; but for the less sophisticated learners, the most effective condition was the most explicit training, i.e., training in rules and their control. Training in rule use alone was an effective technique, but adding the general self-management instruction did not provide any additional help. The poorer students were not able to integrate the rules and self-management instructions for themselves and needed explicit instructions in the control of the rules in order to bring their level of performance up to that of four-year-college students (Brown & Day, Note 1).

The more sophisticated students benefitted more from all forms of training and were able to integrate the general self-management and rule training for themselves; therefore there was no difference between the two rules plus self-management conditions. Again this shows that the more sophisticated students benefit more from training and need less explicit prompts than do the less sophisticated trainees, even though they did not appear to differ on pretraining.

The pattern was repeated with the very difficult invention rule; remember that even four-year-college students only used the rule on 50% of appropriate occasions (Brown & Day, Note 1). The less sophisticated junior college learners improved only, and then only slightly, with the most explicit training. More sophisticated learners improved as a function of explicitness of training, but note that here, with the more difficult rule, it takes the explicit coordination of rules and their control before junior college students perform on a par with four-year-college students.

The general pattern of results is very similar to that found with the much simpler recall-readiness experiment described earlier. The students in the summarization training study (as in the recall-readiness study) did not differ on pretraining, but the more sophisticated students benefitted more from training. Training results in greater use of the rules, and improvement is effected with less explicit instruction with more advanced students. For those students with more severe learning problems, training results in less improvement, and more explicit training is needed before we get any effect of training. The extent of instruction needed to bring about improvement is a sensitive measure of the students' zone of potential development in the training domain; i.e., we learn a great deal about a student's competence by assessing not only his starting level, but his readiness to benefit from instruction (Brown, 1980; Brown & Campione, in press; Brown & French, 1979).

Helping Students Learn to Learn from Texts

The two sets of studies we have used as illustrations, the recall-readiness (Brown, Campione, & Barclay, 1979) and summarization (Day, 1980; Brown & Day, Note 1) training studies, were selected not only for the obvious reason that they were conducted in our laboratory, but also because they are excellent examples of what we can do readily and what we have more difficulty accomplishing. For example, with detailed task analyses, experts' help, and intensive training, we were able to help remedial college students improve their ability to summarize texts. But the texts were very easy for them; i.e., they were texts of fifth-grade readability level and were focused on familiar content. Therefore, instructions to delete trivia met with compliance. If the texts had concentrated on less familiar content or had been more structurally complex, it is not clear that the instruction to delete trivia would be so easy to follow. One must have some background concerning the content knowledge to enable one to recognize trivia readily.

There are two general classes of problems that can impede effective studying: inefficient application of rules and strategies, and impoverished background knowledge. The child may lack the necessary strategies to engage in appropriate learning activities, and we have ample evidence in the literature of children's lack of strategic knowledge. Alternatively, or in addition, the child may lack the requisite knowledge of the world to understand certain texts that presuppose adequate background experience. Instruction aimed at instigating strategic activity is somewhat easier to design than instruction aimed at instilling relevant knowledge, although unfortunately the two forms of knowledge interact in quite complex ways (Brown, in press; Chi, in press).

Consider, first, instruction in rules and strategies. If adequate performance depends on the application of a set of rules, and these rules can be specified exactly, then it should be possible to design instructional routines that introduce the uninitiated to these possibilities. For example, merely making children aware that they should continue studying and self-testing until ready for a test improves study performance in young children (Brown, Campione, & Barclay, 1979). Instructing students in efficient self-question techniques is also an effective training procedure (André & Anderson, 1978). Sensitizing young readers to the logical structure of text and the inherent meaning in certain passages again helps the less able reader (Bransford, Stein, Shelton, & Owings, 1980). The more detailed understanding the instructor has of effective rules for reading and studying, the more readily can those rules be trained. Our work with summarization rules is a case in point. Merely instructing students to make their summaries as brief as possible, and to omit unnecessary information, was not an explicit enough guide for junior college students. Exact specification of the rules that could be used to achieve this aim, however, was an extremely effective instructional routine. Quite simply, the more we are able to specify the rules used by experts, the more we will be able to successfully instruct the novice.

The second major impediment to effective learning is a deficient knowledge base. If the text deals with topics that the reader is not familiar with, it will be difficult for him to understand the significance of the material, to select main points and disregard trivia. One has to understand the meaning of the material one is reading to be able to identify just what is important and what is trivial. One answer to this problem is to select texts that do deal with familiar material, but this is not always possible. And, whereas the teacher may actively attempt to provide the requisite background knowledge for a particular text, she cannot always do this. The only answer, then, is to increase the learner's store of information, but this takes time; the only prescription for training that follows a diagnosis of deficient knowledge is one of general enrichment, which few schools have the resources to provide.

Undoubtedly, the task of instructing effective learning from texts is a complex one. But, if we keep in mind the interactive nature of learning, this should provide excellent insights into how we might help students become more effective text processors--despite the admitted difficulties. In Figure 1 we have modified a tetrahedral model of learning adapted from

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Insert Figure 1 about here.

Jenkins (1979), Bransford (1979), and Brown (in press) to emphasize its relevance to the task of studying from texts.

Imagine, if you will, a learner considering a learning task from the viewpoint of the center of the tetrahedron. In designing a plan for learning, the four points of the model must be considered. We believe that this is the end result that cognitive training should strive for. Learners must themselves consider the four points and their interaction--perhaps as follows: (a) Learning Activities: The learner should consider his available strategies, both general and specific. Specific strategies could be the rules for summarization just described, while general strategies could be variants of such general comprehension and study-monitoring activities as generating hypotheses about the text, predicting outcomes, noting and remediating confusions, etc. (Baker & Brown, in press; Brown, 1980). (b) Characteristics of the Learner: The learner should also consider his general characteristics, such as his limited immediate memory capacity for meaningless materials and his reservoir of appropriate prior knowledge. Thus, he should not overburden his memory by attempting to retain large segments of texts, too many pending questions, too many unresolved ambiguities, etc. (Baker & Brown, in press). He should attempt to tie the informational content into any prior knowledge he may have, to activate appropriate schemata (Anderson, 1977; Brown, Smiley, Day, Townsend, & Lawton, 1977), to seek relationships or analogies to prior knowledge (Brown, in press; Simon & Hayes, 1976; Gick & Holyoak, Note 2) in order to see the information in the light of knowledge he already has. (c) Nature of the Materials: The learner should also examine the text itself for the logical structure of the material, its form as well as its content (e.g., is it a story, an expository text, a riddle, etc.). Although meaning does not reside in the text alone, authors are sometimes helpful in cueing meaning. They flag important statements by such devices as headings, subsections, topic sentences, summaries, redundancies and just plain "and now for something really important" statements. Students can be made aware of the significance of these cues and induced to actively seek help from such sources. (d) Criterial Task: The learner should consider the aim of the learning activity, the purpose of his endeavors; he should also be aware that different desired outcomes require different learning activities and thus learn to tailor his efforts accordingly.

As psychologists interested in learning, it is important for us to understand the interactive nature of the tetrahedral model. As psychologists interested in methods for training effective learners, we believe that our main aim is to get the student to understand this point also. What we are advocating is, of course, an avoidance of blind training techniques, and a serious attempt at informed, self-controlled training--to provide novice learners with the information necessary for them to design effective plans of their own. The essential aim of training is to make the trainee more aware of the active nature of learning and the importance of employing problem-solving, trouble-shooting routines to enhance understanding. If learners can be made aware of (a) basic strategies for reading and remembering, (b) simple rules of text construction, (c) differing demands of a variety of tests to which their information may be put, and (d) the importance of activating any background knowledge they may have, they cannot help but become more effective learners. Such self-awareness is a prerequisite for self-regulation, the ability to orchestrate, monitor, and check one's own cognitive activities.

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Footnote

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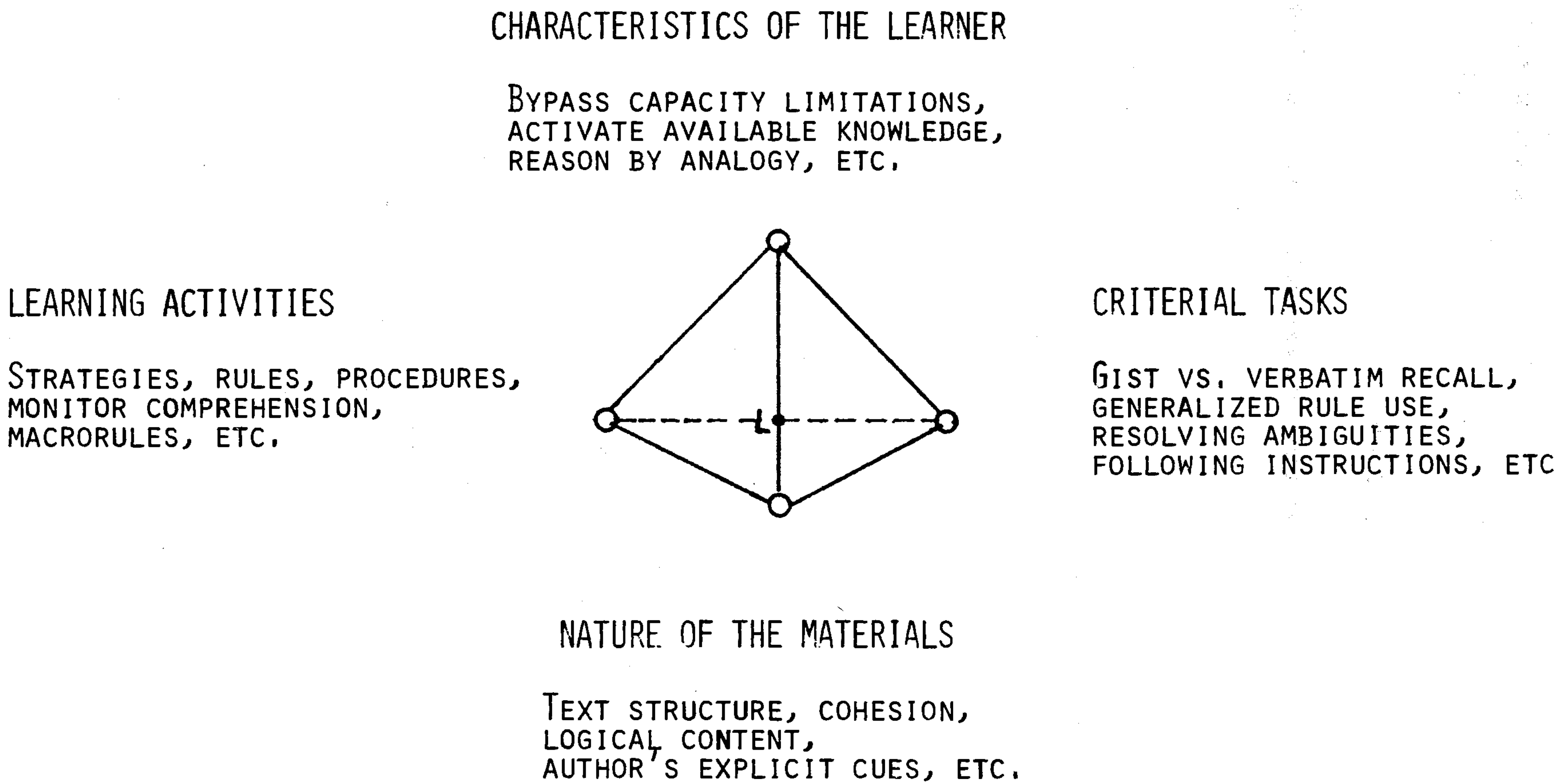
Figure Caption

Figure 1. An organizational framework for exploring questions about learning from texts.


CHARACTERISTICS OF THE LEARNER
BYPASS CAPACITY LIMITATIONS,
ACTIVATE AVAILABLE KNOWLEDGE,
REASON BY ANALOGY, ETC.
LEARNING ACTIVITIES
STRATEGIES, RULES, PROCEDURES,
MONITOR COMPREHENSION,
MACRORULES, ETC.
CRITERIAL TASKS
GIST VS. VERBATIM RECALL,
GENERALIZED RULE USE,
RESOLVING AMBIGUITIES,
FOLLOWING INSTRUCTIONS, ETC.
NATURE OF THE MATERIALS
TEXT STRUCTURE, COHESION,
LOGICAL CONTENT,
AUTHOR'S EXPLICIT CUES, ETC.

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