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Practical Implications of Cognitive Theories

Marilla D. Svinicki

To adopt cognitive theory is to build one's teaching practice on the following assertion:

Learners are not simply passive recipients of information; they actively construct their own understanding.

The learner is at center stage. The instructor becomes a facilitator of learning, rather than one who delivers information. This perspective on learning contrasts sharply with models that imply that learners get the point as long as the instructor provides an appropriate stimulus. Cognitive psychology says that the learner plays a critical role in determining what he or she gets out of instruction.

As instructors, we may provide the same information to several students, but we cannot always predict how a student will interpret or use the information. To illustrate this dilemma consider what comes to mind when you hear the word *cardinal*. Some individuals think of baseball, some of numbers, some of the Roman Catholic church, some of the color red. Some even think of sin; it all depends on background and current mindset. As a teacher, my goal is that when I say the word *cardinal*, everyone in the class makes the same association. It has been shown (Naveh-Benjamin, McKeachie, Lin, and Tucker, 1986) that students who make the same connections and use the same content-organization patterns as the instructor do best on standard measures of learning, no matter how they start out organizing or associating content. This change in the conception of what happens during learning makes big differences in our perception of what students and teachers do in the classroom. Let us explore what some of those differences are.

Redefining the Student Role

Many students are under the impression that their task in class is passively to absorb what the teacher says in lecture, what is in the textbook, what they see in lab, and what they practice in homework. They are often unaware that what they think they absorb, read, see, or learn from practice may not be what the instructor intends. Their understanding of all these things is strongly influenced by a whole array of variables: their prior knowledge, their interpretation of what is important, the frequency with which they test themselves and their understanding, their perspectives on how all this relates to future use, and so on. Whether they realize it or not, and whether they like it or not, what they learn depends on who they are, where they have been, and what they do. Thus truth is no longer absolute, even the initial intake of information is subject to idiosyncratic interpretation. Scholars in the field of communication have long maintained that both the receiver and the medium are part of the message.

To be most effective, learners must become aware of how their own biases and behaviors filter the information they receive. They must also take a developmental step forward in their understanding of the epistemology of knowledge. They must come to understand that there are multiple ways of interpreting reality. In one cognitive-development model (Perry, 1981), this movement from a dualistic view of the world ("Truth is truth") to a multiplicitic view ("Truth is subject to interpretation") carries with it a necessary change in one's view of oneself and in what one does during learning. It is the change from lower cognitive levels (memorization and simple translation of authoritative sources) to higher levels (analysis, evaluation, and acceptance of personal responsibility for one's choices).

Redefining the Instructor Role

For the instructor's role, the first implication of shifting to a cognitive perspective is that neither the teacher nor the content is at the center of the learning universe. Instructors become facilitators of learning. What we say is not necessarily what students get, unless we are very careful and deliberate about how it is presented. Information is easily garbled in transmission. Our job becomes one of minimizing the noise in the transmission, so that all the listeners (learners) interpret our statements in the same way, or in as close an approximation as possible, and store information in long-term memory so that they can retrieve it in the future. Better yet, we hope to convey the message in such a way that the learner can retrieve it without our intervention when the occasion demands. We do this by careful attention to how the content is structured, how it is sequenced, what examples and activities we use, how we respond to initial learning attempts, and an array of other instructional strategies.

A second implication for the instructor's role is that we are freed from our "Atlas complex" (Finkel and Monk, 1983). The weight of the world of learning does not rest on our shoulders alone; that responsibility is shared with students. They are the ones who must do the learning. They select the learning strategies, monitor their own comprehension, and chart their own future course. What we do is help them understand the tools they need for success and arrange the environment to make success possible.

These are difficult adjustments for teacher and student alike, but, in the end, students are better off. Someone will not

* Marilla D. Svinicki is director of the Center for Teaching Effectiveness, University of Texas, Austin.
It is natural, in the flow of conversation, to cite examples, evoke images through metaphors and analogies, and translate abstractions into concrete instances of understanding. Most instructors use these devices regularly in explaining content. All these devices depend heavily on students’ prior knowledge and experience. An example does not clarify a concept if the student has no experience with that example. Saying that a *prrratz* works just like a *klogue* does not help if you do not know how a *klogue* works in the first place. Thus it becomes important for an instructor to know students and their backgrounds and to use that knowledge in the selection of activities and examples for use in class.

Students should be encouraged to make their own connections between what is being studied in one class and what they have learned in previous classes or in other settings. For example, students can create personal bibliographies of texts and readings from other courses that are related to the content at hand and then use those materials to supplement assigned readings. Many instructors have students scan the news media for examples related to class concepts. Students can learn to use vivid images and other elaboration strategies as described in the previous chapter, if the instructor allows time during class for such activities. Instructors can also counsel students to incorporate this practice of making content meaningful into their regular study procedures. An instructor who finds a student having difficulty creating class notes can suggest alternatives to make notes more meaningful. For example, class notes do not have to be exclusively in prose format; sketches and other visual stimuli can serve as helpful elaborations on a basic text. The common thread in these examples is to encourage students to make connections between what they know and what they are learning.

**Principle 3.** Learners store information in long-term memory in an organized fashion related to their existing understanding of the world. Implication: the instructor can facilitate the organization of new material by providing an organizational structure, particularly one with which students are familiar, or by encouraging students to create such structures; in fact, students learn best under the latter condition.

This principle is at the heart of the cognitive view of learning. We learn and remember information because we act on it in such a way as to fit it into an organized pattern based on our world view. Instructors who present course content in an organized fashion are increasing the probability that students will use that organizational structure to understand and store the content. For a single lecture, this means having a clear outline, displaying that outline as a guide to listening, and maintaining an orderly sequence of concepts and examples. Earlier, we saw that the outline enhances attention; here, we see it playing an additional role in learning.

In the overall course structure, organization means relating logical units of content to one another and building in a regular pattern toward the ultimate goal of the course. The pattern can be chronological, comparative, hierarchical, or representative of any other relationship. Whatever pattern is chosen, it should be made explicit to students.

The second part of the concept for ease of understanding the organizational structure to students’ existing world views. In the absence of a clearly delineated structure from the instructor, students will impose on content the organization most closely related to their current view of things. Thus, in a history course, the organizational structure that students are most likely to choose is chronological; it is what they are used to and is often their sole view of how history is organized. If the instructor’s thinking is organized around
some other structure, such as causes and effects, and if that organization is not made clear to students, then class content may appear very confused and disorganized. In the sciences, the influence of students' preexisting organizations shows up in common sense misconceptions about the causes of everyday phenomena. These misconceptions can create some bizarre attempts to explain events and are often very difficult to overcome.

In the absence of a preexisting organization or one provided by the instructor, students are likely to revert to rote memorization, a technique that may work in the short run but will eventually reach critical mass and produce failure. When new information is not or cannot be tied to old, students may easily encapsulate it as separate from everything else. This makes the new information hard to learn and easy to forget. It pays for the instructor to be aware of students' backgrounds and predispositions and to clarify which patterns of organizing the content are acceptable and which may be in conflict with those of the students.

Students can learn to recognize or create structures to facilitate their own learning. As noted earlier, one measure of students' grasp of content is the degree to which each student's conceptual map of the content organization matches the instructor's map. Getting in the habit of outlining readings and lecture notes, creating tree diagrams showing the relationships of concepts to one another, and learning other forms of content organization are tools students can use to make learning more efficient. By introducing students to these tools, an instructor helps them move closer to self-sufficiency.

**Principle 4. Learners continually check understanding, which results in refinement and revision of what is retained.**

Implication: opportunities for checking and diagnosis aid learning.

Think about how you read different types of material. If you are truly attending to the material and not just skimming it, you constantly monitor your reading. Sometimes you are brought up short when you find a sentence that seems incongruent with your understanding of what has gone before. At that point, you back up and reread, to find the cause of the discrepancy. That practice illustrates comprehension monitoring, an important executive process in learning. In reading, we have the luxury of interrupting ourselves to check on understanding, going back and replaying what we have just read to look for inconsistencies. In classes, however, most students do not have that opportunity, because they are not in control of the pace of the class; the lecturer controls the pace. If they do not understand something or think they hear a discrepancy, few students have sufficient self-confidence to interrupt and ask for clarification. Their usual response is to write down verbatim what is being said and go back and check it later. Poorer students, especially, may have given up the monitoring process altogether, in favor of just getting it all down. They feel they do not have time to think during class.

The instructor could give them that time. Most instructors pause periodically and ask for questions. They may rarely hear the important questions, however, because they seldom wait long enough for students to formulate them. It takes a few seconds to mentally look back over what has just been said and check for understanding. It takes a few more seconds to create a question that will make sense to others and not make the questioner look foolish. That is already six seconds, at the minimum, and only for really good students who have been able to keep up. Most instructors have difficulty waiting even three seconds before moving on; no wonder we seldom get questions. Students do not understand everything perfectly—they are just not fast enough to recognize what they do not understand and then ask.

Once instructors become aware of the need for and difficulty of monitoring, they can take steps to help students engage in this important strategy. For example, as just discussed, learning to wait a little longer after inviting questions (known as wait time) can be a big help. An even more significant step is to be very directive about checking understanding. For example, many instructors insert pauses in their lectures, during which students are instructed to write a one- or two-sentence summary of what has just been discussed. One or two of those summaries are then reviewed out loud for accuracy. This practice gets students in the habit of thinking in terms of major ideas and summaries and periodically checking their understanding. Students who have not been able to produce the summaries become aware immediately that they did not understand something and can either ask questions or note their confusion for future questioning or remediation. This practice also provides the instructor with feedback on students' understanding before it is too late to do something about it. These are only a few examples of how monitoring can be built into a class. For additional ideas on monitoring, consult Cross and Angelo (1988).

Students can be encouraged to engage in their own comprehension monitoring. One particularly popular strategy is to set aside a column on each sheet of class notes. In this column, the student records monitoring questions as the lecture or class period proceeds, noting confusions, connections with other ideas, potential test questions, and so on. The more presence of this column reminds the student to monitor thinking as the class proceeds.

Comprehension monitoring shows up most frequently in suggestions about reading. Students are encouraged to preview the reading and to record questions that they expect to be answered in the material. As they read, the need to answer those questions prompts students to process the reading at a deeper level than mere repetition of the words on the page. Getting in the habit of pausing at each break in the reading (say, where headings appear) and asking questions about what went before is another way of tracking comprehension. There are many possibilities for increasing awareness of understanding and its failure. Most important is to ensure that students see the need to pay attention to their attention.

**Principle 5. Transfer of learning to new contexts is not automatic but results from exposure to multiple applications.**

Implication: provision must be made during initial learning for later transfer.

To believe that one exposure to material is sufficient to allow a student to use that information forever in the future is naive. To believe that a beginning student is able to see all the potential uses for what he or she is learning is also naive. Indeed, much of their schooling seems to have convinced students of the independence of content; what they learn in math class has no relationship to what they learn in English or chemistry and vice versa. As instructors however, we know that knowledge is inter-related and that using it in different contexts makes it more meaningful and more easily remembered. We also know that, in the real world, students are unlikely to encounter situations for using their new knowledge that are exactly the same as what they experience in the classroom. They must learn how to take what they learn and transfer it.

We can help them make that transfer by building it in from the very start. Our greatest tool for facilitating transfer is incorporating a wide range of application opportunities and settings into the learning situation. The more (and the more different) situations in which students see a concept applied,
the better they will be able to use what they have learned in the future. It will no longer be tied to a single context.

An instructor can facilitate transfer through sheer repetition. The more we use a skill or concept, the more automatic its use becomes, until we hardly have to think about it at all. It is the rare student who can learn to solve a complex type of math problem after trying only one example. It takes many hours of practice to become proficient at most things, to reach a level of "automaticity." Why should intellectual skills be any different?

A final facilitator of transfer involves getting students to abstract the principle from the practice. If students can articulate the steps they are taking to solve problems, or if they can extract an underlying concept from a set of examples, then they will be more likely to use that abstraction in a different context. This is known as decontextualizing and is the more complex complement of "automaticity." In practice, an instructor can help students talk to one another about the processes they are going through to solve problems. In so doing, they become aware of the steps they use (Lochhead and Whimbey, 1987). This awareness is then translated into increased ability to apply the same steps, now detached from their original context, to a new situation.

**Principle 6. Learning is facilitated when learners are aware of their learning strategies and monitor their use.**

Implication: the instructor should encourage students to learn how to translate these strategies into action at appropriate points in their learning.

These six principles discuss instructors' activities in the context of teaching the content of specific courses, but they also apply to the content of knowing how to learn. (Learning strategies, too, can be viewed as content to be learned.) Attention should be drawn to learning strategies. Their use should be monitored, and their transfer to new settings should be ensured. When an instructor takes on the task of teaching both the content of the discipline and the content of learning strategies within the same course, he or she will enrich students in both areas. There are several objectives and instructional methods for teaching the content of learning strategies.

**Students need to know what cognitive learning strategies are.** Most students are not aware of the different strategies available to them. An instructor can illustrate the strategies that exist by taking every opportunity to point out the process of learning as it occurs. For example, to help students learn to recognize the cues that indicate the importance of material and the degree of attention it should receive, the instructor, during the first few class periods, can explain the purpose of using visuals or the blackboard to highlight important concepts, as well as how the textbook uses similar techniques to highlight important ideas. After the first lecture, the instructor can illustrate these strategies by taking a few minutes to show students how the organization of the lecture should be reflected in their notes and to remind them of how that organization was made explicit during the lecture itself. At the beginning of the next class period, students can be asked to recall the main points of the previous class and to discuss how the organizational structure helped them remember the main ideas. These are only a few examples of how an instructor can make learning strategies explicit in the context of the course itself. These strategies are applicable to listening in class, reading the textbook, preparing for exams, monitoring understanding, managing time, and a whole range of other general learning situations that students may never have analyzed in just this way.

**Students need to know how to monitor their own use of learning strategies.** Perhaps the best way an instructor can help students get in the habit of using learning strategies is by providing opportunities, within the structure of the course itself, for students to use them. As discussed earlier, the instructor can pause during class to allow students to monitor their comprehension, by asking questions of themselves and of the instructor. An instructor can incorporate an optional learning log, in which students keep track of ways they have applied some of the strategies suggested by the instructor. The instructor can build a component on time and resource management into a term paper assignment, so that students set up work schedules, with goals and action plans, early in the semester and monitor their adherence to or revision of those plans. The instructor can take time after an exam to work with students on understanding how to use errors to diagnose study problems. All these activities both give students the opportunity to use learning strategies in their classes and demonstrate how important the instructor thinks these strategies are.

**Students need to know when to use the strategies they have learned.** This is a more difficult task for the instructor, because much of the decision about when to use a strategy depends on students' individual needs, as well as on the context. Nevertheless, the instructor helps by providing information on what alternative strategies are available and how they can be applied to different situations. He or she can model different strategies while answering questions or solving problems raised in class. Too often, students believe that the instructor immediately knows all the answers to all questions asked; they do not realize that instructors frequently have to think through new problems and new questions, just as students do. Taking the opportunity to work on new problems with students and show how to approach a new situation serves as a good model for students to understand that different problems require different approaches.

Another opportunity to help students understand the situational contexts of learning strategies occurs when students come individually for assistance. Talking with them about the strategies and the organization of the lecture should be reflected in their notes and to remind them of how that organization was made explicit during the lecture itself. At the beginning of the next class period, students can be asked to recall the main points of the previous class and to discuss how the organizational structure helped them remember the main ideas. These are only a few examples of how an instructor can make learning strategies explicit in the context of the course itself. These strategies are applicable to listening in class, reading the textbook, preparing for exams, monitoring understanding, managing time, and a whole range of other general learning situations that students may never have analyzed in just this way.

**Students need to know how to adapt their strategies to new situations.** This is really the problem of transferring taken one step farther. Just as we need to vary contexts in order for students to transfer content skills to new situations, we need to vary learning situations in order to show how strategies apply to different situations. Something that would be particularly helpful in this task is cooperation among instructors in different areas. This has been referred to as the metacurriculum (Wellstein, 1982): the idea of incorporating instructions in learning strategies into all courses, regardless of content. If instructors in chemistry used the same terms for learning strategies that instructors in history used, students would begin to decontextualize those strategies and then be more likely to apply them to French as well. They may not work identically in all fields, but many of the concepts can be applied across disciplines, or at least in similar contexts (for example, in all language classes or in all fact-based classes).

**Summary.**

There is a great deal of intuitive appeal to the cognitive approach to teaching. It echoes our own experience as learners and is easy to understand. Applying the approach is more difficult, however, because we must give up our illusion of control. That change shakes the foundation of content as the primary focus of our teaching. We are then faced with the task of adapting to the needs of learners, a varied and
unpredictable group. Fortunately, if we accept the precepts of cognitive theory—that learning is active, not passive—we will help to develop more productive learners who will function effectively and independently in the uncertainties of the future. Isn't that what it means to be a teacher?

References


Faculty Teaching Excellence Program
University of Colorado at Boulder
Campus Box 360
Boulder, CO 80309-0360
(303) 492-4985
http://www.colorado.edu/ftep