Chapter 1

Retrieving

INTRODUCTION

I wrote almost every word of this book sitting in a coffee shop about two blocks from my home. Most weekdays I would walk in, find a spot near an electrical outlet, fire up my laptop, and then head to the counter to order my beverage. I am a person of routines when it comes to food and drink, so every day for about 6 months I placed the same order: medium green tea. The coffee shop had its routines as well, which meant that most of the time I was placing my order with the same young woman. Yet in spite of the fact that she saw my smiling face 3 or 4 days a week making the same order, she always looked up at me expectantly when I arrived, as if I had not requested the same thing a hundred times before. She would even ask me the same two questions about my tea order every time: "Hot or cold?" "Honey or lemon?" Hot and No. Every time. As the weeks and months of this stretched on, it became a mild source of amusement to me to see if she would ever remember my order. She never did. Until, that is, I walked in one day and felt a little mischievous.

"Can I help you?" she said.

"Can you guess?" I replied.

She looked up as if seeing me for the first time, and she smiled sheepishly.

"Oh gosh," she said. "Why am I blanking?"

"It's OK," I said. "No problem. Medium green tea. Hot, nothing in it."

The next time I showed up at the coffee shop was a couple of days later. I walked in, found my spot, fired up the laptop, and approached my forgetful friend at the counter. To my astonishment, she pointed at me with a smile and said:

"Medium green tea, hot, no honey or lemon?"

This little story illustrates perfectly a learning phenomenon called the retrieval effect (and sometimes also called the testing effect). Put as simply as possible, the retrieval effect means that if you want to retrieve knowledge from your memory, you have to practice retrieving knowledge from your memory. The more times that you practice remembering something, the more capable you become of remembering that thing in the future. Every time I walked into that coffee shop and told the barista my order, she was receiving the information afresh from me; she did not have to draw it from her memory. She was doing the student equivalent of staring at her notes over and over again—a practice that cognitive psychologists will tell you is just about the most ineffective study strategy students can undertake. When I made one very small change to our interaction by "testing" her to remember my order—even though she didn't get it right—she had to practice, for the first time, drawing that piece of information from her memory. And because it was such a simple piece of information, one practice was enough to help her remember it for the next time. It won't be quite as simple for our students, who have to remember more complex stuff than my order at the coffee shop. But the principle is exactly the same. The more times any of us practice remembering something we are trying to learn, the more firmly we lodge it in our memories for the long term.

This retrieval effect has been the subject of multiple articles in the popular press in recent years, as research findings from

cognitive scientists jump from their laboratories into the laps of journalists and popular education writers. But folk psychological awareness of this phenomenon has been around since the time of the ancient Greeks. The philosopher Aristotle was describing it when he said in his essay "On Memory," that "exercise in repeatedly recalling a thing strengthens the memory" (cited in Brown, Roediger, and McDaniel 2014, p. 28). With his use of the words *exercise* and *strengthen* he also initiated a long tradition, now frequently repeated in articles on the retrieval effect in the popular press, of thinking about the brain like a muscle. This comparison helps illustrate the fact that memory practice improves memory skills in the same way that swimming practice improves swimming skills. However, this analogy also has the potential to horrify your neuroscience friends because the physical organ of the brain is totally unlike a muscle. But if we can limit ourselves to the statement that training yourself to remember something resembles training a muscle to do something, in the very limited sense that both require frequent and deliberate practice (or exercise), we can let it stand.

The retrieval effect is also sometimes called the testing effect as a way to help teachers recognize its significance for student learning in their classrooms. Teachers (and students and parents) typically think about tests as a means to measure student learning. But tests, thought about in the most general way possible, are actually memory exercises. And if the research suggests that memory exercises improve our memories, that should mean that tests have the potential not just to measure learning but also actually to improve it. The problem with using the phrase *the testing effect* is that many of us have a very limited understanding of what the word *test* means—it recalls for us anxious students biting their pencil erasers as they sweat their way through a multiple-choice final exam. But of course testing can happen in a thousand different ways, from small daily quizzing exercises to oral examinations

to online short-answer questions. The research that we will consider encompasses multiple types of these testing activities, all of which help students exercise their memory muscles to improve and solidify their knowledge base. Testing here simply means forcing learners to recall learned information, concepts, or skills from their memory. It can take the form of oral questioning in the opening 5 minutes of class just as easily as it can take the form of a high-stakes final exam. For that reason, I will continue to speak primarily of the retrieval effect and retrieval practice in what follows to avoid limiting your thinking about how you might manifest this teaching strategy in your classroom, and especially to help you think about how to implement retrieval practice through a variety of small teaching activities.

IN THEORY

The most recent, real-world experiments designed to illustrate the power of the retrieval effect have come from the Memory Lab of Henry L. Roediger at Washington University in St. Louis, which comprises the work of multiple researchers exploring the educational implications of their work on learning, cognition, and memory. As Roediger and his co-authors report in *Make It Stick: The Science of Successful Learning,* in 2006 researchers from the Memory Lab began working with a middle school in Columbia, Missouri, to see whether they could leverage the power of the retrieval effect in order to improve student learning (Brown, Roediger, and McDaniel 2014). Research associate Pooja K. Agarwal worked with a sixth-grade social studies teacher, Patrice Bain, to explore whether a structured set of retrieval practice activities in her six classes would help improve her students' learning. Rather than using retrieval practice with some of the classes and not with others, they divided the course material—standard-issue

middle-school social studies textbook stuff, covering major world civilizations—into three groupings and treated each of those groupings differently. For the first set of material, the students were given three opportunities to practice retrieval in the form of regular quizzes, which were spaced out in the following way: one at the beginning of class, after they had read course material for homework but prior to the teacher discussing it; one at the end of class, after discussion of the material; and one just before each major test for the class. The teacher excused herself from the room during the quizzes; the students were shown the correct answers after they had given their answers, but the quizzes did not count toward their grades. For the second grouping of material, the students had the opportunity to restudy key concepts from the course that would appear on the exams. Bain covered the final grouping of material with her usual teaching methods, without any additional study or retrieval practice. It's worth noting, before discussing the results, that the additional retrieval practice did not come *in addition to* students' normal classroom time. It took place within the regular classroom hours, which means it was substituting for something else—lectures, or class discussions, or independent study time, or whatever else the teacher did on the nonquiz days. This deserves notice because some teachers might fear that retrieval practice will take time away from other, more important learning activities.

The experiment yielded, for our purposes, three important results. First and foremost, the authors explain, it demonstrated the potency of retrieval practice: "The kids scored a full grade level higher on the material that had been quizzed than on the material that had not been quizzed" (Brown, Roediger, and McDaniel 2014, p. 35). A year later the research group tried this same experiment in eighth-grade science courses at the same school, and the results were even stronger: "At the end of three semesters, the eighth graders averaged 79 percent (C+) on the science material that had

not been quizzed, compared to 92 percent (A–) on the material that had been quizzed" (p. 35). A second important result was that the grades on the second grouping of material (for which the students had been given additional study time) were no better than the grades on the third grouping of the material (which had no special intervention at all). In other words, additional study time provided them with no additional learning benefit. "Mere re-reading," the authors conclude, "does not much help" (p. 35). Finally, and perhaps most importantly, the positive results of the experiment extended far out in time: "The testing effect persisted eight months later at the end-of-year exams" (p. 35). This has obvious implications for us as teachers; we want students to remember our course material beyond the initial testing period, and spaced-out retrieval practice (more on this spacing in Chapter 3) seems to have a powerful impact on long-term learning. But I can't leave this paragraph without highlighting these results one last time: a brief (and ungraded) multiple-choice quiz at the beginning and end of class and one additional quiz before the exam *raised the grades of the students by a full letter grade*.

Let's consider two more demonstrations of the power of retrieval practice before discussing the mechanics behind it and its translation into small teaching activities. The number of experiments in this area are rising dramatically each year, so we have many to choose from. However, I like an elegant demonstration of it by Roediger and Butler (2007) because it helps confirm what many readers might suspect: that not all types of testing are equal. In this experiment, Roediger and Butler had students observe three 30-minute lectures on art history, with slide shows, over a 3-day period. At the end of each lecture, students did one of four things: (a) take a short-answer test on the material they had just learned; (b) take a multiple-choice test on the material; (c) restudy some of the key facts from the lecture; or (d) walk out the door with no additional activity (which of course is what

happens at the conclusion of most college classes). The students came back 30 days after the last of the three lectures to take a final short-answer test on the material; this time lapse created what the authors called "a more realistic timescale over which students may retain classroom lecture information prior to a test." In other words, students often learn material in class and are not tested on it until several weeks later; a final test thirty days after the learning period mimicked that longer interval (517). The students who took the short-answer tests directly after the lectures (a) scored the highest on the final exam, at 47%; the students who took multiple-choice exams (b) and had additional study time (c) scored about equally, at 36%; those who had no activity (d) scored around 20%. These numbers can seem a little disheartening, but keep in mind that in this experiment students had no reason or opportunity to revisit the course material during the 30-day interval between the lectures and the final exam—which, to a certain extent, makes the results of the students who took the short-answer exam really astonishing, since they recalled almost 50% of the material 30 days later with absolutely no reexposure or study time.

But this study helps us draw out some nuances. First, the students who performed the best were the ones who had to put the most active thought into their answers through short-answer questions. In the pithy formulation of Daniel Willingham, "Memory is the residue of thought" (Willingham, 2009, p. 54). Those short-answer questions required students to formulate answers in their own words, and hence to spend more time answering than the multiple-choice questions. Second, note that in this case the students who had the opportunity to engage in what the authors call "focused restudy" did perform better than the students who had no activity at all. I find this result somewhat heartening, because I have not spent my entire career using the kind of small teaching retrieval practice I am recommending in this chapter, and I would

like to think that students who studied hard still learned something! So while some experiments, like our first one, have shown little difference between students who had extra study time and students who had no additional study or testing, this one yielded a different, more positive result. Third and finally, the students who scored the highest on the last short-answer test were the students who had taken previous short-answer tests. This could mean that the similarity in format between the two types of questions produced the better learning results. In other words, it may be that answering multiple-choice questions at the conclusion of a lesson produces one type of learning, and that type of learning does not translate well into performing well on short-answer questions.

To address that possibility, and to make a case for the special power of writing and problem-solving activities as a part of your retrieval practice, I want to consider one final experiment, this one conducted not by memory researchers in the laboratory but by the instructor in a real set of college chemistry courses. Brian Rogerson details in this study the result of an experiment he conducted over five semesters of teaching introductory chemistry at Richard Stockton College in New Jersey. During three of those semesters, which included his first year as a full-time faculty member, he taught using standard lecture techniques. During two of them, he made only one simple change to the course: 10 minutes before the end of each 75-minute class period, he stopped and asked students to respond to a question on the material he had just covered in the lecture. This question was the chemistry equivalent of a short-answer question, as you can see in this sample question he gives: "Give two reasons that K is more reactive than Li." Some of them required answers in the form of equations or formula, but all of them required more than just repetition from memory. The students wrote their answers down twice—once on a form that they returned to him and once on a paper to keep. This allowed Rogerson to review the answers prior

to the next class—though he did not grade or return them—and then to address problems in their responses at the beginning of that next class session, with students able to check the answers they had given.

In the three semesters in which he did not conduct these end-of-class assessments (which he derived from Angelo and Cross's justly famous book *Classroom Assessment Techniques*) the rate of students who failed or withdrew from the course was 35%. In the semesters in which he used the technique, that rate fell to 17%. The number of Cs and Ds rose in the assessment semesters, which means that students who would have dropped were now performing at the C and D levels—not a miraculous transformation, but an impressive one nonetheless. The rates of A and B students stayed roughly stable in both cohorts, which may partially reflect the fact that an A or B student doesn't have as much room to improve as a C or D student does. Interestingly, in his introduction and discussion of this experiment, Rogerson made no mention of the possibility that retrieval practice may help explain the results of this experiment. Like most instructors who use assessments of any kind, he implemented it as a means to gauge the learning of his students and then saw it as an opportunity to provide feedback on their work. But you will note the similarity between the small task he required of his students and what the researchers in our last experiment required of their subjects: directly following the lecture, they asked students short questions about the material they had just covered. The results of such questions can be disheartening, as Rogerson pointed out: "Even after classes in which I felt I had explained something very well and thoroughly, there were students for whom the answer to the assessment was not obvious" (Rogerson 2003, p. 163). But even when students are frequently providing wrong answers, as they did for Rogerson and will do in your classes—and as long as you provide them feedback to help them

correct their mistakes—the results of these experiments are hard to dismiss.

It remains for us only to note briefly why the retrieval effect works. The very short version is that memory researchers these days seem to believe that our long-term memories are capable of holding a huge amount of material. As cognitive psychologist Michelle Miller wrote in *Minds Online*, "There's wide consensus among memory researchers that long-term memory is essentially unlimited" (Miller 2014, p. 94). However, that unlimited storage capacity can be as much of a problem as a long-term memory with smaller storage capacity. In an earlier essay on what college teachers should know about memory, Miller explained that "in long-term-memory the limiting factor is not storage capacity, but rather the ability to find what you need when you need it. Long-term memory is rather like having a vast amount of closet space—it is easy to store many items, but it is difficult to retrieve the needed item in a timely fashion" (Miller 2011, p. 119). So the challenge for students, or for any of us, is not jamming facts and information down into our long-term memories but instead drawing those facts and information out when we need them or when they will help us in some way. Every time we extract a piece of information or an experience from our memory, we are strengthening neural pathways that lead from our long-term memory into our working memory, where we can use our memories to think and take actions. The more times we draw it from memory, the more deeply we carve out that pathway, and the more we make that piece of information or experience available to us in the future. So retrieval practice, in the form of either informal remembering of things, such as someone's order for a cup of green tea, or formal testing or quizzing in a school environment, as we saw in the aforementioned experiments, helps us pave the way for our memories to strengthen and improve.

MODELS

You don't have to think too hard about how to give your students effective retrieval practice; you just have to do it. The stumbling block for instructors arises less from designing strategies than from worrying about time: how much of their classroom or planning time do they want to devote to helping students remember foundational knowledge? Small teaching can come to the rescue here, as it can help instructors envision how to incorporate retrieval practice into bite-sized moments such as the opening and closing minutes of class and into small exercises in online or blended courses.

Opening Questions

The quickest method for cultivating retrieval practice in class takes the form of asking questions, either orally or in writing, about material that either you or the students have covered already. So instead of walking into class and providing an overview of what happened in the last class period or reminding students about the larger unit in which this particular class session is embedded, ask them to provide you with that information.

- Before we start, can anyone remind me what we talked about in class on Monday? How about what we were working on last week?
- Before I introduce the third major theory we will explore in the course, what have been the two main theories we have discussed thus far?
- We've seen several experiments in this area already this semester. Can someone remind me of the results we observed?

I should note from personal experience that if you have never tried this before, you might be surprised and disappointed at how difficult students will initially find such retrieval exercises. They will stare at you with jaws agape when you ask them about material you covered the day before yesterday—material you spent many hours preparing with care in your office. Take heart and persist. The more you do it, the better they will get it—and the better they get at it, the more deeply they are learning it. If you wish to formalize this type of activity, you could follow the lead of Annie Blazer: she begins each class with a single student providing a 3–5-minute summary of the previous class, and each student does this at least once per semester (Blazer 2014, p. 344).

Naturally, the same types of questions will work for material that students have read in advance of the class or for any homework problems they have completed. Again, prior to launching a lecture or course activity for the day, ask students to provide you with the highlights of the reading or work they have completed the night before. Students in my classes engage in brief writing exercises along these lines at the start of almost every class. When I started using these exercises, at the beginning of my teaching career, I knew nothing about the power of retrieval practice for learning. I implemented them for a very different reason: to help spark discussion. I had found that just walking into the room and asking students to engage in discussion of complex issues or questions did not work very well; it worked much more effectively if I posed a question, gave them 5 or 10 minutes to write a response, and *then* opened up the floor for discussion. But I also used them as a form of low-level quizzing, just to ensure that students were reading. Every question requires students to do a little bit of remembering and a little bit of thinking. If students have been assigned the first 75 pages of a novel for a class, for example, I might ask them to describe for me the primary qualities or characteristics of the narrator of the story. The word *primary*

requires them to make some judgments about the variety of characteristics they might remember. Over the course of my 15 years of full-time teaching, I have come to recognize that these small writing exercises constitute the best method I have for supporting student learning in my courses—even if, as with most positive teaching experiences I have had, I stumbled upon this strategy through dumb luck or for the wrong reasons. Even though the students groan occasionally about the writing exercises over the course of the (long) semester, they note their value frequently both in conversation with me and in their evaluations of the course.

Brian Rogerson pointed out in his essay that one of the benefits of asking students to complete questions in writing, as opposed to just orally, is that it demands participation from all students. "These assessments," he wrote of his end-of-class questions, "attempt to survey all the students in the class, not just the more vocal ones as occurs when prompting the class for questions" (Rogerson 2003, p. 163). In other words, when you throw out your opening questions orally, you may be concerned that you are providing retrieval practice only for the students who habitually participate in class, thus leaving many other students without this benefit. However, this may not be the case. A memory experiment in which subjects were asked to view a map and to practice retrieval of the map's features *covertly* (i.e., simply by thinking about it and not speaking or writing any answers aloud) still showed boosts to their subsequent ability to reproduce the map from memory. This research suggests that "covert retrieval practice is as good as overt practice in benefitting later retention … both methods produce a robust testing effect" (Pyc, Agarwal, and Roediger 2014, p. 80). Of course, this will work only if you provide the opportunity for covert retrieval, which means that you should ask questions, pause for a few moments to allow everyone to engage in retrieval practice, and then call on the

student who has an answer at the ready. Even the students who don't speak the answer aloud can benefit from opening questions if they have a moment to think.

Closing Questions

Extrapolating from opening questions to closing questions doesn't take much creative thinking, and much of the research on retrieval practice—such as the experiment with those art history lectures—has focused on the effects of asking students questions about material they have just learned. So we know that closing questions are an effective small teaching strategy, and the same principles articulated before also apply here: focus on the key concepts that you want students to take away from the class session, and favor writing over oral questions whenever feasible. If you are using opening activities like prediction (discussed in the next chapter) or retrieval practice from the homework, and you have just one or two key concepts or ideas that you want them to take away from the class, you might consider asking the same question at the beginning and end of the class. If I asked my students at the beginning of class what they see as the primary characteristics of the narrator in the novel they read last night, and then we discussed that question and listed a bunch of characteristics on the board, I might conclude class by asking them to revisit and hone their judgment by writing a few final sentences for me on what they now see as the one most salient characteristic of the narrator. Likewise, if you ask students to make a prediction about course material you are about to present (an activity we will consider in the next chapter), you could conclude the class by asking them to revisit their prediction from the beginning of class, to explain why it was correct or incorrect, and to write down what they have learned from class that day. You can find a number of variations on closing questions for a class in *Classroom*

Assessment Techniques (Angelo & Cross, 1993) and by using that phrase to search for other strategies online.

Two other quick points are worth noting here. First, make sure that closing-question activities are processed in some way. Processing opening class predictions or retrievals will come naturally enough, since you have the whole class period in front of you and they will be sitting and waiting expectantly to find out whether they got it right. This can prove more logistically challenging when you ask them to retrieve information or solve problems or exercise skills at the conclusion of class, and they walk out afterward. You can handle this in a few different ways. If it's a simple enough question you have posed at the end, you can make the exercises the penultimate activity and a brief review of the answer the ultimate activity. If you are using a virtual learning environment or social media sites like Twitter or Facebook as a part of your course, you can post the answers there after class. If neither of these options is available, make sure you address the question from the end of the previous class at the beginning of the next class. As we shall see in the next chapter, wrong answers made on activities like this will not necessarily harm student learning as long as they are not allowed to persist uncorrected. Ensure that this does not happen by finding ways to address their responses as soon as possible after the exercise.

Finally, if you do ask students retrieval-based questions either at the beginning or end of the class, you will have to spend at least the first few classes reminding them not to look in their notebooks or their textbooks for the answers. I promise you that this will be their first inclination. Throw out a question about what you have just taught them or about what you did in class last week, and they will immediately begin flipping through their notebooks to find the answer. You will have to remind them that you are not conducting a scavenger hunt for answers or a race to see who can find the answer most quickly. You are helping them remember

information, and this will benefit them only if they take the time to draw the information from their brains and not their notebooks. If you spend a lot of time reading about experiments in learning and memory, as I have done while preparing and writing this book, you will notice that almost every experiment uses a control condition in which students simply review their notebooks, textbooks, or key concepts in a study guide. In almost every experiment that I have encountered in this research, *this method proves less effective for long-term retention*. In other words, almost anything that students do with learned information or ideas or skills works more effectively than just looking at your notes about it, even doing so multiple times (although activities such as comparing or rewriting one's notes can produce more positive results). You might want to explain to your students the purpose of opening and closing questions and how it will help them learn the material more deeply; then they won't be so baffled when you introduce small teaching activities that require them to close their books and notebooks and ask them to remember something they have learned, either at the opening or closing of class.

Online Retrieval

The challenge with implementing retrieval practice in online environments is that students are typically working away from you, so you cannot control whether or not they have access to the materials they are tasked with remembering. So while you might be asking them to remember something, they could be just searching for the answers in their notebooks, which will not give them that valuable retrieval practice. With that said, still consider Miller's (2014) suggestions for small teaching activities or course design tweaks as ways to offer students in online or hybrid courses the opportunity to engage in retrieval practice, even if you can't ensure total compliance.

Reading Checks Retrieval practice can begin when students first engage with course materials that you have put online. Include retrieval type questions at the end of every page or section's worth of material, and ensure that students can't get to the next section until they take a brief quiz. Miller pointed to a study in which students who read new material and were quizzed on it in this fashion outperformed nonquizzed students on the final exam. She noted a bonus effect demonstrated by the study: "although the frequent quiz breaks kept students more attentive, they did not seem to tip them over into anxiety; students who did the interspersed quizzes actually reported *less* anxiety about the cumulative test" (p. 78).

Frequent Quizzing Create or find as large of a question bank as possible and require students to take online quizzes frequently. If the bank is large enough, you can allow multiple retakes of the quiz, which would help boost memory because each retake will constitute another instance of retrieval practice. (If the bank is not large enough, you can run into problems with cheating.) As the experiment with the art history lectures demonstrated, and as Miller noted as well, "Short-answer questions do produce a moderate advantage over multiple choice" (p. 108). However, as she also noted, "The best quiz is the one that students will actually *do*—so don't let the perfect be the enemy of the good as you work to create more frequent testing opportunities" (p. 108). If multiple-choice quizzes will ease your grading burden and give you time to create more questions, use multiple-choice questions. Setting time limits on the quiz can help ensure that students don't have a wide-open window to search around in their course materials for answers and might encourage more of them to engage in true retrieval practice on your quizzes.

Space Out Due Dates When you are creating the due dates for your online course, space them out so that quizzes and assessments are occurring on a very regular and frequent schedule

(a good practice for face-to-face courses as well, by the way). The more frequently that your students have to check in and offer some demonstration of their learning, the more often you are giving them retrieval practice. Miller recommended setting up "a recurring weekly schedule where each kind of work (discussion, quizzing, homework, any higher-stakes assignments such as major exams or papers) is due on a different day" (p. 109). Such a recommendation will help both with retrieval practice and with interleaving, another key tool for learning.

The Retrieving Syllabus

I'll finish with a simple suggestion for the use of the syllabus to promote retrieval practice. One of the benefits that a syllabus can provide to students is helping them see the overview of the course topics and how they fit together. For this reason I advocate filling out the course schedule section of your syllabus with as much detail as possible. Include phrases or even sentences that describe what will happen in the different units of the course so that students can keep the syllabus as a living document that guides them throughout the semester. If you do this, you can also use it as a small teaching retrieval tool. Require the students to bring their syllabus to class every day, and occasionally use those precious opening and closing minutes of class for a very simple exercise. Have your students pull out their syllabus, and then point them to a previous day's content and ask them to spend a few minutes writing down what they remember about it. You can do this informally, by having them do so in their notebooks, or you could do it in the form of a writing exercise that you collect. You could even do it orally. Point to the date, give them a minute to think, and then collectively ask the class to remind you about what key concepts or skills they took away from that class period or that course unit. Too often, the course syllabus makes an

appearance on the first day of the semester and then remains buried in a folder for the rest of the course, serving only as a list of due dates or assignments to complete. Use your course syllabus as a means to foster retrieval practice through brief, small teaching moments in individual class sessions.

PRINCIPLES

Retrieval practice will help your students retain foundational material, which they are most likely to encounter in introductory or entry-level courses in your field. Hence when you are considering how to incorporate retrieval into your teaching repertoire, look first to the lower-level classes you are teaching. The following principles can help guide you through the use of the models above or through the creation of alternative retrieval exercises tailored to your courses.

Frequency Matters The first and last implication of all of this research on retrieval practice is very straightforward: the more students practice retrieval, the better they learn. Frequency matters. The easiest way to implement frequent practice is through regular quizzing. That should be your default strategy. Give quizzes at least once a week, and don't hesitate to give them every class. But all of that quizzing can mean lots of grading, especially if you are using short-answer questions. If you don't want to rely exclusively on quizzes, mix quizzing with small teaching questions (either orally or in writing) at the opening or close of class. Whatever strategy or mix of strategies you choose, implement them as frequently as possible given all of the other demands on your time.

Align Practice and Assessments Whatever type of memory tasks you will ask of your students on your high-stakes assessments

(such as midterms and exams) should appear in the retrieval practice you use. If you ask students to remember names and dates of key thinkers in your field on your final exam, make sure they are getting practice in remembering those thinkers throughout the semester. If you give multiple-choice final exams, use clicker questions in class to give them practice in multiple-choice retrieval. If you give them essay exams that require some memory mixed in with thinking, give them writing exercises in class in which they have to answer final exam–type questions.

Require Thinking Remember Willingham's axiom that we remember what we think about? Help your students remember by giving them something to think about. Your retrieval practice might sometimes take the form of simple memory exercises—after all, we likely all have certain key facts or basic information that we want students to have mastered. For example, I want students in my British literature survey course to know that Robert Burns is Scottish because his Scottish identity helped influence much of what he wrote. They can't do higher order analysis of a Burns poem on a final exam if they forget that key fact. But rather than asking students to practice remembering his nationality by selecting it from a list, I can ask them short-answer questions that require them to remember that fact and put it to some use: How does the national identity of Robert Burns influence his writing?

SMALL TEACHING QUICK TIPS: RETRIEVING

Memory retrieval works especially well in brief classroom interventions. You can find room for retrieval in almost any class period or learning session, even if it takes only a minute. But my favorite opportunities for retrieval appear in the opening and

closing moments of class, or in the form of regular quizzes or writing exercises.

- Give frequent, low-stakes quizzes (at least weekly) to help your students seal up foundational course content; favor short answers or problem solving whenever possible so that students must process or use what they are retrieving.
- Open class periods or online sessions by asking students to remind you of content covered in previous class sessions; allow students time to reflect for a few moments if you do so orally.
- Close class by asking students to write down the most important concept from that day and one question or confusion that still remains in their minds (i.e., the minute paper).
- Close class by having students take a short quiz or answer written questions about the day's material or solve a problem connected to the day's material.
- Use your syllabus to redirect students to previous course content through quizzes or oral questions and discussion.

CONCLUSION

I have heard college and university teachers express reluctance at the use of regular quizzing because they feel like it infantilizes the students or changes the atmosphere of the classroom from one of shared learning and discussion to one of testing and evaluation. I had those exact same feelings about quizzing when I began my teaching career. I just wanted to engage in interesting discussions with my students about literature and not impede our relationship with heavy-handed tactics like quizzing and testing. Dude.

However, I had too many experiences of having interesting discussions about literature with students who had not done the

reading (but who were very good at faking their way through discussions) and who remembered nothing of what we had discussed at the end of the semester for that perspective to last very long. So I understand any emotional hesitation you might feel at the prospect of regular retrieval practice in your classroom, but remember that such practice helps your students learn foundational knowledge as effectively as anything else we know. Think about retrieval practice as I have been arguing for it here: as an activity that lends itself perfectly to small teaching and therefore doesn't require you to devote huge amounts time or energy to it. If you consider it in that light and push yourself to implement regular quizzing or retrieval practice, you will likely find that your students are grateful for it by the end of the semester. In addition to the memory practice it provides them, it also ensures that they stay on top of the reading or homework, which means they won't find themselves stuck at the end of the semester with lots of catching up to do. As always, you can help them recognize the value of those quizzes by teaching transparently. Tell them what the research says about the value of quizzing and retrieval practice and about your decision to use it. They still might not love taking quizzes during the long slogging weeks of October, but they will recognize their value and reap the rewards on those final assessments in December.