CHAPTER 12

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Making the Lecture a Learning Experience

Lecturing is the transfer of information from the notes of the lecturer to the notes of the student without passing through the minds of either.

—MORTIMER ADLER, ARISTOTELIAN PHILOSOPHER

Lecture has gotten a bad rap over the past few decades. Although it is just as effective as any other teaching method in conveying factual knowledge, numerous studies find that it falls short in promoting deeper-level student learning and development—specifically, the ability to examine and possibly change attitudes and values, critical thinking and problem-solving skills, the transference of knowledge to new situations, open-minded exploration of controversial or ambiguous material, mastery of a performance technique or technical procedure, improvement in communication skills, personal and social adjustment, motivation for further learning, satisfaction with the course, and retention of knowledge after the course is over (Bligh, 2000; Bonwell & Eison, 1991; Hake, 1998; Jones-Wilson, 2005; McKeachie, Pintrich, Lin, Smith, & Sharma, 1990). In addition, it encourages a surface (superficial, nonconceptual) approach to learning (Canfield, 2002). For deep learning and higher-order thinking outcomes, more student-active methods such as discussion and inquiry-based learning are more successful.

There is more bad news for lecture lovers: from research dating back to the 1920s, lectures have an infamous reputation for being utterly forgettable. Their much-replicated "forgetting curve" for the average student is 62 percent recall of the material just presented, 45 percent recall three to four days later, and only 24 percent recall eight weeks later (Menges, 1988).

Lecture doesn't have to be the mindless, quickly forgotten transmission that Mortimer Adler described. It can be saved—but only if it is used for the right purposes, is carefully prepared and eloquently delivered, and is supplemented with thought-provoking student activities. With lecture, less is more.

PURPOSE: TO LECTURE OR NOT TO LECTURE?

As Chapter Eleven advised, student learning outcomes should guide choice of methods. Already listed above are outcomes that lecture doesn't serve well.

According to Table 11.1, straight lecture has proven effective only in helping students acquire knowledge, and given its forgetting curve, it hasn't done a very good job of that. Still, knowledge is at the heart of our enterprise. Therefore, for at least segments of a class period, the lecture may be essential. The list below sets out occasions when it is probably the most effective and efficient option (Bligh, 2000; McKeachie, 2002):

- You want to model a problem-solving approach or a kind of higher-order thinking before asking your students to try it themselves.
- You want to provide some quick background knowledge that is not summarized in print.
- You want to adapt very sophisticated knowledge to your students' level and needs in a way that no other available source does.
- You want to present a particular organization of the material that clarifies the structure of the reading, the course, or the field.
- You want to add your personal viewpoint on the material or your own related research.
- You want to update your students with the very latest material, and it is not yet available from another source that is targeted to the students' level.
- You want to pique your students' curiosity and motivation to learn if your style is very expressive.

You will note that some of these occasions are qualified by the lack of other sources. If you can find the same material online or in print, you may want to make it a reading assignment. In fact, some faculty have turned their lectures into homework, posting print versions, videos, or podcasts of them on the course website for students to download. Many of these faculty teach online or hybrid courses, but some just want to reserve their face-to-face class time for student activities.

Do not lecture material that simply duplicates the assigned readings or other course materials. Repetition and redundancy have their place, but student-active exercises can duplicate the material at a higher cognitive level, such as application, analysis, synthesis, and evaluation. Deleting a redundant lecture frees plenty of class time for student activities. Besides, if a lecture primarily repeats the readings, any rational student will decide either to do the readings or to attend lecture (see Chapter Twenty-Three)—no doubt not what you intend.

If you are uncertain of your students' level of expertise, preparation, and interest, have them do one or more classroom assessment exercises (see Chapter Twenty-Eight) before planning your lectures. Otherwise you risk going over the students' heads or boring them with basics.

PREPARING AN EFFECTIVE LECTURE

Bligh (2000) lays out several organizational models for lectures, but they share the common ground summarized here.

Class Outcomes

First, determine your student learning outcomes for the class period. What precisely do you want your students to learn that day? How will you express your outcomes to the class? If a lecture serves only one or two of the multiple objectives you have for the class, then it should fill only part of the period.

Overview

Whenever possible, limit one class's lecture to one major topic. Some students find it difficult to pick up a lecture from one period to the next, and global thinkers need to see the big picture before any of the details and examples will make sense. Also lay out a time-content schedule, bearing in mind the two most common lecturing errors: trying to include too much material and delivering the material too fast. While you're lecturing, you will have to proceed slowly enough, including pausing after major points, for students to take notes. So if anything, underbudget content.

To start planning your lecture, you might begin by subdividing the major topic into ten- to fifteen-minute chunks. Then plan student-active breaks of two to fifteen minutes between these chunks. Later in this chapter, you find a wide variety of short break activities that you can use, but feel free to devise your own. Most of them can be (and have been) conducted in large lectures of hundreds of students as well as smaller classes. So class size need not deter you. Finally, allow two to five minutes for some kind of recap activity at the end.

Let us turn to the internal organization of your lecture. The skeleton for any lecture is the introduction, the body, and the conclusion (McKeachie, 2002).

Introduction

The ideal introduction has three parts, the order of which is really an aesthetic decision: (1) a statement that frames the lecture in the context of the course objectives, (2) a statement reviewing and transitioning from the material covered in the previous class period, and (3) an attention grabber for the new material. Effective attention grabbers include an intriguing question the lecture will answer, a story or parable that illustrates the new subject matter of the day, a demonstration of a nonobvious phenomenon, a reference to a current event or movie, a case or a problem that requires the lecture's information to solve, or a strong generalization that contradicts common thought. The idea is to draw in the class with surprise, familiarity, curiosity, or suspense.

Body

The body is your presentation and explication of new material. It is within this section that you subdivide the major topic into minilectures, each of which should revolve around only one major point. There is no best logic to follow in organizing a minilecture except to keep it simple. You can choose from an array of options: deduction (theory to phenomena/examples); induction (phenomena/examples to theory); hypothesis testing (theory to hypothesis to evidence); problem to solution; cause to effect; concept to application; familiar to unfamiliar; debate to resolution; a chronology of events (a story or process)—to name just some common possibilities. To appeal to different learning styles, try to vary your organization from one minilecture to another (see Chapter Twenty-Five).

Organizational Outline

Make whatever organization you select explicit to students. For instance, tell the class, "I am going to describe some common manifestations of dysfunctional family behavior, then give you a definition and general principles that apply to the phenomenon."

It is best to provide a general outline of the main points (only) of your lecture on the board, on an overhead or slide, or in a handout. An outline will ensure that students are following your logical flow, especially if you occasionally refer to it to point out your location in the lecture. It should also highlight new terms you are introducing. However, keep this outline skeletal so students still have to take notes. Research shows that the process of note taking has learning and retention benefits (see the "Teaching Students to Take Good Notes" section later in this chapter.)

In addition, try to integrate as many of these learning aids as you can:

- *Visuals.* As you plan the material, think about how you can convey or repackage it visually—in pictures, photographs, slides, graphic metaphors, diagrams, graphs, and concept or mind maps (spatial arrangements of concepts or stages linked by lines or arrows). Prepare these graphics for presentation to the class. While such visual aids facilitate almost everyone's learning, they can be critical for students with a visual learning style (see Chapters Twenty-Five and Twenty-Six).
- *Examples.* Think about illustrating abstract concepts and relationships with examples. Ideally these examples should be striking, vivid, current, common in everyday life, and related to students' experiences (past, present, or future). Making them humorous also helps students remember them.

- *Restatements*. Consider how you can restate each important point in two or three different ways—in scholarly terms, lay formal language, and informal language. Restatements not only demystify the material, making it more comprehensible, but they also build students' vocabulary and encourage their own paraphrasing of the material.

Conclusion

For learning purposes, the conclusion should be a two- to five-minute recap of the most important points in your lecture. It is too important to be rushed after the bell. You should plan and direct the recap activity, but the students should do it. The prospect of having to retrieve the material helps keep all students on their toes. The recap activity may take the form of an oral summary presented by one or more students, a free-recall writing exercise (see Chapter Seventeen), a classroom assessment technique such as a one-minute paper (see Chapter Twenty-Eight), or a quiz.

In fact, we know that giving a quiz, graded or ungraded, at the end of the class period is a particularly effective means to ensure students retain more of your lecture content. Recall lecture's infamous forgetting curve: 38 percent of the material gone within minutes, 55 percent in three to four days, and 76 percent in eight weeks. Now recall from Chapter One that people learn less by reviewing material and more from being tested or testing themselves on it, as the latter activities involve greater cognitive processing and practice retrieving (Dempster, 1996, 1997; Roediger & Karpicke, 2006). This is why giving some kind of test right after a lecture doubles both factual and conceptual recall after eight weeks (Menges, 1988).

Your Lecture Notes

Your lecture notes should be easy to read at a glance and as sketchy as you can handle. After all, you know the material. So all you need is a map showing your next conceptual destination. Therefore, consider laying out the lecture graphically in flowcharts, concept maps, tree diagrams, Venn diagrams, network models, and so on, including any visual aids you plan to put on the board. Some instructors like to color-code their notes for quick visual reference. If a graphic organization does not appeal to you, make a sketchy outline of your lecture. But be sure it's very sketchy. In any case, write big and leave a lot of white space.

The habit to avoid is writing out sentences (except direct quotes). That may tempt you to read them in class, in which case you will lose spontaneity, expressiveness, flexibility, eye contact, and, most important, psychological contact with the class, lulling students into a passive, inattentive state of mind (Day, 1980). Confine the words in your notes to key concepts and phrases, transitions to make explicit to the class, and directions to yourself (for example, "board," "pause," "slide," "survey class," "ask class question," "break activity #2—voltage problem").

DELIVERING AN EFFECTIVE LECTURE

Actually a lecture can be highly motivational, but its success depends on the lecturer. An expressive, enthusiastic instructor can ignite students' interest in the material, and a reserved, boring one can douse it.

The platform skills that convey energy, dynamism, and charisma can be isolated—they are listed in Chapter Seven—and learned. Public speaking courses and clubs help people develop and practice eye contact, effective verbal pacing and pausing, vocal quality and variety, facial expressions, gestures and movements, lectern and microphone use, visual aid display, and so on. Those who start out weak in these skills but work on them diligently can achieve impressive results within a year.

Some scholars may dismiss such presentation techniques as mere acting. In fact, some people seem to have a knack for them, while others acquire them only with concentration and practice. Acting or not, like it or not, these public speaking techniques have a powerful impact on students' motivation and learning, as well as on their course and instructor evaluations (see Chapter Thirty-Two). But this is

true only to the extent that an instructor relies on the lecture format. With the variety of teaching methods available, no instructor need rely on it much at all.

Therefore, instructors have a choice. Those who happen to have an expressive, dynamic public personality or are willing to acquire the trappings of one can afford to use the lecture more in their teaching. (For the sake of student learning, however, even the most charismatic instructor should not depend on it exclusively.) Those who do not project such a persona can avoid lecturing whenever possible and employ more student-active methods. In brief, you should play to your natural and acquired strengths. The wide array of effective teaching methods should put to rest the notion that good teachers are born and not made.

INCORPORATING STUDENT-ACTIVE BREAKS: THE INTERACTIVE LECTURE

Well-chosen student-active breaks—coined "brainy breaks" by Rick Beam, academic dean and vice president for academics at Johnston Bible College—comprise the heart of the interactive lecture, transforming the traditional lecture into a series of minilectures.

Attention Span Limits

According to studies cited in Bligh (2000), Bonwell and Eison (1991), and Middendorf and Kalish (1996), a lecture begins with a five-minute settling-in period during which students are fairly attentive. This attentiveness extends another five to ten minutes, and then students become progressively bored, restless, and confused. Focus and note taking increasingly drop—some students effectively fall asleep—until the last several minutes of the period, when they revive in anticipation of the end of class. Bligh reconfirmed this pattern using students' heart rates as a measure of arousal. Even medical students display similar patterns of concentration levels: an increase over about fifteen minutes, followed by a sharp decrease.

This is unsettling, sobering news for the higher education community. After all, if highly motivated learners like medical students demonstrate such a brief attention span in the lecture setting, what can we expect of our undergraduates? No doubt enthusiastic, engaging lecturers can extend that narrow time horizon. But aside from improving our platform skills, what else can we do when we must lecture?

In a word, pause. One study supports the practice of pausing at least three times during each lecture to allow pairs or small groups of students to discuss and clarify the material (Rowe, 1980). Another recommends pausing for two minutes every fifteen to eighteen minutes to permit student pairs to compare and rework their notes (Ruhl, Hughes, & Schloss, 1987). This latter study was designed experimentally with a control group receiving a series of traditional nonstop lectures and a treatment group hearing the same lectures with periodic pauses. Both groups took free-recall quizzes during the last three minutes of each lecture (that is, students individually wrote down everything they could remember from the lecture) and the same sixty-five-item multiple-choice test twelve days after the last lecture. In two different courses repeated over two semesters, the treatment group performed much better than the control group on both the quizzes and the test—better enough to make a mean difference of up to two letter grades (17 percentage points), depending on the cut-off points. Translated into learning terms, sacrificing the least important 12 percent of your lecture content for periodic two-minute pauses can increase the learning of your current C students to that of your current B students and even A students.

Ideas for Student-Active Breaks

During student-active breaks, students should be in some way interacting with the material (and often one another) for brief, controlled periods of time. Add in the appropriate breaks, and suddenly you can help your students achieve almost every type of learning outcomes—those requiring any of Bloom's

cognitive operations and those involving cognitive development.

Ideally the breaks should supply students the opportunity to practice performing your learning outcomes or applying the lecture content you just gave. How well they complete the break task should furnish you with a diagnosis of their understanding. After all, you shouldn't move onto the next chunk of material unless students comprehend this one.

To keep the breaks brief and controlled, carefully time-control them. Inform your students that they will have exactly X number of minutes to complete the activity you assign them. Strictly enforced, those limits keep students focused on the task. When in doubt, allocate a little less time than you think some of them will need, but feel free to extend the limit a bit if they are working diligently. To make managing easier, bring a timer or stopwatch to class. Also circulate around the classroom to let students know you are listening to them and are willing to answer any procedural questions.

These breaks work well in any size class. In larger classes, however, having students work with their neighbors (in *ad hoc* pairs or triads) is quicker and easier than having them get into preorganized small groups, unless you arrange for group members to sit together during every class.

Ask students to work and talk as quietly as they can, but expect the classroom to get noisy anyway. After their activity time is up, you can bring even the largest class to silence within seconds by taking this tip from cooperative learning researchers: set the rule that you will raise your hand when the time is up. Tell your students that as soon as they see your hand up, they should immediately stop talking and raise their hands. The rest of the class will quickly follow suit.

Below are some commonly used break activities, along with the number of minutes each typically takes. (They come from Bonwell & Eison, 1991; Cross & Angelo, 1993; McKeachie, 2002; and informal collegial exchanges.) Some of them recommend randomly calling on individual students or groups to hold them accountable for participating in the activity. Let these examples serve as your inspiration to conceive and experiment with your own innovations:

- *Pair and compare.* Students pair off with their neighbor and compare lecture notes, filling in what they may have missed. This activity makes students review and mentally process your minilecture content. Time: Two minutes.
- *Pair, compare, and ask.* Same as pair and compare but with the addition that students jot down questions on your minilecture content. Students answer one another's questions; you then field the remaining ones. Time: Three minutes, plus one or two minutes to answer questions.
- *Periodic free-recall, with pair-and-compare option.* Students put away their lecture notes and write down the most important one, two, or three points of your minilecture, as well as any questions they have. The first two times you do this, use a slide, overhead, or the board to give instructions. After that, just telling them will do. Again, this activity makes students review and mentally process your minilecture content. Students may work individually, but if they work in pairs or triads, they can answer some of each other's questions. Time: Two minutes, plus one or two minutes to answer students' questions.
- *Reflection/reaction paragraph.* Students individually write out their affective reaction to the minilecture content (or video or demonstration). Ask a few volunteers to share. Time: Three to four minutes.
- *Solve a problem.* Students solve an equational or word problem based on your minilecture. (Chapter Twenty-One describes a problem-solving strategy you can teach them.) They can work individually or, better yet, in *ad hoc* pairs or triads. Randomly call on a few individuals or groups to sample their answers. Time: One to three minutes for problem solving, depending on the problem's complexity, plus one or two minutes for surveying responses.
- *Multiple-choice item.* Put a multiple-choice item, preferably a conceptual one, related to your minilecture on the board, a slide, or an overhead,

and give four response options. Survey your student responses (the next section, "Surveying Student Responses: Hands, Flashcards, and Clickers," explains various ways to do this). You can also ask students to rate their confidence level in their answer. Then give them a minute to convince their neighbor of their answer, and resurvey their responses. This activity, developed by Mazur (1997), makes students apply and discuss your minilecture content while it's fresh in their minds, and it immediately informs you how well they have understood the material. You can then clarify misconceptions before proceeding to new material. Time: Three minutes, plus one to two minutes to debrief and answer questions.

- *Multiple-choice test item.* In contrast to the multiple-choice item task above, this one puts students in pairs or small groups to compose multiple-choice items on your minilecture for a test you will give in the future. As we know, this is no easy task, so provide your students some training in good test-item writing. Teach them Bloom's taxonomy. Tell them the characteristics of plausible distractors (see Chapter Twenty-Nine). Show them examples of well-constructed and poorly constructed items, then lower-order recall and higher-order thinking items. Students will be motivated to write test items you will want to use because they will know the answers to the ones they submitted. And you will never have to write multiple-choice items again. Nor will students ever again blame you for items they find tricky, ambiguous, or too hard. Of course, you should reserve the right to tweak their submissions. Time: One to three minutes for each item they write.
- *Listen, recall, and ask; then pair, compare, and answer.* Students only listen to your minilecture—no note taking allowed. Then they open their notebooks and write down all the major points they can recall, as well as any questions they have. Instruct students to leave generous space between the major points they write down. Finally, they pair off with their neighbor and compare lecture notes, filling in what they may have missed and answering one another's questions. Again, this activity makes students review and mentally process your lecture content. Time: Three to four minutes for individual note writing plus two to four minutes for pair fill-ins and question answering.
- *Pair/group graphic.* Students develop a concept map, mind map, thinking map, graphic organizer, picture, diagram, flowchart, or matrix of your minilecture content in pairs or small groups. What they are actually doing is integrating and reassembling their understanding of the content into a big picture graphic. It is one of the purest constructivist activities you can have them do, and it yields powerful learning benefits, which will be detailed in Chapter Twenty-Six. Because these graphics provide you with deep insight into your students' interpretation of the material, you may want to collect and peruse them. You may also want to return them with some feedback—at the very least, pointing out any misconceptions and oversimplifications they reveal. Time: Three to ten minutes in class.
- *Quick case study.* Students debrief a short case study (one to four paragraphs) that requires them to apply your minilecture content to a realistic, problematic situation. (Chapter Nineteen addresses the case method, including tips on developing your own cases.) Display a very brief case on an overhead or slide; put longer ones in a handout. You may add specific questions for students to answer, or teach your class the standard debriefing formula: What is the problem? What is the remedy? What is the prevention? Instruct students to jot down their answers. Students can work individually or, better yet, in *ad hoc* pairs or small groups. Time: Three to five minutes, depending on the case length and complexity, plus five to ten minutes for class exchange and discussion.
- *Pair/group and discuss.* Students pair off with their neighbor or get into small groups to discuss an open-ended question that asks them to apply, analyze, or evaluate your minilecture content or to synthesize it with other course material. This question should have multiple possible correct answers. (Refer to Chapter Fourteen for helpful questioning schema and question framing techniques.) Have students outline their answers in writing. This activity makes

students examine and extend, as well as process, your minilecture content and serves as an effective prelude to a general class discussion. Time: Three to ten minutes, depending on the question's complexity, plus five to ten minutes for class exchange and discussion.

- *Pair/group and review.* Same as above but with an essay question designed for preexam review. Randomly select student pairs or groups to present their answers to the class. Then mock-grade them based on your assessment criteria (explain these before the exercise). You can also have the rest of the class mock-grade these answers to help students learn how to assess their work. Time: Three to ten minutes, depending on the question's complexity, plus five to fifteen minutes for pair/group presentations.

Here are several other break activities that apply to a wide range of content areas. Johnston and Cooper (1997) developed them under the apt name, "quick-thinks." Each takes one or two minutes, plus one to four minutes to survey responses:

- *Correct the error.* Using immediate minilecture content, students correct an error in a statement, equation, or visual that you have intentionally made. The error may be an illogical or inaccurate statement, premise, inference, prediction, or implication.
- *Complete a sentence starter.* Students accurately complete a sentence stem related to your minilecture content. The completed statement may be a definition, a category, a cause-and-effect relationship, an implication, a rationale, or a controversy. Present students with a sentence starter that requires reflection and higher-order thinking, not just rote knowledge, to complete.
- *Compare and contrast.* Students identify similarities or differences between parallel elements in your minilecture, such as theories, methods, models, events, problems, solutions, or artistic or literary works. To comprise a true analysis task, students must work on elements that have not been compared and contrasted in your minilectures or the readings.
- *Support a statement.* Students garner support for a statement—a conclusion, inference, theory, opinion, or description—you present. Sources of support may be your minilecture, the readings, or evidence they generate on their own.
- *Reorder the steps.* Students correctly sequence items that you present to them in mixed order. These items may be elements of a procedure, process, cycle, method, plan, strategy, or technique.
- *Reach a conclusion.* Students logically infer the implications of facts, concepts, or principles drawing from data, opinions, events, or solutions. The inferred conclusions can be probable results, probable causes, or outcomes.
- *Paraphrase the idea.* Students put an idea—a definition, theory, statement, procedure, or description—into their own words. This task can be just a check on their comprehension or a little more when you add the twist of targeting the paraphrase to a specific audience.

Finally, the least cognitively active break is what Kodani and Wood (2007) coin the *seventh inning stretch*. For a few minutes, they play some popular music and have their students just get out of their seats and stretch. Afterward their classes seem more alert. When Kodani and Wood surveyed their classes, their students overwhelmingly appreciated this break and believed it enhanced their learning. But a few would have preferred it to be content focused.

You will find many other options for student-active breaks in Chapter Seventeen (writing-to-learn activities), Chapter Eighteen (learning in groups), and Chapter Twenty-Eight (classroom assessment techniques).

Surveying Student Responses: Hands, Flash Cards, and Clickers

When you develop a lecture break around a multiple-choice item—or for that matter, a true-false item—follow up by surveying your students' responses before and after they discuss their answers with their neighbors. The fact that students commit to an answer makes them more interested in finding out what the correct response is, and the results furnish you with valuable feedback on their understanding.

You can collect those responses in several ways. First, you can ask for a show of hands for each response. While very simple, this option has its weaknesses. In a large class, you can't know for sure whether everyone is participating, and since you don't have time to count all the hands, you may get only a vague measure of the distribution of responses. You have no record of these responses either. One additional problem is that responses are not anonymous, so students may mindlessly change their answers just to follow the crowd.

Second, you can distribute four 8 1/2- by 11-inch "flash cards" (you can use heavy cover stock) of different colors to each student, where each color signifies an answer—for example, red for a, blue for b, yellow for c, and green for d. Then have students put up the color of paper that signifies their response choice. With this alternative, you can get a somewhat better idea of your participation rate and response distribution, especially if you have students put the stock directly in front of their faces. If you see a face, you can coax the student to make a choice. With students' faces covered by their choices, the answers become more anonymous as well. The only problem is that you have no record of the responses.

Third, you can use clickers, more formally known as personal or classroom response systems or voting systems. Students simply push a button indicating their response, and a receiver connected to your computer picks up the signals and immediately tallies all the answers, displaying them in a histogram on your monitor. You then have the option of revealing these results to the class. Of course, this alternative involves more advanced technology, which means that your institution, your students, or both have to pay for the clickers and your receiver. In addition, you have to learn the technology. However, you can tell exactly who isn't participating (and push them to participate) and exactly how the responses distribute, and you can archive the survey results. The process is completely anonymous so only you know how each student is responding. This also means you can take a confidential survey on sensitive attitudinal or behavioral topics. If you think students may be concerned about your knowing their individual responses, you can turn off your receiver's identification function and tell them that you have.

Almost all of the research on the impact of this lecture break technique—that is, posing a multiple-choice question and surveying student responses before and after a short pair discussion—has been conducted on clickers. Compared to a traditional lecture, incorporating clicker breaks enhances student learning substantially, often by an entire letter grade on tests (Crouch & Mazur, 2001; Deal, 2007; Fagen, Crouch, & Mazur, 2002; Kaleta & Joosten, 2007; Mazur Group, 2008; Reay, Li, & Bao, 2008; additional studies listed at Bruff, 2008). The good news is that lower-tech survey methods, at least flash cards, produce learning gains just as impressive as clickers (Lasry, 2008). The payoff comes from the lecture break activity itself, not the technology. Therefore, the vast majority of the learning-relevant research involving clickers applies to hand raising and flash cards as well.

The student learning benefits of this lecture break technique over traditional lecture derive from its very specific effects. The literature reports that this technique increases class attendance, broadens class participation to literally the entire class, multiplies the chances for both student-to-student and student-to-faculty interaction, affords students regular practice in higher-order thinking, teaches them to critically examine and defend their thinking, improves the formative assessment of learning, provides instant feedback to students and the instructor on their understanding and retention, heightens students' attention and alertness in class (even early and late in the day), enhances their engagement in the material, and develops their metacognition, allowing for mindful and self-regulated learning (Bergtrom, 2006; Bruff, 2009; Crouch & Mazur, 2001; Deal, 2007; Fagen et al., 2002; Kaleta & Joosten, 2007; Mazur Group, 2008; Radosevich, Salomon, Radosevich, & Kahn, 2008). You can also use this technique to assess students' prior knowledge and launch discussion. Clickers offer the additional opportunities to do the following: take attendance instantly, with or without

posing a question; grade participation, even in a large class, based on the number of correct responses to questions; play academic games, such as Millionaire; and give objective-item quizzes, as long as considerable cheating isn't likely.

Of course, these benefits depend on the questions; they must require higher-order thinking and problem-solving skills. For example, they may ask students to choose an example of a principle or to choose a principle to explain an example. They may survey an opinion, pose an ethical dilemma, have students classify a concept, or challenge them to make a prediction. (Chapter Fourteen on questioning techniques supplies many more examples.) If clickers collect the responses anonymously, the questions can address controversial or personal matters, such as students' opinions on hot-button issues or private experiences that illustrate a theory, principle, or finding (Bruff, 2007, 2009).

Since this lecture break technique started in large science classes, the STEM fields (science, technology, engineering, and mathematics) already have large online collections of well-tested break questions; start with Databases of Concept Questions at www.skylight.science.ubc.ca/cqdatabases. Bruff (2009) and his website (2008) at www.vanderbilt.edu/cft/resources/teaching_resources/technology/crs_biblio.htm offer other sources of questions for a much wider array of disciplines.

TEACHING STUDENTS TO TAKE GOOD NOTES

Many students come to college—and often leave it—with poor note-taking skills. The average student's notes include only 10 percent of the lecture (Johnstone & Su, 1994) and 40 percent of its critical ideas (first-year students, just 11 percent) (Kiewra, 1985, 2005), and only about a third of students take decent notes (Johnstone & Su). One reliable way to get your material into those notes is to write it on the board. But students also make errors copying material, particularly diagrams, equations, numbers, and the contents of slides and transparencies, through which we often move too quickly. They also tend to leave out the instructor's corrections, descriptions of demonstrations, examples of applications, the structure of arguments, and technical definitions (Johnstone & Su).

And some students don't take notes at all, especially when they have a hard copy of the lecture's presentation slides. But having these slides often gives them a false sense of security that all the material they need to know for the test lies in front of them, and they may think they will remember what they have heard and read at the same time. We must realize that most young students did not take notes in high school. Teachers often provided handouts and gave easy tests. If students succeeded academically without taking notes before, they may question why they should now. So they don't even know that they should take notes, let alone how to take good ones.

Selling Students on Note Taking

Before teaching your students how to take good lecture notes, you have to motivate them to take them, to sell them on the benefits. Fortunately, you can make your case from plenty of research (Carrier, 1983; Johnstone & Su, 1994; Kiewra, 1985, 2005; Potts, 1993; numerous studies cited in Bligh, 2000, and McKeachie, 1994). Students who take their own notes and review them later reap numerous cognitive payoffs over those who just listen. Note taking fosters attention to and concentration on the lecture, accurate judgments about the relative importance of content (from nonverbal cues), understanding of the development and structure of the knowledge, far-transfer application of the material, and deeper cognitive processing. In deeper processing, learners engage in more thoughtful and active listening. They are paraphrasing, interpreting, and questioning, as well as integrating the new material into their organized bank of prior knowledge. Perhaps most compelling to students, taking notes better cements the knowledge in their memories, especially if they

review their notes later. This means note takers perform better on all types of tests than non–note takers. Of course, it is just as important that students review their notes, but you can incorporate lecture breaks and end-of-class activities to ensure they review them at least once (see the "Ideas for Student-Active Breaks" section above).

Kiewra (1985) conducted some intriguing research on the relative value of students studying from their own lecture notes versus the instructor's lecture notes. On factual tests, students who studied only the instructor's notes performed better than those who studied only their own notes. In fact, this former group did better even if they did not attend lectures! However, the highest factual test scorers were those who studied both the instructor's notes and their own notes. When students took tests requiring higher-order thinking, the instructor's lecture notes were of no help to them. It seems, then, that for higher-order cognitive outcomes, the greater focus and deeper thought processes that note taking engages really pays off.

Teaching Note Taking

After selling students on note taking, acquaint them with some note-taking systems (Bligh, 2000; Ellis, 2006; Kiewra, 2005). Show them how to make a formal outline with first-order headings, second-order headings, and so on. (Points of equal importance or generality should start at the same distance from the left margin.) Tell them about the Cornell system: drawing a line down each page one-third in from the left, taking lecture notes on the right two-thirds of the page, and reserving the left one-third for reviewing activities, such as condensing the notes and rewriting the most critical content. You might also teach your students how to reorganize their notes into concept maps, mind maps, graphic organizers, matrices, and diagrams so they can take advantage of the learning and memory benefits of visual representation (see Chapter Twenty-Six). No one strategy is equally effective for everyone, so advise students to try out at least a couple.

In addition, explain to your students that the real art of taking notes is putting the most knowledge into the fewest possible words, preferably their own words. It is not transcription. Students should avoid writing complete sentences unless the specific wording is crucial. So tell them to take notes sparingly, dropping all unnecessary words and recording only the words and symbols needed to recall the idea they signify later.

Finally, share with your class some note-taking pointers, such as these (Bligh, 2000; Ellis, 2006; Kiewra, 2005):

- Arrive early to class to warm up your mind. Review your notes from the previous class and the assigned readings. Ask the instructor to clarify what doesn't make sense.
- Avoid cramming your notes or writing too small. Strive for easy readability. Leave a generous left margin for rewriting important words and abbreviated key content later.
- Occasionally glance back over the last few lines of notes you have taken, and rewrite any illegible letters, words, or symbols.
- Make key words, important relationships, and conclusions stand out. Underline, highlight, box, or circle them, or rewrite them in the left margin.
- Organize your notes according to the instructor's introductory, transitional, and concluding words and phrases, such as "the following three factors," "the most important consideration," "in addition to," "on the other hand," and "in conclusion." These phrases signal the structure of the lecture: cause and effect, relationships, comparisons and contrasts, exceptions, examples, shifts in topics, debates and controversies, and general conclusions.
- Identify the most important points by watching for certain instructor cues: deliberate repetition, pauses, a slower speaking pace, a drop in pitch, a rise in interest or intensity, movement toward the class, displaying a slide or transparency, and writing on the board.

- Pay close attention to the instructor's body language, gestures, and facial expressions, as well as changes in pace, pitch, and intonation. The instructor's subtlest actions punctuate and add meaning to the substance of the lecture.
- Whenever possible, draw a picture, concept map, or diagram to organize and abbreviate the relationships in the lecture material. Most people can recall a visual more easily than a written description.
- Develop and use your own shorthand, such as abbreviations and symbols for common or key words—for instance, btw for between, + for and, b/c for because, rel for relationship, df or = for definition, cnd for condition, nec for necessary or necessitates, hyp for hypothesis, Δ for change, T4 for therefore, + for more, − for less, ↑ for increasing, ↓ for decreasing; → for causes, ← for is caused by, and two opposing arrows for conflicts with.
- Take notes quickly and at opportune times. Use the instructor's pauses, extended examples, repetitions, and lighter moments to record notes. You can't afford to be writing one thing when you need to be listening closely to another.
- To help speed your note taking, try different pens until you find an instrument that glides smoothly and rapidly for you.
- If the instructor tends to speak or to move from point to point too quickly, politely ask him or her to slow down. You are probably the most courageous student of many who cannot keep up either.
- If you lose focus and miss part of a lecture, leave a space and ask a classmate, a teaching assistant, or the instructor to help you fill in the blank.
- Separate your own comments and reactions from your lecture notes.
- Review, edit, clarify, and elaborate your notes within twenty-four hours of the lecture, again a week later, and again a month later—even if for just a few minutes. While reviewing, recite, extract, and rewrite the key concepts and relationships. With enough review, the knowledge will become yours forever.

Making Note Taking Easier for Students

We can do a lot to help students take good lecture notes and have already addressed these strategies in detail earlier in this chapter. Still, they are worth highlighting here. For starters, we can organize our lectures clearly and simply, giving each an introduction, a body, and a conclusion and making the organization explicit in class. We can deliver our content using nonverbal cues (vocal variety, gestures, movement) to signal the most important points. We can chunk the content into minilectures, each making one major point, with student-active breaks between them. Finally, we can schedule lecture breaks and end-of-class review activities that allow students to review, fill in, and revise their notes, individually or in pairs (Carter & Van Matre, 1975; Kelly & O'Donnell, 1994; O'Donnell & Dansereau, 1993).

The most effective learning aids we can furnish are skeletal lecture notes that provide just the main headings and subheadings of our lectures and appropriately sized blocks of white space below them. Students need these notes at the beginning of the lecture, so you should post them for downloading on the course website or distribute them as handouts before starting class. With an even sketchy lecture outline in front of them, students tend not to get lost, and they quickly figure out from the amount of white space how much note taking to do on their own. According to research, students not only take better notes on skeletal outlines but also perform better on tests, suggesting they learn more (Cornelius & Owen-DeSchryver, 2008; Hartley & Davies, 1986; Potts, 1993). To make the most of skeletal notes, we can include the type of material that students often miscopy (diagrams, equations, numbers, and the contents of slides and transparencies) and insert a heading and white space for them to record what they frequently leave out: demonstrations, examples of applications, the structure of arguments, and technical definitions (Johnstone & Su, 1994). You can also include the directions or the triggers for lecture-break activities as well as the space to record the discussion, problem solution, answer, graphic, conclusion, most important

points, and so on. To prevent that false sense of security that printouts of presentation slides give many students, word-process your skeletal notes.

Whether or not you make skeletal notes for your classes, you might want to display or hand out your own lecture notes just once or twice early in the term to provide students a model of how they should be taking notes.

MAKING THE LECTURE EFFECTIVE FOR EVERYONE

To encourage and enable academic success and lifelong learning, we should incorporate as many learning skills, such as lecture note taking, as we can fit into our courses. But for a small subset of students, note taking can actually interfere with their learning and recall. Those with relatively low ability, poor short-term memory, or little prior knowledge of the subject matter are often unable to assimilate new material as quickly as a lecture demands (McKeachie, 2002). They are totally dependent on our instructional aids, such as skeletal notes and student-active breaks like pair and compare that allow them to draw on their neighbor's notes. Try to get these students special help by referring them to your institution's learning skills or academic assistance center. It may offer workshops or one-on-one tutoring in note taking.