CLASSROOM ASSESSMENT TECHNIQUES

A Handbook for College Teachers

SECOND EDITION

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CHAPTER

1

What Is Classroom Assessment?

Through close observation of students in the process of learning, the collection of frequent feedback on students' learning, and the design of modest classroom experiments, classroom teachers can learn much about how students learn and, more specifically, how students respond to particular teaching approaches. Classroom Assessment helps individual college teachers obtain useful feedback on what, how much, and how well their students are learning. Faculty can then use this information to refocus their teaching to help students make their learning more efficient and more effective.

PURPOSE OF CLASSROOM ASSESSMENT

There are more than three thousand colleges and universities in the United States, and the diversity in their missions and students is enormous. Yet all these institutions share one fundamental goal: to produce the highest possible quality of student learning. In other words, the central aim of all colleges is to help students learn more effectively and efficiently than they could on their own.

Learning can and often does take place without the benefit of teaching—and sometimes even in spite of it—but there is no such thing as effective teaching in the absence of learning. Teaching without learning is just talking. College instructors who have assumed that their students were learning what they were trying to teach them are regularly faced with disappointing evidence to the contrary when they grade tests and term papers. Too often, students have not learned as much or as well as was expected. There are gaps, sometimes considerable ones, between what was taught and what has been learned. By the time faculty notice these gaps in knowledge or understanding, it is frequently too late to remedy the problems.

To avoid such unhappy surprises, faculty and students need better ways to monitor learning throughout the semester. Specifically, teachers need a continuous flow of accurate information on student learning. For example, if a teacher's goal is to help students learn points A through Z during the

course, then that teacher needs first to know whether all students are really starting at point A and, as the course proceeds, whether they have reached intermediate points B, G, L, R, W, and so on. To ensure high-quality learning, it is not enough to test students when the syllabus has arrived at points M and Z. Classroom Assessment is particularly useful for checking how well students are learning at those initial and intermediate points, and for providing information for improvement when learning is less than satisfactory.

Through practice in Classroom Assessment, faculty become better able to understand and promote learning, and increase their ability to help the students themselves become more effective, self-assessing, self-directed learners. Simply put, the central purpose of Classroom Assessment is to empower both teachers and their students to improve the quality of learning in the classroom.

CHARACTERISTICS OF CLASSROOM ASSESSMENT

Classroom Assessment is an approach designed to help teachers find out what students are learning in the classroom and how well they are learning it. This approach is learner-centered, teacher-directed, mutually beneficial, formative, context-specific, ongoing, and firmly rooted in good practice.

Learner-Centered

Classroom Assessment focuses the primary attention of teachers and students on observing and improving learning, rather than on observing and improving teaching. To improve learning, it may often be more effective to help students change their study habits or develop their metacognitive skills (skills in thinking about their own thinking and learning) than to change the instructor's teaching behavior. In the end, if they are to become independent, lifelong learners, students must learn to take full responsibility for their learning. To achieve that end, both teachers and students will need to make adjustments to improve learning. Classroom Assessment can provide information to guide them in making those adjustments.

Teacher-Directed

A defining characteristic of any profession is that it depends on the wise and effective use of judgment and knowledge. No one can provide teachers with rules that will tell them what to do from moment to moment in the complex and fluid reality of a college classroom. What faculty do depends on their skill, experience, professional knowledge, and insight. Classroom Assessment respects the autonomy, academic freedom, and professional judgment of college faculty. As a result, in this approach, the individual teacher decides what to assess, how to assess, and how to respond to the information gained through the assessment. Furthermore, the teacher is not obliged to share the results of Classroom Assessment with anyone outside the classroom.

Mutually Beneficial

Because it is focused on learning, Classroom Assessment requires the active participation of students. By cooperating in assessment, students reinforce

their grasp of the course content and strengthen their own skills at self-assessment. Their motivation is increased when they realize that faculty are interested and invested in their success as learners. When students focus more clearly, participate more actively, and feel more confident that they can succeed, they are likely to do better in their course work.

Faculty also sharpen their teaching focus by continually asking themselves three questions: "What are the essential skills and knowledge I am trying to teach?" "How can I find out whether students are learning them?" "How can I help students learn better?" As teachers work closely with students to answer these questions, they improve their teaching skills and gain new insights.

Formative

Classroom Assessment is a formative rather than a summative approach to assessment. Its purpose is to improve the quality of student learning, not to provide evidence for evaluating or grading students; consequently, many of the concerns that constrain testing do not apply. Good summative assessments—tests and other graded evaluations—must be demonstrably reliable, valid, and free of bias. They must take into account student anxiety, cheating, and issues of fairness. Classroom Assessments, on the other hand, are almost never graded and are almost always anonymous. Their aim is to provide faculty with information on what, how much, and how well students are learning, in order to help them better prepare to succeed—both on the subsequent graded evaluations and in the world beyond the classroom.

Context-Specific

To be most useful, Classroom Assessments have to respond to the particular needs and characteristics of the teachers, students, and disciplines to which they are applied. Any good mechanic or carpenter will tell you, "You need the right tool to do the job right"; similarly, you need the right Classroom Assessment Technique to answer the question right. Therefore, Classroom Assessment is context-specific: what works well in one class will not necessarily work in another.

As all experienced college teachers know, each class has its own particular dynamic, its own collective personality, its own "chemistry." Many of us who have been assigned to teach two sections of the same course in a given semester—using the same syllabus, the same books, the same lecture notes, perhaps even the same room—have discovered that these "parallel" sections quickly become very different classes. Each individual student brings a complex mix of background variables to the course. The student's socioeconomic class, linguistic and cultural background, attitudes and values, level of general academic preparation, learning strategies and skills, and previous knowledge of the specific subject matter can all influence his or her performance in the course. As students interact in the classroom, the mixture of variables that can affect learning becomes vastly more complex. In addition, the instructor, the discipline, the organization of the course, the materials used, and even the time of day the class meets—all have an effect on classroom learning.

As a result of these complex interactions, each class develops its own "microculture." The most successful faculty members are those who recognize and respond to these differences by fitting their teaching to the context of the class, even as they subtly shape that context through their teaching. Classroom Assessment respects and depends on the faculty's professional judgment, the "craft knowledge" that college teachers develop over time. We assume that the most appropriate person to assess student learning is the person who is responsible for promoting student learning: the individual faculty member. That is why the Classroom Assessment Techniques in this handbook are presented as examples and suggestions to be adapted, not as models to be adopted.

Ongoing

Classroom Assessment is an ongoing process, perhaps best thought of as the creation and maintenance of a classroom "feedback loop." By employing a number of simple Classroom Assessment Techniques that are quick and easy to use, teachers get feedback from students on their learning. Faculty then complete the loop by providing students with feedback on the results of the assessment and suggestions for improving learning. To check on the usefulness of their suggestions, faculty use Classroom Assessment again, continuing the "feedback loop." As this approach becomes integrated into everyday classroom activities, the communications loop connecting faculty to students—and teaching to learning—becomes more efficient and more effective.

Rooted in Good Teaching Practice

Most college teachers already collect some feedback on their students' learning and use that feedback to inform their teaching. Classroom Assessment is an attempt to build on existing good practice by making it more systematic, more flexible, and more effective. Teachers ask questions, react to students' questions, monitor body language and facial expressions, read homework and tests, and so on. Classroom Assessment provides a way to integrate assessment systematically and seamlessly into the traditional classroom teaching and learning process.

By taking a few minutes to administer a simple assessment before teaching a particular class session, the teacher can get a clearer idea of where the students are and, thus, where to begin instruction. A quick assessment during the class can reveal how well the students are following the lesson in progress. Classroom Assessment immediately after the class session helps to reinforce the material taught and also uncovers gaps in understanding before they become serious impediments to further learning.

Finally, teaching students techniques for self-assessment that they can use in class or while they are studying helps them integrate classroom learning with learning outside school. Directed practice in self-assessment also gives students the opportunity to develop metacognitive skills; that is, to become skilled in thinking carefully about their own thinking and learning.

NEED FOR CLASSROOM ASSESSMENT

As they are teaching, faculty monitor and react to student questions, comments, body language, and facial expressions in an almost automatic

Exhibit 2.1. Teaching Goals Inventory, Self-Scorable Version.

Purpose: The Teaching Goals Inventory (TGI) is a self-assessment of instructional goals. Its purpose is threefold: (1) to help college teachers become more aware of what they want to accomplish in individual courses; (2) to help faculty locate Classroom Assessment Techniques they can adapt and use to assess how well they are achieving their teaching and learning goals; and (3) to provide a starting point for discussions of teaching and learning goals among colleagues.

Directions: Please select ONE course you are currently teaching. Respond to each item on the inventory in relation to that particular course. (Your responses might be quite different if you were asked about your overall teaching and learning goals, for example, or the appropriate instructional goals for your discipline.)

Please print the title of the specific course you are focusing on:

_____

Please rate the importance of each of the fifty-two goals listed below to the specific course you have selected. Assess each goal's importance to what you deliberately aim to have your students accomplish, rather than the goal's general worthiness or overall importance to your institution's mission. There are no "right" or "wrong" answers; only personally more or less accurate ones.

For each goal, circle only one response on the 1-to-5 rating scale. You may want to read quickly through all fifty-two goals before rating their relative importance.

In relation to the course you are focusing on, indicate whether each goal you rate is:

(5)	Essential	a goal you always/nearly always try to achieve
(4)	Very important	a goal you often try to achieve
(3)	Important	a goal you sometimes try to achieve
(2)	Unimportant	a goal you rarely try to achieve
(1)	Not applicable	a goal you never try to achieve

Rate the importance of each goal to what you aim to have students accomplish in your course.	*Essential*	*Very Important*	*Important*	*Unimportant*	*Not Applicable*
1. Develop ability to apply principles and generalizations already learned to new problems and situations	5	4	3	2	1
2. Develop analytic skills	5	4	3	2	1
3. Develop problem-solving skills	5	4	3	2	1
4. Develop ability to draw reasonable inferences from observations	5	4	3	2	1
5. Develop ability to synthesize and integrate information and ideas	5	4	3	2	1
6. Develop ability to think holistically: to see the whole as well as the parts	5	4	3	2	1
7. Develop ability to think creatively	5	4	3	2	1
8. Develop ability to distinguish between fact and opinion	5	4	3	2	1
9. Improve skill at paying attention	5	4	3	2	1
10. Develop ability to concentrate	5	4	3	2	1
11. Improve memory skills	5	4	3	2	1
12. Improve listening skills	5	4	3	2	1
13. Improve speaking skills	5	4	3	2	1
14. Improve reading skills	5	4	3	2	1
15. Improve writing skills	5	4	3	2	1
16. Develop appropriate study skills, strategies, and habits	5	4	3	2	1
17. Improve mathematical skills	5	4	3	2	1
18. Learn terms and facts of this subject	5	4	3	2	1
19. Learn concepts and theories in this subject	5	4	3	2	1
20. Develop skill in using materials, tools, and/or technology central to this subject	5	4	3	2	1
21. Learn to understand perspectives and values of this subject	5	4	3	2	1

Exhibit 2.1. Teaching Goals Inventory, Self-Scorable Version, Cont'd.

Rate the importance of each goal to what you aim to have students accomplish in your course.	*Essential*	*Very Important*	*Important*	*Unimportant*	*Not Applicable*
22. Prepare for transfer or graduate study	5	4	3	2	1
23. Learn techniques and methods used to gain new knowledge in this subject	5	4	3	2	1
24. Learn to evaluate methods and materials in this subject	5	4	3	2	1
25. Learn to appreciate important contributions to this subject	5	4	3	2	1
26. Develop an appreciation of the liberal arts and sciences	5	4	3	2	1
27. Develop an openness to new ideas	5	4	3	2	1
28. Develop an informed concern about contemporary social issues	5	4	3	2	1
29. Develop a commitment to exercise the rights and responsibilities of citizenship	5	4	3	2	1
30. Develop a lifelong love of learning	5	4	3	2	1
31. Develop aesthetic appreciations	5	4	3	2	1
32. Develop an informed historical perspective	5	4	3	2	1
33. Develop an informed understanding of the role of science and technology	5	4	3	2	1
34. Develop an informed appreciation of other cultures	5	4	3	2	1
35. Develop capacity to make informed ethical choices	5	4	3	2	1
36. Develop ability to work productively with others	5	4	3	2	1
37. Develop management skills	5	4	3	2	1
38. Develop leadership skills	5	4	3	2	1
39. Develop a commitment to accurate work	5	4	3	2	1
40. Improve ability to follow directions, instructions, and plans	5	4	3	2	1
41. Improve ability to organize and use time effectively	5	4	3	2	1
42. Develop a commitment to personal achievement	5	4	3	2	1
43. Develop ability to perform skillfully	5	4	3	2	1
44. Cultivate a sense of responsibility for one's own behavior	5	4	3	2	1
45. Improve self-esteem/self-confidence	5	4	3	2	1
46. Develop a commitment to one's own values	5	4	3	2	1
47. Develop respect for others	5	4	3	2	1
48. Cultivate emotional health and well-being	5	4	3	2	1
49. Cultivate an active commitment to honesty	5	4	3	2	1
50. Develop capacity to think for one's self	5	4	3	2	1
51. Develop capacity to make wise decisions	5	4	3	2	1

52. In general, how do you see your primary role as a teacher? (Although more than one statement may apply, please circle only one.)

1 Teaching students facts and principles of the subject matter

2 Providing a role model for students

3 Helping students develop higher-order thinking skills

4 Preparing students for jobs/careers

5 Fostering student development and personal growth

6 Helping students develop basic learning skills

Source: Classroom Assessment Techniques, by Thomas A. Angelo and K. Patricia Cross.

Exhibit 2.2. Teaching Goals Inventory, Self-Scoring Worksheet.

1. In all, how many of the fifty-two goals did you rate as "essential"? _____

2. How many "essential" goals did you have in each of the six clusters listed below?

	Cluster Number and Name	*Goals Included in Cluster*	*Total Number of "Essential" Goals in Each Cluster*	*Clusters Ranked—from 1st to 6th—by Number of "Essential" Goals*
I	Higher-Order Thinking Skills	1–8	_____	_____
II	Basic Academic Success Skills	9–17	_____	_____
III	Discipline-Specific Knowledge and Skills	18–25	_____	_____
IV	Liberal Arts and Academic Values	26–35	_____	_____
V	Work and Career Preparation	36–43	_____	_____
VI	Personal Development	44–52	_____	_____

3. Compute your cluster scores (average item ratings by cluster) using the following worksheet.

	A	*B*	*C*	*D*	*E*
	Cluster Number and Name	*Goals Included*	*Sum of Ratings Given to Goals in That Cluster*	*Divide C by This Number*	*Your Cluster Scores*
I	Higher-Order Thinking Skills	1–8	_____	8	_____
II	Basic Academic Success Skills	9–17	_____	9	_____
III	Discipline-Specific Knowledge and Skills	18–25	_____	8	_____
IV	Liberal Arts and Academic Values	26–35	_____	10	_____
V	Work and Career Preparation	36–43	_____	8	_____
VI	Personal Development	44–52	_____	9	_____

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If you are just beginning to experiment with Classroom Assessment, it is not necessary, or productive, to worry too much about linking goals to assessment tools. Many faculty start out by trying a few simple Classroom

Techniques for Assessing Course-Related Knowledge and Skills

CHAPTER 7

The goals of college teachers differ, depending on their disciplines, the specific content of their courses, their students, and their own personal philosophies about the purposes of higher education. All faculty, however, are interested in promoting the cognitive growth and academic skills of their students. In the drive toward academic excellence, the assessment of cognitive skills and mastery of subject matter has been given major attention, especially in institutional and statewide assessment plans. The assessment movement has had an important impact on the design and content of standardized tests and, to a lesser degree, on curricula and graduation requirements. Its impact on the measurement of student learning in the classroom is less clear. Although classroom teachers have been testing students on their mastery of subject matter for centuries, there is a growing conviction that, as classroom assessment resources, tests are limited in scope and in usefulness. One problem is that traditional classroom tests are frequently used as summative evaluations—as "final" exams or other measures to grade students. They are not often used to provide feedback to both students and teachers on whether learning goals are being met.

Tests are, however, an effective way to define the goals of the course. Research suggests that students concentrate on learning whatever they think will be on the test. As McKeachie and his colleagues observe, "Whatever teachers' goals and no matter how clearly they present them, students' goals are strongly influenced by tests or the other activities that determine grades" (McKeachie, Pintrich, Lin, and Smith, 1986, p. 76). No matter how clear the teacher is about the "big picture," students are unlikely to share and appreciate the view unless tests and other assessment measures point them toward it. Formative, mid-course feedback at the classroom level, especially if it is repeated at regular intervals, helps students and teachers clarify their goals and assess progress toward them while there is still time to make changes based on that feedback.

A second problem in current classroom assessment is that the tests devised frequently measure low-level abilities to remember and reproduce

what is presented by others. Yet the emphasis in the 1980s reform movement is on the development of critical thinking, problem solving, and independent thought—the capacity to analyze the ideas of others and generate ideas of one's own. This higher-order capacity is much more difficult to measure.

Assessing accomplishment in the cognitive domain has occupied educational psychologists for most of this century. "As yet, however, there is no comprehensive and universally accepted theory capturing complex human intellectual functions in a single conceptual framework" (Segal, Chipman, and Glaser, 1985, p. 7). Research on the assessment of academic skills and intellectual development is in a period of especially rapid change right now, and a number of potentially useful theories and taxonomies exist side by side.

The most influential mapping of the cognitive terrain for educational purposes is still the extensive classification system devised by Benjamin Bloom and his colleagues (Bloom and others, 1956; Bloom, Hastings, and Madaus, 1971). The assumption underlying what has become known as the "Bloom taxonomy" is that cognitive abilities can be measured along a continuum from simple to complex. A brief description of that taxonomy (as presented by Bloom, Hastings, and Madaus, 1971, pp. 271–273) follows.

1.0 Knowledge	Recalling specific facts or general concepts.
2.0 Comprehension	Demonstrating the lowest level of understanding. The individual can make use of what is being communicated without necessarily relating it to other material or seeing its fullest implication.
3.0 Application	Using abstractions in concrete situations. The abstractions may be principles, ideas, and theories that must be remembered and applied.
4.0 Analysis	Breaking down a communication into its constituent elements. The relationships between ideas are made explicit, and the organization of the communication is understood.
5.0 Synthesis	Putting together elements to form a whole—arranging elements to constitute a structure not clearly there before.
6.0 Evaluation	Making judgments about the value of materials and methods for given purposes. The individual can make appraisals that satisfy criteria determined by the instructor or by others.

Yet another view of the structure of cognition is presented by McKeachie and his colleagues (1986) at the National Center for Research to Improve Postsecondary Teaching and Learning (NCRIPTAL) at the University of Michigan. They conducted a comprehensive review of the literature on teaching and learning in higher education and decided to organize their discussion of student cognition under the rubrics of knowledge structure, learning strategies, and thinking and problem solving. Although these categories sound familiar, the emphasis of the NCRIPTAL group is less on measuring student outcomes than on understanding cognitive processes. For

this reason, their definitions and their measures are more complex than those of the Bloom taxonomy.

Under knowledge structure, the NCRIPTAL group (pp. 16–35) advocates study of both the structure of the subject matter and students' internal representations of that structure. Students' learning in this area can be measured both indirectly (by word association, card sorting, ordered-tree techniques, and interviews) and directly (by concept mapping, networking, concept structuring, and similar techniques). Their second category of student cognition, learning strategies, deals with how students acquire and modify their knowledge base. McKeachie and his colleagues group these skills into three broad categories: cognitive, metacognitive, and resource management. "The cognitive category includes strategies related to the students' learning or encoding of material as well as strategies to facilitate retrieval of information. The metacognitive strategies involve strategies related to planning, regulating, monitoring, and modifying cognitive processes. The resource management strategies concern the students' strategies to control the resources (i.e., time, effort, outside support) that influence the quality and quantity of their involvement in the task" (p. 25). The third category, thinking and problem solving, includes critical thinking, problem solving, and reasoning—in general, the use of learning in new situations to solve problems or make decisions. There has been a great deal of research on problem solving and critical thinking in recent years, and a number of instruments exist for the measurement of these skills (see pp. 37–42).

McKeachie and his colleagues point out the recent advances made in the field of cognitive psychology—notably, the assimilative approach, which holds that meaningful learning occurs only when new inputs are linked with already existing schemata. In this view, learning is a creative, active process, and learners create new knowledge out of what's already in their heads. According to Ausubel (1968), an early advocate of this school of cognition, "If I had to reduce all of educational psychology to just one principle, I would say this: 'The most important single factor influencing learning is what the learner already knows. Ascertain this fact and teach him accordingly'" (prefatory note). In this view of learning, assessment depends not on tests—in the usual sense of questions asked and problems to be solved—but on the match between the conceptual map of the discipline or subject being taught and the internal cognitive map that illustrates what the learner knows.

It is not our intention to make classroom teachers into cognitive psychologists. However, since college teachers have a responsibility and a desire to promote their students' intellectual development, some acquaintance with current trends in cognitive psychology is clearly desirable. Moreover, since classroom teachers understand the structure of knowledge in their disciplines and have opportunities to observe learning in progress every day, they can contribute greatly to the improvement of their own teaching, and to our understanding of student learning, by becoming astute observers and skilled assessors of learning in process.

Our selection of feedback measures for assessing academic skills and intellectual development required a framework that could accommodate outcomes specified by these various theories and research currents but that

was primarily teacher-oriented. To that end, the assessment techniques presented in this chapter provide information on skills and competencies identified in the latest developments in cognitive assessment, but the techniques are grouped in sets that are familiar and useful to the average classroom teacher.

Assessing Prior Knowledge, Recall, and Understanding

1. Background Knowledge Probe
2. Focused Listing
3. Misconception/Preconception Check
4. Empty Outlines
5. Memory Matrix
6. Minute Paper
7. Muddiest Point

The seven Classroom Assessment Techniques presented in this section assess students' learning of facts and principles, often called declarative learning; that is, they assess how well students are learning the content of the particular subject they are studying. The kind of learning task or stage of learning these techniques assess is what Norman (1980, p. 46) calls accretion, the "accumulation of knowledge into already established structures." Although such learning is not sufficient in higher education, it is certainly necessary. In most college classrooms, teachers and students focus a great proportion of their time and efforts on declarative learning. By investing a few minutes of class time to use one of these seven techniques, faculty can better gauge how well the content is being learned.

Two techniques, Background Knowledge Probes and Misconception/Preconception Checks, allow faculty to assess students' prior knowledge and understanding, so they can teach accordingly. Focused Listing, the Empty Outline, and the Memory Matrix assess recall of "new" information presented in class or through homework assignments. These CAT's focus on students' ability to remember the "new" declarative knowledge they are being exposed to, providing feedback on how well they are "accreting" or accumulating that content. To a limited extent, the Empty Outline and the

Memory Matrix also assess how and how well students are organizing the new content they are learning. The Minute Paper and the Muddiest Point, though extremely simple, focus on understanding, a somewhat deeper level of learning than simple recall. By asking students to judge what was clear and what was not, or what was most important and what they still have questions about, these CATs require learners to engage in simple acts of metacognition, to reflect on and assess their own understanding of the content they are learning.

Taken together, these seven CATs are among the most generic and most widely applicable tools in this handbook. They are also among the quickest and simplest CATs to use. For these reasons, they can be, and have been, successfully adapted to assess subject matter learning in almost every discipline.

CLASSROOM ASSESSMENT TECHNIQUE

1

Background Knowledge Probe

Estimated Levels of Time and Energy Required for:	
Faculty to prepare to use this CAT	**MEDIUM**
Students to respond to the assessment	**LOW**
Faculty to analyze the data collected	**MEDIUM**

DESCRIPTION At the first class meeting, many college teachers ask students for general information on their level of preparation, often requesting that students list courses they have already taken in the relevant field. This CAT is designed to collect much more specific, and more useful, feedback on students' prior learning. Background Knowledge Probes are short, simple questionnaires prepared by instructors for use at the beginning of a course, at the start of a new unit or lesson, or prior to introducing an important new topic. A given Background Knowledge Probe may require students to write short answers, to circle the correct responses to multiple-choice questions, or both.

PURPOSE Background Knowledge Probes are meant to help teachers determine the most effective starting point for a given lesson and the most appropriate level at which to begin instruction. By sampling the students' background knowledge before formal instruction on that topic begins, these probes also provide feedback on the range of preparation among students in a particular class.

For students, the Background Knowledge Probe focuses attention on the most important material to be studied, providing both a preview of what is to come and a review of what they already know about that topic. Background Knowledge Probes can also be used as pre- and post-assessments: before instruction, to find out the students' "baseline" knowledge level; and immediately after, to get a rough sense of how much and how well they have learned the material. This CAT elicits more detailed information about what students know than Focused Listing (CAT 2) can.

RELATED TEACHING GOALS
Improve memory skills (TGI Goal 11)
Develop appropriate study skills, strategies, and habits (TGI Goal 16)
Learn terms and facts of this subject (TGI Goal 18)
Learn concepts and theories in this subject (TGI Goal 19)
Develop an informed historical perspective (TGI Goal 32)

SUGGESTIONS FOR USE You can use this technique as early as the first class meeting; it works well in classes of any size. Focus the questions in your probe on specific information or concepts that students will need to know to succeed in subsequent assignments, rather than on their personal histories or general knowledge. Make sure to ask at least one question that you are certain most students will be able to answer correctly, and at least one other that you judge to be more difficult. At the next class meeting, individual students can find out how the class as a whole did, and can gauge their level of preparation in relation to that of the group. To assess changes in students' knowledge and concision in responding, you can use the same or similar questions at the midpoint and at the end of the lesson, unit, or term. The probe can also be used to introduce important concepts that will subsequently be developed through a number of lessons, or throughout the entire course.

EXAMPLES

From a Survey of English Literature (English/Literature)

> On the first day of class, to get an idea of how much exposure her students had had to Shakespeare's plays, this professor prepared a Background Knowledge Probe. The form asked students in her lower-level English literature course to list the plays that they were familiar with. For each work listed, they were to check off whether they had read it, seen it performed in a theater, or seen it in the movies or on television.
>
> Most of the lists she got back were predictably short; and *Romeo and Juliet*, *Hamlet*, and *Macbeth* were the titles most frequently named. A handful of students turned in quite long lists, however, while a few turned in blank forms. Several other students included works on their lists that were not by Shakespeare. More students had seen Shakespeare's works on television or in the movies than had read them, and only a quarter had seen a live performance. As a result, most of the students were familiar with abridged and sometimes drastically altered versions of the original plays.
>
> At the next class meeting, the English literature professor shared a summary of this information with the class, letting some of them know that they would be encountering a play for the second time and explaining that she had substituted *King Lear* for *Macbeth* because many already had seen or read the latter. She complimented the students who had already read and/or seen a work of Shakespeare and asked them to assist those in class to whom it would be totally new. She also alerted the class to major differences between the texts they would read and some of the filmed versions they had seen. She then passed out a handout summarizing the feedback gathered and giving the names of the authors of the works listed that were not by Shakespeare.

From Fundamentals of Electric Circuits (Electrical Engineering)

> Before their first lecture-demonstration-lab session, this electrical engineering instructor wanted to determine what his students might already have learned—whether through course work or on-the-job expe-

rience—about measuring current, voltage, and resistance. To find out, he prepared a Background Knowledge Probe that contained five illustrations representing the displays of the following instruments: voltmeter, ammeter, ohmmeter, deflection multimeter, and digital multimeter. Each illustration clearly indicated a different reading or readings through the pointer positions and switch settings, or digital readouts shown. Near the end of the first class session, he presented students with these illustrations, reproduced on two pages, and asked them to determine, and write out, the readings for the five instruments shown.

The responses to his probe indicated that most students were more familiar with digital instrument displays and that most of them had some idea what the readings on at least one of the instruments meant. But he also saw that most students did not use standard electrical engineering notation and vocabulary in their responses and that there was quite a range of prior knowledge. A few students had no idea how to respond; a few others got everything correct.

To capitalize on the diversity in preparation, he decided to start the next class with a small-group warm-up exercise. He randomly assigned students to groups of four and then handed out clean copies of the same Background Knowledge Probe. He gave the groups fifteen minutes to come up with correct readings for all five instruments. They were told that each person in each group was expected to learn the correct answers. This, of course, meant that the more experienced students had to explain and teach their responses to the novices.

After the instructor had asked questions of each group, he commented on the diversity of the earlier, individual responses to the probe. To respond to this diversity, he told the class, he had to include material that would be totally new to some of them but would be review to others. He asked the more advanced students to consolidate their knowledge by helping their less experienced classmates. And he asked the beginners to recognize their responsibility to invest relatively more time and effort.

STEP-BY-STEP PROCEDURE

1. Before introducing an important new concept, subject, or topic in the course syllabus, consider what the students may already know about it. Recognizing that their knowledge may be partial, fragmentary, simplistic, or even incorrect, try to find at least one point that most students are likely to know, and use that point to lead into other, less familiar points.

2. Prepare two or three open-ended questions, a handful of short-answer questions, or ten to twenty multiple-choice questions that will probe the students' existing knowledge of that concept, subject, or topic. These questions need to be carefully phrased, since a vocabulary that may not be familiar to the students can obscure your assessment of how well they know the facts or concepts.

3. Write your open-ended questions on the chalkboard, or hand out short questionnaires. Direct students to answer open-ended questions succinctly, in two or three sentences if possible. Make a point of announcing that these Background Knowledge Probes are not tests or quizzes

and will not be graded. Encourage students to give thoughtful answers that will help you make effective instructional decisions.

4. At the next class meeting, or as soon as possible, let students know the results, and tell them how that information will affect what you do as the teacher and how it should affect what they do as learners.

TURNING THE DATA YOU COLLECT INTO USEFUL INFORMATION

After you have collected the responses, try dividing them into three or four piles, according to degree of preparation for the upcoming learning tasks. You can, for example, quickly rate both written answers and multiple-choice responses, classifying them into the following four categories: [− 1] = erroneous background knowledge; [0] = no relevant background knowledge; [+ 1] = some relevant background knowledge; [+ 2] = significant background knowledge. By summing the individual numerical ratings for each question, you can find out whether the class as a whole has more knowledge about some topics than about others. For an even faster analysis, you can simply sort responses into "prepared" and "not prepared" piles.

IDEAS FOR ADAPTING AND EXTENDING THIS CAT

After students have responded individually to the probes, ask them to work in pairs or small groups to come up with mutually acceptable, correct answers.

Divide the class into small groups of students and ask them to rate and sort responses from other groups.

If you have a small number of students in an upper-level course, consider having the students interview each other, taking notes on the responses to probe questions.

Use Background Knowledge Probes as a higher-level follow-up or alternative to Focused Listing (CAT 2).

PROS

Background Knowledge Probes can provide useful data not only about students' knowledge of the topic but also about their skills in communicating what they know.

They provide baseline data that teachers can use to make critical instructional decisions before instruction begins.

By building on specific background knowledge that students do have, the instructor can give students a familiar starting point, a "hook to hang new information on."

Like Focused Listing, this technique can "prime the pump" of recall, encouraging students to connect the lesson or course topic to their own past experiences and prior knowledge and prodding students to begin constructing their own "bridges" between old and new knowledge.

CONS

If student responses are at odds with the teacher's expectations, the feedback can sometimes be overwhelming and even demoralizing to the instructor.

In a similar fashion, trying to respond to the probe can be a difficult and frustrating experience for students who are underprepared.

In the process of reading and classifying responses, a teacher may form hard-to-change first impressions, which can affect his or her expectations of the students for the remainder of the term.

CAVEATS

Feedback from this technique can throw even the best-planned lesson or syllabus into serious question by demonstrating the need for quick and sometimes major revisions in instructional plans. Therefore, Background Knowledge Probes should be used only if you have the time, energy, and willingness to analyze and respond to the information they generate.

Do not generalize too much from the responses to a single administration of this CAT.

Although you will naturally be concerned with the underprepared students that a Background Knowledge Probe is likely to identify, you will also need to plan a response for those students who are adequately to extremely well prepared.

REFERENCES AND RESOURCES

A description of this technique, along with many other useful ideas on teaching and learning, can be found in an in-house publication of Roxbury Community College (1986, especially pp. 8 and 9). For an example of the Background Knowledge Probe used in a political science course, see *Early Lessons* (Angelo, 1991, pp. 20–21).

CLASSROOM ASSESSMENT TECHNIQUE

3

Misconception/Preconception Check

Estimated Levels of Time and Energy Required for:

Faculty to prepare to use this CAT	**MEDIUM**
Students to respond to the assessment	**LOW**
Faculty to analyze the data collected	**MEDIUM**

DESCRIPTION Focused Listing and Background Knowledge Probes are simple techniques for gathering information on what students already know in order to determine effective starting points for instruction. The Misconception/Preconception Check also assesses students' prior knowledge, but with a twist. Its focus is on uncovering prior knowledge or beliefs that may hinder or block further learning.

PURPOSE The greatest obstacle to new learning often is not the student's lack of prior knowledge but, rather, the existence of prior knowledge. Most college teachers know from experience that it's much harder for students to unlearn incorrect or incomplete knowledge than to master new knowledge in an unfamiliar field. Consequently, teachers can benefit from discovering early in the term which common misconceptions and preconceptions students have that are likely to interfere with their learning in a given course. This CAT is designed to uncover specific instances of incorrect or incomplete knowledge, attitudes, or values that represent likely barriers to new learning. Because assessment activities such as this CAT identify misconceptions and preconceptions early on and help students explicitly recognize and understand them, students stand a much greater chance of learning new material correctly and integrating it into their "revised" and often "transformed" knowledge structures.

RELATED TEACHING GOALS

Develop ability to distinguish between fact and opinion (TGI Goal 8)
Learn terms and facts of this subject (TGI Goal 18)
Learn concepts and theories in this subject (TGI Goal 19)
Develop an openness to new ideas (TGI Goal 27)
Cultivate an active commitment to honesty (TGI Goal 50)

SUGGESTIONS FOR USE Although there are common misperceptions or preconceptions about every field, they seem to be most pernicious and common in those areas of the curriculum that have the greatest overlap with life outside the university

classroom. For instance, virtually all incoming first-year college students have knowledge, beliefs, and attitudes about the phenomena they will study in political science, economics, anthropology, sociology, history, and psychology courses. While these same students are likely to have fewer strongly held preconceptions and misconceptions about mathematics, the natural sciences, and related fields, some of the wrongheaded, implicit "commonsense" notions that they cling to can still effectively derail learning.

Thus, this CAT can be particularly useful in social and behavioral science courses, especially those dealing with controversial or sensitive issues. In the natural sciences and mathematics, the Misconception/Preconception Check can help faculty uncover naive and sometimes magical beliefs that can act like filters: allowing disconnected facts and principles through but blocking out a deeper understanding of method or worldview. Although two of the three examples below concern beginning-of-term applications, this technique can be used at any point in a course when students encounter new information or interpretations that they may find counterintuitive or disturbing.

EXAMPLES

From the Americas Before Columbus (History)

On the first day of class, after initial introductions, the instructor in this upper-division course on pre-Columbian history administered a Misconception/Preconception Check. She explained to the twenty-five or so students that she was gathering information on what the class as a whole already knew about the Americas and Native Americans before 1492, so that she could better tailor her teaching to fit them. She then passed out sheets of lined paper and asked the students to write their best answers to three questions, but not their names. She told them they would have five minutes to write. The three questions she wrote on the chalkboard were:

1. About how many people lived in North America in 1491?
2. About how long had they been on this continent by 1491?
3. What significant achievements had they made in that time?

After five minutes, she collected the papers, shuffled them, and handed them back, asking anyone who got his or her own paper back to trade with someone else. Once everyone had someone else's paper, she asked the students to share those responses. First, she elicited the lowest and highest numerical answers for questions 1 and 2, establishing the ranges. The ranges were quite spectacular, and there wasn't much agreement between the poles. For question 3, she simply listed answers on the board until they began to repeat. The list was not particularly long.

Having finished the list, the history professor stood quietly. Finally, one of the students asked her what the right answers were. She allowed that his was an important question, but one that would have to wait until they had explored an even more critical question. She collected their responses again, so that she could read them at home, and then wrote her fourth question on the board: "Where did you get those first three

answers?" The students spent the rest of that session trying to answer question 4. Most of them soon realized that their impressions of pre-Columbian America were based on shaky ground. Then the professor gave them their first library research assignment. They were to work in pairs to double-check the accuracy of their first three answers and, in the process, to find the "right" answers. The students found, of course, that there are no generally accepted right answers but that some answers are more plausible and better supported than others.

From Human Sexuality (Health Science/Biology)

Several weeks into the semester, before students in his large general education course began the unit on sexually transmitted diseases and AIDS, this biology professor constructed a Misconception/Preconception Check focusing on these related topics. He developed a simple questionnaire containing ten prompts designed to uncover commonly held, incorrect ideas and beliefs about how diseases such as gonorrhea, syphilis, hepatitis, and AIDS are transmitted; how prevalent these diseases are among college students; and how individuals can avoid exposure entirely or greatly reduce the risks of infection. Each prompt was a statement, such as "Most of those now infected with the AIDS virus became infected through homosexual activities or intravenous drug use." In response to each statement, the student was to circle one of the answers below.

I'm absolutely certain this is true	I'm pretty sure it is true	I have no idea whether it's true or false	I'm pretty sure it is false	I'm absolutely certain it is false

He asked students to circle the one most appropriate answer for each question, but not to put their names on the questionnaires. After class, he quickly tallied the responses and found that a majority of his students were either operating under dangerously incorrect notions or simply unsure about nine out of the ten issues. The Misconception/Preconception Check also revealed that his students felt more certain about some wrong answers than others. Knowing what the common misconceptions were, and just how common they were in that class, the biology professor could tailor his teaching plan to respond to the particular needs of that group. And knowing that some incorrect notions were more deeply ingrained than others, he could prepare more effectively to meet different degrees of resistance.

At the beginning of the first class meeting on this topic, he displayed a series of ten overhead transparencies, each illustrating the range of responses to each statement. In the lecture and discussion that followed, he explained why the incorrect answers were incorrect and what implications the general "true" information he presented might have for specific individuals. He also talked with students about the evolution of knowledge about these diseases over time, and ways in which the media sometimes encourage or reinforce misconceptions.

From Introduction to the Structure of the Universe (Astronomy)

Ten minutes before the end of the first meeting of a large undergraduate science course, the professor handed out half-sheets of paper and

asked students to write their best answers to the following question: "What makes the seasons change on Earth?" She told them that any sincere answer was acceptable except "I don't know." She explained why she was asking them this question and what she would do with their responses. She also directed the students not to write their names on the papers and assured them that, on the first day of class, she certainly could not yet identify them by their handwriting.

The professor stood by the exit as class ended, holding a small cardboard box for students to drop their answers in, thereby encouraging a high response rate. Later that day, she looked through the student responses very quickly, dividing them into the following four piles, based on the type of explanations given: the "correct" pile, the "distance" pile, the "weather" pile, and the "others" pile. The pile of correct answers was fairly small, representing less than one-tenth of the class. The pile of answers that explained seasons as the result of distance from the sun was the largest, with over 50 percent of the responses. Those who thought that weather somehow caused seasonal change represented almost 20 percent, and the rest came up with a bewildering variety of other explanations, including references to the moon's gravitational pull!

Before the next class, she picked out the clearest, most articulate example from each of the four piles and transcribed those four answers onto a one-page handout, which she then distributed to the students at the beginning of the next class. After they had read all four explanations, she asked them simply to circle the one correct answer and to turn in the handouts. While she went on with her lecture, her teaching assistant quickly tallied the responses. The assistant then wrote the percentages of the various answers from the first assessment and those from the second assessment side by side on the board. The second time around, the proportion of correct responses was much higher, nearly 40 percent. This is a common effect, occurring because students can more often recognize the correct answer when it is presented to them than they can independently produce that same answer.

At that point, the professor stopped her lecture and invited several students to explain their choices to the class. Proponents of each of the four major positions explained their models of seasonal change. That weekend, each student's assignment was to find out which of the answers really was correct and to explain, in less than a page, how he or she could be certain that it was indeed the correct explanation. Students then provided the explanations during the next class, with the professor offering minor corrections and qualifications. The class then discussed the adequacy of the arguments and evidence for each position. The instructor concluded the lesson on seasons by explaining why several other models, though incorrect, were reasonable. She also reminded the class that it had taken humans, as a species, quite a long time to figure out what caused the seasons.

STEP-BY-STEP PROCEDURE

1. Start by identifying some of the most troublesome common misconceptions or preconceptions students bring to your course. Brainstorming this question with colleagues in your department or field can be a very effective way to generate such a list.