

Classroom Assessment opens the opportunity for more than just the improvement of teaching. With a solid grounding in learning theory, it has the potential of helping students become better learners as well.

CATs: A Student's Gateway to Better Learning

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At present, many faculty learn about Classroom Assessment Techniques (CATs) by observing other more experienced faculty members modeling a variety of CATs for colleagues. While modeling is extremely useful for demonstrating the “what” or “how” of Classroom Assessment, it is less successful at conveying the “why” of Classroom Assessment. Faculty members who wish to get the maximum benefit from Classroom Assessment are well-advised to learn about the relationship between CATs and cognitive learning theory. Understanding this link will not only allow them to choose or design CATs to fit the particular needs of their classes, it will also help them make explicit to their students the potential applications of CATs to study strategies in general. Once a student can make this leap, the effects of a single class activity are multiplied many times.

Cognitive Learning Theory

The theory that connects Classroom Assessment to learning is cognitive learning theory. Cognitive theory focuses on what is going on in the mind of the learner rather than thinking of learning as a simple stimulus-response connection. In this theory the learner is an active participant in the learning process; indeed, in some versions of cognitive theory, learning is almost completely a function of the learner's interpretation of events.

In its most general form, the theory describes learning as a building of connections between a learner's prior knowledge and experience and the new information or skill that is being learned. A successful learning episode results in the assimilation of new information into the long-term memory structure

of the learner via these connections. Later, when the new information is needed, the learner will activate any one of a number of these connections and the information will be retrieved for use.

There are several key processes in the building of connections during learning. These three are most important from the perspective of this chapter:

- *Attention*: For information to be learned, the learner must focus attention on it.
- *Encoding (deep processing)*: The learner transforms the information in ways that will make it more meaningful, more connectable, and therefore more retrievable. The most common ways of encoding information involve recognizing or imposing organization on it; elaborating on it by adding information from the learner's background; creating a memorable visual image that represents the information; and (least efficient) rehearsing it until it has been rote memorized, a strictly surface processing technique.
- *Metacognition*: The learner is aware of and in active control of his or her own learning. This is manifest in goal setting (understanding or deciding why something needs to be learned and setting the standard by which progress will be measured); comprehension monitoring (recognizing when one isn't learning and why); strategy selection (being able to select from an array of learning strategies those most likely to achieve the goal); and resource management (being aware of and able to bring a wide range of resources into play in achieving the goal).

The Link to Classroom Assessment

Most of the Classroom Assessment Techniques recommended in Angelo and Cross (1993) are tied in some way to this model of learning. A very thorough discussion of the subject is found in Cross and Steadman's (1996) *Classroom Research: Implementing the Scholarship of Teaching*, which contains case studies addressing universal learning issues in a variety of higher education classrooms and reviews of the literature on learning theory.

When an instructor employs one of the CATs, he or she can use the experience at several levels. There is the feedback to the instructor on instruction that has been the primary focus of this issue, of course. But at the same time, the student is usually getting feedback on his or her own learning of the specific content.

One step up the metacognitive ladder from these two very concrete levels is the opportunity for the CAT to improve the students' monitoring of their own comprehension, a key metacognitive skill. Several authors in this issue note that when students are constantly being asked to provide feedback to the instructor on their learning, they develop the habit of checking that learning periodically on their own so as to be ready to respond to the request for feedback. This often becomes a conscious habit, and this is more likely to happen when the instructor can make it more conscious by directly discussing the possibility with the students regularly.

The next step up the ladder is when students take the comprehension monitoring strategies they have learned in one class and transfer them to other learning episodes, such as when studying alone or with friends, or when participating in another course. This would be facilitated if several instructors began using CATs as learning tools. Seeing them in multiple settings would help students make the transfer of these strategies more readily.

Table 2.1 shows how each of the most commonly used CATs might contribute to learning as conceived of in cognitive theory. In reality each CAT has several possible connections to the learning process. Almost all will focus student attention on key concepts to be learned. Most are also very helpful in articulating ways in which information to be learned can be organized and elaborated on for better storage. The very act of doing a CAT is often the opportunity for increasing metacognitive awareness in students. The repeated use of a particular CAT can establish patterns of thinking about the material that would usually not occur, especially if the instructor makes a point of clarifying the thinking behind its use.

Examples of Using CATs to Enhance Learning

One possible use of CATs would be in large introductory lectures. Faculty might use the *punctuated lecture* CAT (Angelo and Cross, 1993, p. 303). In this technique the teacher stops in midlecture and asks students to reflect on their

Table 2.1. Commonly Used CATs and Their Connection to Cognitive Theory

CAT	Connections to Cognitive Theory
Minute paper	Metacognition—comprehension monitoring Rehearsal of key ideas Organization of knowledge—identifying main points
Muddiest point	Metacognition—comprehension monitoring
Categorizing grid	Organization of knowledge—identifying critical attributes of concepts
Directed paraphrasing	Elaboration—putting things in learner's own words Meaningful connections
Diagnostic learning logs	Metacognition—awareness of strategies; evaluation of strategy use
Concept maps	Organization of knowledge—identifying connections and key ideas Elaboration—making connections
Memory matrix	Rehearsal of key words

learning and listening behavior during the presentation. Students take a few moments to write down their reflections, then share this feedback anonymously with the instructor. Punctuated lecture forces students to reflect on their classroom learning behaviors, and to self-assess their level of comprehension of new material.

The instructor might then prepare a mini-lesson to follow the punctuated lecture CAT by introducing students to the idea of metacognition. Exhibit 2.1 illustrates the ideas that an instructor might include in a discussion of metacognition as illustrated by the punctuated lecture.

In another example of using a CAT to change student study behavior, as a review for an exam, the instructor might project a list of key words that make

Exhibit 2.1. Mini-Lesson on Metacognitive Strategies to Follow Up the Punctuated Lecture CAT

Instructor describes the Learning Strategy: Metacognition is “thinking about thinking” and controlling your learning. This relates to how often you think about what you are hearing, reading, or studying. For example, did you have a hard time describing what you were doing during this lecture when I asked you to just now? Did you find that you were thinking about something else rather than listening and thinking about what I was saying? What did you do to focus your attention on the lecture if you did find yourself drifting? The same thing applies when you are studying at home. Do you monitor your attention while you read, or do you often find that you have read ten pages in your textbook and can’t remember any of it? Do you adjust your reading speed if you’re reading something difficult versus reading for pleasure?

Instructor offers suggestions for using the Strategy: In listening to lectures, pay particular attention at the beginning because most instructors start the lecture with an overview of what will be discussed. Write down what the purpose of the lecture is. This will help you keep yourself focused during the lecture itself. When you find yourself drifting, go back and reread the purpose and see if you can relate what is being said to that purpose. When you have reading to do, skim the material before you begin to see how it is organized. Look at the headings and subheadings of the text to give yourself an idea of how things are related to each other. While reading, ask yourself questions about the paragraph you have just read and scribble keywords in the margins of the book or in a notebook. This will work during lectures, too. Conduct “punctuated study sessions” just like the one we just did to monitor your study behaviors and understanding on your own. Try to determine which concepts you don’t understand well. Although this method takes longer initially, you are more likely to remember what you have read or heard. This saves you time later when studying for a test.

Note: The learning strategy description and suggestions in this exhibit and the ones that follow are partially based on the student feedback section in *A Manual for the Use of the Motivated Strategies for Learning Questionnaire* by Pintrich, Smith, Garcia, and McKeachie (1991).

up the primary concepts of the unit and have the students create concept maps that link the ideas and illustrate the relationships between them (Angelo and Cross, 1993, p. 197). The focus in *concept mapping* is on the relationship among the concepts rather than on the concepts themselves. This forces students to move beyond mere memorization to more relational thinking. In fact, if the instructor begins using the concept mapping strategy as the organizational structure for presenting the material as well, students might have an easier time focusing on relationships in their learning. Again, the instructor can follow up this CAT with a discussion of studying for exams that goes beyond mere memorization or surface learning.

Instead of starting with a CAT and following up with a learning strategy lesson, faculty can start with the learning skills they wish to promote, and then choose CATs that can help students develop those skills. For example, the two worksheets in Exhibit 2.2 and Exhibit 2.3 require an instructor to generate a list of CATs and other learning activities that can encourage students' use of two valuable learning strategies: elaboration and organization.

Another resource in the *Classroom Assessment Handbook* (Angelo and Cross, 1993) is the *teaching goals inventory*, a self-scorable instrument that faculty can use to reflect on and prioritize their objectives for teaching. The teaching goals inventory (TGI) is organized into six clusters of goals for student learning that faculty may choose to emphasize in their teaching: higher-order thinking skills, basic academic success skills, discipline-specific knowledge and skills, liberal arts and academic values, work and career preparation, and personal development.

Faculty are encouraged to use CATs as tools to assess how successfully they are meeting their teaching goals. CATs can also be used as tools in faculty's efforts to achieve those goals. For example, teachers whose goals focus on imparting discipline-specific knowledge and skills could use CATs like the memory matrix (Angelo and Cross, 1993, p. 142) not only to assess whether students have retained course content but also to help students rehearse and retain new material. Faculty interested in assessing and enhancing students' development of higher-order thinking skills may use more complex CATs like approximate analogies (Angelo and Cross, 1993, p. 193) or invented dialogues (Angelo and Cross, 1993, p. 203).

Next Steps

Instructors who wish to learn more about learning theory can, in addition to reviewing the Angelo and Cross (1993) and Cross and Steadman (1996) books, look into just about any textbook on psychology, educational psychology, or cognitive psychology. Most of these sources are designed for those just beginning in the field, so they will be an easy read for faculty in any discipline. Getting together with other faculty and discussing the ideas behind CATs and the theory would also be a very useful way to come to an understanding of alternative ways of using these ideas.

Exhibit 2.2. Learning Theory Application: Elaboration Strategies

<i>Explicit Learning Strategy Instruction for Students</i>	<i>Connecting Learning Theory and Classroom Practice</i>
<i>Description of the Learning Strategy</i>	<i>CAT Connections</i>
<p>Elaboration strategies are your attempts to summarize or paraphrase the material you read in your textbooks, and to relate the material to what you already know or have learned. These strategies usually result in better performance than rehearsal strategies alone because they help learners make meaningful connections with existing knowledge.</p>	<p>Muddiest point Minute paper Punctuated lecture Concept map Word journal Analytic memos Applications cards Approximate analogies Directed paraphrasing, etc. (Angelo and Cross, 1993)</p>
<i>Suggestions for Using this Strategy</i>	<i>What other strategies might students use in class and while studying to improve their learning skills in this area?</i>
<p>Paraphrase and summarize important information. Use your own words to describe the material covered during lecture or in assigned reading. Pretend you're the teacher and are trying to explain the topic to students. Try to figure out how each topic relates to others. What are the connections between what you've heard in lecture, talked about in discussion, read in the textbook, or learned from your own experiences?</p>	<p>Small group discussions Peer tutoring Free writing (students spend five minutes in class writing about a course topic or question in their own words) Pair and share (students explain a course concept to a partner)</p>

Once an instructor has begun to delve beneath the surface of Classroom Assessment, there is much to reward the effort. Ultimately, the instructor will be able to design CATs that are targeted at a given course or concept and will no longer have to rely on or adapt the existing CATs. At that point the instructor's scholarship of teaching will allow a much greater appreciation that something *can* be done to improve student learning, not just in a given class but in general.

Exhibit 2.3. Learning Theory Application: Organization Strategies

<i>Explicit Learning Strategy Instructions for Students</i>	<i>Connecting Learning Theory and Classroom Practice</i>
<i>Description of the Learning Strategy</i>	<i>CAT Connections</i>
<p>Organizational strategies help learners condense large amounts of new information and make sense of relationships among new concepts and existing knowledge. Organizational strategies include outlining information, such as a chapter in a book or concepts from a lecture. Another form of organization is creating diagrams, perhaps of a scientific process, a chain of events, or related course concepts. Clustering ideas into categories that indicate shared characteristics is another organizational strategy.</p>	<p>Concept maps Memory matrix Defining features matrix One-sentence summary Problem recognition task What's the principle? (Angelo and Cross, 1993) Building bridges (Cross and Steadman, 1996)</p>
<i>Suggestions for using this strategy</i>	<i>What other strategies might students use in class and while studying to improve their learning skills in this area?</i>
<p>Outline course material and identify where the text and lecture overlap and don't overlap. This will give you a starting point in developing connections between ideas presented in two different contexts. Make charts, diagrams, or tables of important concepts. A flow chart or a tree diagram may help you understand how different ideas fit together.</p>	<p>Card sorting Venn diagrams Color coding concepts</p>

References

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