Memo to the Faculty

Faculty Teaching Excellence Program
Office of Academic Affairs, University of Colorado at Boulder

Implications of Cognitive Psychology for College Teaching

Wilbert J. McKeachie

Higher Education is more complex than other levels of education and much more complex than the sort of learning studied in psychology laboratories; yet the concepts derived from laboratory studies seem to me to have implications for those concerned with improving college level teaching and learning.

One of the themes of this book is that learning is a constructive process. Learners bring to classrooms and assignments their experiences and expectations. They try to make sense out of what the teacher or textbook says and to integrate the subject matter into some meaningful structure. Not all students do this to the same extent or in the same way. Thus the teacher is faced with individual differences among students which affect the effectiveness of teaching. It is not simply what the teacher does or assigns but also what the students do that determines educational effectiveness.

A second theme of the cognitive approach is closely related to this emphasis upon what the student brings to the classroom. Rather than focusing on teaching methods—the area to which I have devoted most of my career—the cognitive psychologist calls attention to what the student does outside the classroom. Studying, rather than lecturing, becomes the epitome of education. I feel a personal sense of irony in this because my first research studies were investigations of student-centered teaching. We observed how much students participated in class discussions; we emphasized the participation of the class in decisions normally made by the teacher; we encouraged flexible scheduling. But our observations and measures were all carried out in classrooms. Yet what could be more student-oriented than studying—an activity in which the student controls the time, place, and method of procedure?

In studying, students must monitor their own learning, determine when to go back to review, decide what additional resources are needed, and determine when they have reached appropriate criterion levels. They determine their own objectives for studying and develop their own methods for assuring retrieval when the knowledge or skill learned is needed—usually at a course examination (see Anderson, 1978). When written programs, computers, or tutors direct study, students often have little chance to practice evaluating their own understanding because the tutor does it for them. Rather than directing the students' study, the teacher should help the students direct their own study more effectively.

The cognitive view of the centrality of the learner is as important for student motivation as for teacher planning. A heavy emphasis upon teaching, upon teacher planning and teacher organization of learning experiences may lead both teachers and students to feel that the teacher controls learning and that the student must therefore be dependent upon the teacher. The cognitive view, on the other hand, may give students a greater sense of their own responsibility and their own skills and effectiveness as learners.

As we saw in the chapter by Snow and Peterson, students who see their fate as controlled by external factors learn more effectively from programmed instruction than from a contract plan. The teacher's task, however, is not simply one of teaching the knowledge gained from the program, but also that of determining how to increase these students' sense of their own effectiveness as learners in future learning situations.

What cognitive psychologists have to say is really different in nature as well as content from earlier psychological approaches. The difference is that the newer information-processing, cognitive approach is not as prescriptive—not as oriented toward behavioral control. As Greeno (1976) wrote:

As we get deeper into the analysis of what human beings actually do in cognitive tasks, we become more appreciative of the adaptive quality of cognitive processes. General laws of the kind needed for control of behavior in Skinner's sense do not characterize the science of psychology, because the interesting features of cognitive...
systems are not context free. What we seem to be developing, rather than a set of general laws, is a set of rather specific descriptions. As our knowledge is translated into application, I think it will have much more the character of permitting individuals to achieve their potential, based on capabilities that are understood because of scientific study, rather than of laws that determine what people will do.

Needed Research

This prospect suggests the need for more research. An impressive characteristic of the cognitive psychologists is the way in which they have analyzed the material to be remembered and the intellectual processes involved in learning. Even relatively simple laboratory tasks prove to be complex when carefully analyzed. The task of analyzing learning in college is more difficult. Nevertheless, it seems that even a relatively simple analysis of an educational task may be useful. For example, to the question "Why does a student fail an essay question on an exam?" one might propose:

1. He did not understand the question.
2. He did not learn the material.
3. He lacks cues for retrieval.
4. He lacks an appropriate strategy for retrieving the material.
5. He lacks words needed for an answer.
6. He lacks a conception of the required solution; (for example, when asked to explain he lacks an adequate conception of what is involved in an adequate explanation.)
7. He cannot hold the required material in active memory while writing the answer.

That one could forget part of an answer while beginning to write it down seems preposterous. Yet when long-term memory is unorganized, a big load is placed on short-term memory during the task of writing an appropriate answer. For example, Cole and others (1971) found that nonliterate African children seemed deficient on free recall tests, but when they were led by special techniques to respond in meaningful categories, recall was similar to that of American children. Some college students may have similar difficulties in organizing course material into meaningful categories.

The point of such an analysis of an essay test failure is that rather than simply telling a student doing poorly to study a particular chapter more thoroughly, we can look for common threads of difficulty such as the types of processing found in answers to several questions; we might even design tests to lay bare the different possible sources of difficulty so that remedial action could be taken.

Many teachers and learners are probably not very efficient. When preparing a course, teachers may simply update a set of lecture notes; when told to learn something, students may simply repeat and rehearse material—using methods not very effective for learning, remembering, and using meanings. Analyses of the processes students use in reading an assignment, in answering a question, or in other aspects of education may be useful in locating difficulties and suggesting more effective learning and teaching strategies.

If students understand their own mental processes and the conditions of effective operation, they should be better able to deal with a variety of learning and testing situations. Certainly the most important factor in the ultimate realization of this possibility is the continuation of basic research efforts in the broad area of information processing. A secondary, but not unimportant factor, is the continuation of attempts to bridge the gap between theory and application.

Some Generalizations

We already have some ideas that seem likely to be helpful to professors and students thinking about teaching and learning:

1. Human beings are learning organisms—seeking, organizing, coding, storing, and retrieving information all their lives; building on cognitive structures to continue learning throughout life (certainly not losing the capacity to learn); continually seeking meaning. Paradoxically, this new view of the organism as always learning has resulted in a reduction of interest in learning theory and a shift to other aspects of cognition, such as memory.

2. Human beings can remember images, remember transcriptions of the exact words that were used in a lecture or textbook, or remember meanings—depending upon the demands of the situation.

3. In our society, at least, there is a strong tendency to store and retrieve meanings rather than exact reproductions of what we experience. What meaning a student gets depends not only upon the student's past experience and resulting expectancies, but also upon the student's learning strategy or style.

4. Effective teaching helps students construct meanings more efficiently—meanings that are more valid, have more relationships to other knowledge and experience, and are more quickly and readily retrievable.

5. We teach students not only the knowledge of history, biology, or psychology, but also modes of thought and strategies for learning (Olson, 1976). Just as students have learned a grammar for sentences, they learn grammars of educational discourse. Different means may produce the same knowledge but not the same broader understanding for different learners or different uses. Comparisons of college teaching methods typically find no significant differences in tests of knowledge. There are, however, differences between teaching methods in
6. The effectiveness of student learning depends to some extent upon the strategy used by the student. Students often fail to choose the strategy that they can use most effectively and also fail to match their strategy to the learning task. This suggests two tasks for teachers: (1) teaching students to identify their own most effective learning strategies, and (2) teaching students how to use a larger repertoire of methods of learning. If this were achieved, instead of teachers adapting teaching methods to students, students could adapt the learning strategy most effective for whatever teaching method they encountered.

7. One way of teaching new strategies may be through our methods of testing. Does a course using essay tests have different effects on a student's later approach to similar subject matter than a similar course using objective tests? Does the type of question used produce an effect lasting beyond the particular course? My guess is that the effect of essay testing may well depend—among other things—on the sort of comments or questions written by the instructor on the test. Comments may help students learn new strategies or skills for learning and using a particular subject matter—and perhaps several types of courses taught in this way may produce effects generalizing across subject matters.

So far as I know, there are no systematic rules for teaching new strategies, although Norman's chapter illustrates one promising approach. I suspect that good teachers teach new strategies intuitively, as is probably the case with teachers who write comments on essay tests. Often their comments not only indicate errors and inadequacies, but also ask questions or make suggestions steering students to a more sophisticated, or deeper, approach. As Johnson (1975) has shown, the creativity of answers is influenced by marginal comments.

8. Teaching is usually based on implicit theories of teaching, and such theories probably contain much truth. Nevertheless, if we can help teachers become more explicit about these theories, there should be a better chance for the theories to improve with experience.

9. The cognitive structure of each student is different from that of the teacher. Thus we have the paradox that the teacher must learn from the students' structures if the teacher wants to be more effective in helping students learn from the teacher.

10. If we are to make bridges between structures in the subject matter, the curriculum, and the course design, strategies in the teacher, and structures in learners, we need to carry on discussions in which students have an opportunity to express their problems and progress. Talking, writing, doing, interacting, and teaching others are important ways in which learners restructure their learning. Since such activities become increasingly difficult as class size increases, we need to provide at least some opportunities for small group discussion, dialogue, writing, explaining, or doing something to which the teacher, other students, and the individual learner can respond (for example, see Leith, 1974).

11. Different methods are effective for different outcomes; in addition, different methods are effective for different learners. Because of interactions among student characteristics, teacher characteristics, goals, subject matter, and methods (as we have seen, for example, in the chapter by Snow and Peterson), flexibility and variability of approaches is likely to be more effective than a single method. Any given method is likely to be more effective than other methods for some students and less effective for other students.

12. In the classroom three levels of processes are going on. These are: (1) the level of the subject matter content. As Olson suggests, this content level is inseparably linked with (2) the level of cognitive structure in which the content is organized by the teacher and by the students. And in the background of these cognitive aspects of teaching-learning is (3) the interpersonal level of emotional relationships of students to teachers.

We know little about how to integrate these three levels in such ways as to optimize education. Clearly necessary, however, is a dynamic, ongoing process involving much adaptation on the part of both teacher and students.

13. Teachers are important as models for students. Personal, warm encouragement from a fellow human being has important effects upon motivation to learn and upon the degree to which students attempt to follow the example of a model. As Bandura (1976) and Eelen and D'Ydewalle (1976) have shown, learning from observing a model may be very effective.

14. Increases in effectiveness of education may come as much, or more, from helping students understand their own learning processes as from varying teaching (Norman, 1977).

15. Increases in effectiveness may also come from building the students' sense of self-efficacy and motivation for learning as they develop increased skill in learning, remembering, and problem solving.

Sources of Additional Assistance

A number of journals publish the current research on learning and memory. Those likely to be most available are: Journal of Experimental Psychology, Human Learning and Memory, Memory and Cognition, Cognitive Psychology, Journal of Educational Psychology.
Faculty Teaching Excellence Program
University of Colorado at Boulder
Campus Box 360
Boulder, Colorado 80309-0360
(303) 492-4985

References


Olson, D. "Toward a Theory of Instructional Means." Educational Psychologist, 1976, 12, 14-35.

Wilbert J. McKeachie is a professor of psychology and director of the Center for Research on Learning and Teaching at the University of Michigan.

Reprinted by permission, from W.J. McKeachie (ed.), Learning, Cognition, and College Teaching. New Directions for Teaching and Learning, no. 2. Copyright 1980 by Jossey-Bass Inc., Publishers. For use by faculty at University of Colorado at Boulder. All rights reserved.