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ABSTRACT

J. D. Bransford's tetrahedral model of learning considers four variables: (1) learning activities, (2) characteristics of the learner, (3) criterial tasks, and (4) the nature of the materials. Bransford's model provides a research-based theoretical framework that can be used to teach, model, and have students apply a variety of study strategies to the learning situation. Learning activities, for example, include study techniques that give rise to learning, such as surveying, questioning, mapping, text underlining, making concept cards, summarizing, and so forth. The most important idea is that students learn a study sequence to follow. The second crucial aspect of the learning process is what the student brings to the learning situation, such as prior knowledge. College reading instructors can teach students how to tap into existing knowledge and how to use it in a variety of ways. The third variable, the ability to determine and carry out a variety of tasks, involves teaching students how to take both essay and objective tests, as well as how to solve problems. The fourth variable--the text--usually determines why a professor selects one text over another. Major differences among texts involve text organization, format, study aids, clarity of explanation, and occasionally readability. Students should learn to carefully examine a required text to see how it is organized. Teaching students in such a way that all four variables are addressed should be the major goal of any college reading program. (HOD)

Tetrahedral Models of Learning:

Application to College Reading

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RUNNING HEAD: Learning

Abstract

Bransford's (1979) tetrahedral model of learning purports four interrelated variables: (1) learning activities, (2) characteristics of the learner, (3) criterial tasks, and the nature of the materials. In order for college students to be efficient and effective learners, all four variables must be operating. The purposes of this article are (1) to discuss each of four aspects of the model and (2) to give practical suggestions which encourage the integration of all four variables into an efficient and effective learning process.

Tetrahedral Models of Learning:

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In order for students to be academically successful, they must be active learners (Tierney, 1982), be able to regulate and monitor their learning (Brown, Campione, & Day, 1981), and be able to generate and transfer meaning (Whittrock, 1974). The many facets of what must transpire in order for understanding and learning to occur are no more apparent than at the college level where professors expect students to be competent and effective learners. However, anyone who teaches college reading/study strategies courses knows that professors are often shocked at the incompetency of students' learning and studying behaviors. In fact, it is common knowledge that in recent years the readability of college level texts has declined while grade inflation has increased (Maxwell 1979). Rather than examining the reasons why students enter college as inefficient and ineffective learners educators at all levels often place the blame on someone else. College reading instructors blame high schools for inadequately preparing students, high schools blame middle schools, middle schools blame elementary schools, and of course elementary schools blame parents. Few people--professors, teachers, parents, students--stop to consider the complexity of the

learning process itself as a plausible explanation for the inadequacies of students--even college students.

Even feeble attempts at examining learning leaves one with the overwhelming feeling that it is indeed a miracle that we learn anything! The purposes of this paper, therefore, are (1) to examine the interrelated aspects of learning using Bransford's tetrahedral model (1979) and (2) to provide practical techniques, strategies, and considerations for each facet of Bransford's model that can be used to make college students more efficient and effective learners.

Bransford's Tetrahedral Model

As the term tetrahedral suggests, Bransford's model of learning considers four variables: (1) learning activities, (2) characteristics of the learner, (3) criterial tasks, and (4) the nature of the materials. Learning activities involve an array of processes in which students must engage in order to learn, understand, and remember. These processes include attending to the information to be learned, using the appropriate rehearsal strategies, and elaborating so that the material can be more deeply processed. Note that these learning activities enable information to move through the different memory systems, be stored, and subsequently retrieved at future times. While it is fairly easy to teach students a variety of learning strategies, it is often difficult to get students to apply them.

Characteristics of the learner pertain to the attitudes students have about learning, the skills that they bring with them to the learning situation, and perhaps most important, the prior knowledge and experiencial backgrounds that students possess. Without sufficient prior knowledge, comprehension is difficult, if not impossible and without comprehension, little learning can occur. Students not only must have "memory hooks" on which to hang new incoming information but also they must be able to activate the prior knowledge that they have. Insufficient prior knowledge is much more difficult for instructors to impact upon than either attitudinal problems or teaching students how to activate the prior knowledge they have. College instructors tend to become most frustrated when dealing with this aspect of learning.

The third variable in Bransford's model is carrying out the specific criterial tasks so important for learning to occur. These tasks include the ability to perform on both recognition and recall tests, transferring learning from one situation to a new but similar situation, and problem solving. Many students are under the assumption that studying for objective and essay tests requires the same set of strategies. Likewise applying knowledge to new situations is certainly more difficult than

memorization and the difficulty many students have with mathematics indicates that problem-solving abilities are often weak.

The fourth variable in the model, the nature of materials, examines the organization, structure, and conceptual difficulty of the learning materials. It also examines imagery, meaningfulness, and the deep and surface structure of language.

What is apparent from Bransford's tetrahedral model is that learning is an extremely complex process having many interrelated parts. If only one aspect of the learning process is weak or not present, other aspects will be overtaxed--perhaps to the point where learning is inefficient or ineffective. For example, students who know appropriate study strategies but do not apply them because of motivation or attitude problems, or students who have test anxiety will experience difficulty in college because at least one aspect of learning is not functioning properly.

Since learning involves numerous interwoven factors, both isolating the skills for research purposes as well as conducting naturalistic research are problematic. Isolation of strategies, such as comparing underlining to outlining, actually tells little about learning, yet researches often make sweeping generalizations about the effectiveness of one strategy over another. On the other hand, total naturalistic research is also often misleading because it is difficult to determine to just

what extent one variable affects the other. Weinstein and Rogers (1984) support this view and offer suggestions for future consideration:

> Much research has been directed to identifying the important attributes of a variety of learning strategies. The older literature is replete with folklore and common sense notions about study skills that only recently are being subjected to more systematic empirical study, and much of the literature on cognitive strategies is too new to offer well-documented procedures. When these problems occur, we must create instructional guidelines based on the data available. These new instructional sequences are then field tested in supplementary studies and in the course itself. This is a challenging and laborious task, but a necessary step toward the development of effective training programs. (p. 16)

While you may be hard pressed to find college reading instructors who disagree in theory that learning is an active as well as an interactive process, in practice, teaching methodology is often inconsistent with the Bransford model. Instructors who teach college reading as a series of isolated skills may fail to emphasize the interactive process of learning, fail to teach study strategies or to have students apply them in realistic contexts. Two examples illustrate problems with the traditional skills models. First, giving college students the task of finding the main idea of a paragraph of a brief article has

little relevancy in the real college world. In what course will students have to perform such a task? Finding the main idea of a paragraph has little, if anything, to do with being able to pull out major concepts from a text chapter or lecture notes.

Second, while college reading instructors may spend a brief period of time discussing study strategies, students are rarely expected to apply the strategies to college level texts. Nor can students learn an adequate study process in a week. For most students enrolled in a college reading course, it takes at least one term for most students to be able to effectively apply the strtegies. Even with outstanding instruction, it is difficult to get students to apply what they have learned in a reading/study skills course to outside content courses. Nevertheless, there is a much better chance of transfer when students see the relevancy and interactive nature of what they are taught.

Bransford's model provides a research based theoretical framework that can be used to teach, model, and have students apply variety of strategies. The techniques suggested below stress the interrelated aspect of the model since all of the techniques consider more than one of the four variables. However, the techniques and strategies will be described under the aspect to which they most directly relate.

Learning Activities

Being able to apply a variety of learning activities is certainly a prerequisite to college academic success. Without

knowledge of a repetoire of study techniques, students will be neither efficient nor effective learners. Learning activities are those techniques that give rise to learning--surveying, questioning, mapping, proper text underlining, making concept cards, summarizing--are but a few strategies that college students should be able to apply. As suggested by Weinstein and Rogers, the most important idea is that students learn a study sequence to follow. They need some order to how they approach a task. They need to understand the importance of distributed practice. Above all else, students must apply the proper study methods again and again until they become an integral part of their daily routine.

Mnemonic devices are also important strategies for students to learn. Exposing students to the peg word method, method of loci, imagery, and other mnemonics can make factual and concrete learning easier. While mnemonics will not work for all kinds of learning, they give students additional techniques to use in specific situations. For example, the peg word method is particularly good for learning lists, while imagery is particulary useful for learning new terms or concepts, particularly those which are concrete.

Teaching students how to "chunk" information also falls under learning activities. Many freshmen view learning as isolated in that each new bit of information is learned by itself. Chunking is especially important for holding information in short-term

memory (Miller, 1956). Students can readily remember "photosythesis," one word or chunk, but would have difficulty remembering "pkyirtczsyvcbq," 14 letters or chunks. Hence, in order to be efficient and effective learners students must be taught how to chunk new incoming information for the purposes of storage and retrieval.

Finally, students must learn the importance of daily review stressing the role of distributed practice. All too often, students equate time on task with success. With such an attitude, the amount of information learned in ten hours the night before a test, would equate with ten hours of preparation spread over five days before the exam. Students must clearly understand not only the imporatnce of daily review for each object, but also the difference between using rehearsal strategies for initial learning and reviewing to maintain the information in long-term memory.

Characteristics of the Learner

The second crucial aspect of the learning process is what the student brings to the learning situation. Obviously this aspect of the model is one over which the instructor has little control. Those enrolled in a college reading course often have inadequate or limited prior knowledge on topics covered in content courses. These deficiencies surface as weak vocabularies and weak or nonexistent "memory hooks" on which to hang incoming information.

However, college reading instructors can help fill in some of these gaps by using weekly news magazines such as Newsweek or Time and newspapers in their classes. These types of reading expose students to a variety of current topics which can be used for not only providing background information but also for increasing vocabulary, creating interest, and increasing comprehension (Nist, Kirby, and Ritter, 1983).

Not all underprepared students lack prior knowledge, however. Many simply do not realize the importance of activating the knowledge they already possess. They tend to view each learning situation in isolation and do not tap their existing knowledge--psychology has nothing to do with sociology, which has noting to do with philosophy, which certainly has nothing to do with literature. In fact, some students look at each psychology or sociology chapter as isolated fragments of information and dismiss what they have learned after they are tested. Hence, college reading instructors must students how to tap into that existing knowledge and how to use it in a variety of situations. This can be accomplished in several ways. Using news magazines, instructors can select a topic and develop a better understanding of the topic by building on it throughout the term. For example, my students knew nothing about the apartheid policy in South Africa. After a term reading numerous Newsweek articles, they became well-versed on the topic and would even bring in articles

from other sources to share in class. Instructors can readily refer to information gleened in past reading and tie it to new information. This kind of positive modeling points out to students why the activation of prior knowledge aids in both comprehension and memory. Finally, as simple as it sounds, I tell students to list what they already know about topics presented in a chapter after they have surveyed. Most students are extremely surprised to discover that they know a considerable amount about a topic with which they felt very unfamiliar.

A final characteristic of the learner that must be considered is the attitude the individual has about learning. Students who resent taking a college reading class are almost certain to have attitudinal problems, but through good instruction, where students see the relevance of what they are doing, these attitudes can be altered. Though I often hear comments from students such as "I know I'm a poor writer so I need developmental English" or "I'm awful in math so I need developmental math" rarely do I hear "Gee, I don't know how to study so I need a developmental reading course." Unfortunately college reading instructors are faced with the task of convincing students that what they have to say is important and will be useful to preparing for content courses.

Criterial Tasks

The third facet of Bransford's model is the ability to determine and carry out a variety of tasks. For the college reading instructor, this would involve teaching students how to take both essay and objective tests as well as how to solve problems. While most students are aware that differences between tests exist, few realize the implications these differences have in selecting the appropriate study strategies, preparing for the tests, and in actually taking the test.

Few students realize the importance of predicting test items before the exam. Teaching students to use all information available to them as a way to "get inside" a professor's head in order to make accurate predictions about test questions is one of the most valuable things students need to learn. Encouraging them to write out answers to predicted essay questions and having a classmate critic their answers also help students receive feedback on the quality of their answers. Often I will show students how a certain concept could be asked on a test with several different kinds of questions--a multiple choice question that could be slightly altered and asked as a true-false question or expanded and asked as an essay. Basic test-taking strategies such as doing the items you know first, not changing answers

unless you're positive about the change, being a reflective rather than impulsive test-taker, and eliminating unplausible answers are all ideas that instructors must reiterate again and again.

Instructors also must teach students how to evaluate their test performance (Simpson & Nist, 1984). The majority of students view the end test product as a grade to be tucked away in the back of a notebook. However, students need to be taught to examine the missed items to see what patterns exist in their errors by asking themselves the following questions:

1. Did I miss questions from my lecture notes?
2. Did I miss questions taken from information that I should have underlined/annotated in the text?
3. Did I miss questions over handouts, films, or outside readings?
4. Did I miss questions over key vocabulary?
5. Did I miss application questions?
6. Did I miss questions because I failed to read the item carefully

Once students learn how to use test results diagnostically, scores on subsequent exams improve.

The Nature of the Learning Materials

Instructors and students alike often ignore the importance of the text as a variable contributing to the learning process.

However, this variable usually determines why a professor selects one text over another. For example, there are many introductory psychology texts on the market, each covering similar topics. Major differences among the texts are in text organization, format, study aids provided, clarity of explanation, and in some cases, readability. Students should learn to carefully examine a required text to see how it is organized. Does each chapter follow a similar format? Are study aids such as chapter outlines, headings/subheadings summary statements, questions at the end of the chapter, italicized terms or a list of terms at the end of the chapter provided to help readers more easily learn the information? Is it easy or difficult to pull out the major ideas in the chapter?

To make students aware of the differences, have them go to the library, examine and contrast several texts from the same discipline and several texts from different disciplines. Discovering that differences, often major ones, do occur among texts is yet another way of stressing the importance of the need to possess a variety of study strategies. Since texts differ from each other, methods used to learn such texts must also differ.

Conclusions

Many models and theories of learning and understanding provide little in the way of providing practical suggestions to aid in learning. However, Bransford's tetrahedral model is one for which college reading/study strategy instructors can readily supply teaching suggestions. The model certainly brings to light the complex, interrelated aspects that must mesh in order for learning to occur. It reminds us that the merely teaching a series of reading or study skills to students is at best insufficient to ensure maximum learning. It also reminds us that as instructors in college reading programs, our jobs are indeed massive. However, to teach students in such a way that all four variables in Bransford's model are addressed should be the major goal of any college reading program.

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