I wrote this book to let everyone in on one of the best-kept secrets in education: Any student can use simple, straightforward strategies to start making As in his or her courses and enjoy a lifetime of deep, effective learning.

From Skeptic to Convert

When I first encountered some of these learning strategies, at LSU's Center for Academic Success (CAS), I was skeptical. The strategies seemed too straightforward and simple to make a difference, and I didn't think students would use them. But after I began to see students who had been making Ds and Fs turn into straight-A students, I became convinced that these simple tools work miracles.

If you find yourself feeling skeptical that these strategies will work, I implore you to use them for just three weeks. What have you got to lose?

My Promise to You

By the time you finish this book you will

- understand why you may not know how to learn;
- have concrete, effective learning strategies to try;
- know how to change your mindset about intelligence and increase your motivation; and
- have everything you need to make As in your courses!

I

MY JOURNEY

I Was Once In Your Shoes

I Get It

Let me say a little bit about why I have so much compassion for students. Confession time: Throughout my undergraduate career, I almost never studied until the night before an exam. I love to tell the following story, which illustrates my cluelessness in full Technicolor. One day, during my senior year at Southern University in Baton Rouge, I was walking down the hall with one of my favorite chemistry professors, Jack Jefferson. Dr. Jefferson asked me a question about a basic chemical reaction, and I breezily replied that I had no idea how to answer his question, feeling absolutely no shame about my ignorance. At that time, I had no learning goals.

Another story: After graduation, I headed to Cornell to pursue my graduate degree in chemistry, and I knew that when I arrived, I would have to take placement exams in general, organic, analytical, and physical chemistry. So I arrived in Ithaca a week early and set myself on a crash memorization course. I passed all my exams and was given a full load of graduate courses. I don't know why it didn't occur to me that if I passed the placement exams the subsequent courses I took would require mastery of all the content I'd just tried to force-feed my brain!

I continued my practice of cramming the night before an exam and began to make lower grades in my courses than I ever had in my life. I decided to visit one of my professors, Mel Goldstein, to discuss my grades. Dr. Goldstein gave weekly homework assignments but made them optional. Of course, I never tried to do them until the night before the test. But at that point, I had nowhere near enough time to figure out the problems, so I would give up and go back to rote memorization. During our chat in his office, Dr. Goldstein told me that he was surprised my grades weren't worse, given that I never did the homework. Then he asked me why I never did it. The question caught me by surprise, so I lied and said that I did the homework but didn't turn it in because it was optional. (I'm pretty sure he knew I wasn't telling the truth.) It had never occurred to me that doing nonrequired homework would help me learn the material and improve my performance on tests! Instead of seeing the relationship between effort and performance, I began to think, "If I can't make As in these courses by doing what I've always done to make As, chemistry must not be what I was meant to do."

Although I was at Cornell on a full Danforth Foundation fellowship, I was still required to teach because Cornell views teaching as crucial to its graduate students' intellectual and professional development. That requirement turned out to be my saving grace. I was given one section of introductory chemistry as a teaching assistant, and I instantly fell in love with teaching. I had never taught before, but very quickly I saw that I was effective. My success with students was addictive because I loved seeing that "aha!" moment on their faces. They would come to me in a fog of confusion, convinced that chemistry would be impossible to learn. But when I helped them understand the logic of the discipline, introduced them to a systematic way to approach the material, and expressed confidence in their intellectual abilities, they suddenly began to understand and instantly became motivated to spend time mastering the material themselves. I found, and still find, student transformation intoxicating. And I am convinced that every learner can personally experience it.

In sum, because I found teaching so exciting, I decided to pursue a master's degree in chemical education and have never looked back. I'm

happy to report that, thanks to the learning strategies I acquired along the way, I never earned a grade lower than A in any of my chemistry or education courses for the rest of my graduate career. And today, I know exactly what I would say to myself in 1970 to earn all As in my Cornell graduate chemistry courses!

Good News

The good news is that anyone can undergo the same transformation that I did. I freely admit that I was clueless. If I changed, you can too. You can learn simple strategies that will boost your grades and make learning more fun than you ever thought it could be.

Questions to Ask Yourself

1. Can you relate to the author's experience? If so, how? If not, why?
2. Do you believe your current academic performance is related more to your ability or the amount of effort you are putting into your courses?
3. Do you believe you can undergo the same change as the author?

2

WHY DON'T ALL STUDENTS ALREADY KNOW HOW TO LEARN?

"What did most of your teachers in high school do the class period before the test?"
"They gave us a review."
"What did they do during the review?"
"They told us what questions were going to be on the test and gave us the answers."

Consider some interesting statistics. The Higher Education Research Institute (HERI) published a study in 2017 that revealed that 56.0% of fall 2016 incoming freshmen reported spending *fewer than 6 hours per week* doing homework in 12th grade (Eagan et al., 2017, p. 47), but 92.5% of survey participants said that they graduated from high school with an A or B average (Eagan et al., 2017, p. 31). These statistics demonstrate that for many students, doing the focused, joyful work of deep learning has not been required for good grades.

Presumably because of their grades, these students are also extremely confident; 72.6% of them believe their academic ability is above average or in the highest 10% among people their age (Eagan et al., 2017, p. 49). So, many of you are not only accustomed to successfully breezing

Figure 2.1. Why Many Students Do Not Know How to Learn

- They did not *need* to learn in order to make As and Bs in high school.
- They believe they are in at least the top half of students their age, unaware that they can become smarter.

Note. Data from HERI support the idea that many students do not know how to learn because they are overconfident and academically successful without much effort (Eagan et al., 2017).

through school but also unaware that horizons of learning and success exist beyond those you have already encountered (Figure 2.1).

Okay, So High School Was Easy. Why Don't Some Students Heed Warnings About What They Need to Do in College?

One struggling math major from rural Louisiana on a full scholarship at LSU explained,

> People told me that college was going to require a lot more of my time and effort, but I didn't believe them because I had heard it before. They said that high school was going to be a lot more difficult than middle school, but it wasn't. And when I went to middle school, they had told me it was going to be much harder than elementary school. But I didn't find that at all.

So this young man, along with the other 72.6% of students who judge themselves to be above average compared to their peers (Eagan et al., 2017), very reasonably did not imagine that the typical warnings about a college workload applied to him.

Students are often told that they need to change their habits and do something different when they go to the next level of education,

whether high school, college, graduate school, or professional school. But that's like saying, "When you go to another planet next month, you've got to breathe differently." It's not your fault that you may not know what to do to be successful in a more challenging academic environment. Thankfully, there's a way to learn how to breathe differently—how to engage in deep, satisfying learning.

Questions to Ask Yourself

1. Discuss how easy or difficult you found homework, papers, quizzes, and exams at your previous level of education (e.g., middle school, high school, college, or beyond). Is the learning more difficult at your current level of education? If so, in what ways?
2. How is your current learning experience different, if at all, from your previous level of education (e.g., middle school, high school, undergrad)?

3

METACOGNITION

What It Is and How It Can Turbocharge Your Learning

"I have tried the suggestions you gave . . . and it was like magic, seriously."

—Matt J., junior, Department of Microbiology at Weber State University, personal communication, September 15, 2014

In this chapter, we investigate the overarching principle that enables students to stop failing their classes and start acing them: metacognition. We also get our first taste of how learning strategies can dramatically improve performance.

First, we learn what metacognition is and how it helped two students increase their exam scores by at least 30 points. Second, I ask you to do a brief exercise that demonstrates the huge difference that learning strategies can make. Finally, we discuss why these strategies make such an impact and enable you to take charge of your own learning.

A Tale of Two Students

Figure 3.1 shows the dramatic improvement of two students after learning about metacognition. Some faculty in my workshops have thought that these students are fictional, but I assure you they are as real as you and I. Have I got your attention?

Figure 3.1. A Tale of Two Students

Exam scores showing rapid and dramatic progress of two LSU students after they learned metacognitive strategies

Travis, third-year psychology student
47, 52, **82, 86**

Dana, first-year physics student
80, 54, **91, 97, 90** (final exam)

Note. Figure 3.1 shows the exam scores of two students before (plain text) and after (bold text) being exposed to metacognitive strategies. Travis received a B in Introductory Psychology, and Dana received an A in General Physics.

Before we learn more about Travis and Dana, let's investigate what metacognition means.

What Is Metacognition?

Metacognition, a term coined by John H. Flavell (1976), is *thinking about your own thinking.*[1] It's like you have a big brain outside of your brain looking at what your brain is doing. Aspects of Flavell's definition of *metacognition* appear in Figure 3.2.

When you use metacognition, you become consciously aware of yourself as a problem solver, which enables you to actively seek solutions to any problems you may encounter, rather than relying on others to tell you what to do or to answer your questions. As you make the transition from being a passive student to being a proactive learner, you will gain the ability to monitor, plan, and control your mental processing. In other words, instead of staggering through a maze, using instinct alone to look for cheese, you will become aware that you need to plot a course and search systematically for cheese, keeping track of what works and what doesn't. Metacognition also gives you the ability to accurately judge how deeply you have learned something, whether you have only a superficial understanding or the ability to widely apply your knowledge. For example, while studying, you might start to ask

Figure 3.2. Metacognition

The ability to:

- think about your own thinking
- be consciously aware of yourself as a problem solver
- monitor, plan, and control your mental processing
- accurately judge your level of learning

Note. Figure 3.2 shows four aspects of John Flavell's (1976) definition of *metacognition.*

yourself, "Am I understanding this material, or just memorizing it?" When you use metacognition, you become tremendously empowered as a learner because you begin to be able to teach yourself.

Metacognition, Schmetacognition, I Just Need to Work Harder

How do I know that you need metacognition, that you aren't already aware of yourself as a problem solver and are simply not working hard enough? I wonder whether the following scenario has ever happened to you. You excitedly turn in an exam, an essay, or a research paper, beaming with pride, knowing that you've done a great job. Then when you get it back, it's covered with red ink with a big "C" at the top, or worse, a "D" or an "F."

When your work is returned to you with a much lower grade than expected, it's understandably difficult for you to process the cognitive dissonance. You believed you were smart and competent. Does this grade mean you are dumb and incapable? Of course it doesn't, but your doubts are already active. You begin withdrawing psychologically; you might sit back farther in the classroom or lecture hall; worse, you might start missing class. Then your performance on the next test is worse than your performance on the first. The downward spiral continues until you've flunked the course or barely passed it.

If this has ever happened to you, then clearly you were not able to accurately judge your own learning. And the discouragement of thwarted expectations *prevented* you from working harder. Moreover, even if in such situations you are able to rally and work harder, doing more of what you already know how to do is not likely to help. You need to learn a different way. When you learn about metacognition and implement metacognitive strategies, your performance will turn around. Let's see how well metacognition worked for Travis and Dana.

Travis, Psychology Student

Travis was a junior I started working with only the night before his third introductory psychology exam. He had made scores of 47 and 52 on the first two exams, and we spoke for about 30 minutes via telephone because Travis's schedule didn't allow time for us to meet in person. Travis called me after his test was returned to say he had made an 82! I was quite surprised because I had thought he would score in the low to mid-70s. I kept my surprise to myself and said, "That's fantastic, Travis! Okay, if you make higher than a"—racking my brain for a stretch score that would probably be just out of reach for him—"than an 85 on the next test, I will take you to lunch." Mind you, at that point in my journey with metacognition, I did not expect Travis to score higher than 85. In fact, I thought that his 82 was a fluke. These days, I know that when students use metacognition, the sky is the limit. Wouldn't you know, Travis called me back about three weeks later and said, "Dr. McGuire, I made an 86 on that test!" I started looking forward to lunch because I wanted to find out exactly how Travis had done so well. During our meal, I asked Travis, "What are you doing to earn these fabulous grades?" And he replied, "I'm just doing that stuff you told me to do." We'll see in chapter 5 exactly which metacognitive strategies made the difference for Travis.

Dana, Physics Student

Dana was a freshman physics major who had come to LSU supported by a prestigious American Physical Society scholarship, but we met for the first time at a Change Your Major workshop. Dana was trying to get out of physics. Even though she'd wanted to be a medical physicist since the beginning of her junior year in high school, she had become demoralized after making an 80 and a 54 on her first two general physics exams. In high school, she had been a straight-A student, so when she saw 54 at the top of an exam paper, she thought, "Okay, I'm outta here."

At the Change Your Major workshop, Dana introduced herself. "Hi, my name is Dana. I was a physics major, but I'm having trouble, so I need to find something else." The counselor replied, "Oh, yeah, I understand. Physics is haaaard. We will find you something you can do."

I raised an eyebrow and chuckled to myself.

As Dana was leaving, I called her aside and asked, "Dana, do you have an hour to meet with me in my office?" She readily agreed, and I said to her, "Dana, I'm not going to try to talk you out of leaving physics, because if you really want to do something else, that's fine with me, but I want you to know that if you leave physics, it's not because you can't do physics. It's because you've chosen to do something else."

So Dana came to my office, and we talked for about an hour. She made a 91 on the next test, a 97 on the one after, and a 90 on the final exam. She received an A in her general physics course and a 4.0 that semester. Even though her next semester involved illness and two hospital stays, Dana still earned a 3.2 GPA. She graduated in 2012 with a 3.8 GPA in physics, and in the summer of 2014 she graduated with a master's degree in medical physics from the world-renowned University of Texas MD Anderson Cancer Center. Metacognition can give students back their hopes and dreams. We'll discover in chapter 5 which metacognitive strategies Dana used to make her grades soar.

You Can Do It, I Promise

Even if you have experienced abject failure, all is not lost. I often share with new students the dramatic successes of previous students like Travis and Dana so that they can see what is possible. I say to them, "I don't care if you made a 2% on the first test. I know that you have the ability to make a 100% on the next test because your score on the first test is not any indication of how smart you are. It's a reflection of your behaviors, the way you prepared for the first test. And I can teach you a way to prepare that's going to help you ace the next test."

An Exercise for You: Count the Vowels

Now you're going to do an exercise I often do in my student and faculty workshops. Even if you've seen it before, take a moment to refamiliarize yourself with it. You'll need a few things to do this exercise:

- Timer or stopwatch (most smartphones have them, but a watch with a second hand will also work)
- A piece of paper to cover the opposing page once you turn over page 15 and start the exercise
- A pen or pencil

Once you've collected these supplies, set your timer for 45 seconds. When you press start, you're going to do three things: (a) turn page 15 over, (b) cover the opposing page with a piece of paper, and (c) count all of the vowels in the text of Figure 3.3 on page 16 until time runs out. Ready, set, go!

Turn the page for Figure 3.3.

Figure 3.3. Count the Vowels

Dollar bill	Cat lives
Dice	Bowling pins
Tricycle	Football team
Four-leaf clover	Dozen eggs
Hand	Unlucky Friday
Six-pack	Valentine's Day
Seven-Up	Quarter hour
Octopus	

After time is up, or whenever you've finished counting the vowels, immediately cover up the text and reveal the opposing page for your next instructions.

How did it go? Now close your eyes and try to recall all of the words and phrases that you just saw. List as many as you can in the blanks.

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Now look at the original list, and write down the number of items you were able to accurately remember here: _____. Divide that number by 15, multiply by 100, and that's your score as a percentage. How did you do? C? D? F?

Typically, when I do this in workshops, the average number of correct responses is 3, or 20%, so most workshop groups start out with a spectacularly failing grade. Let's call it F minus.

Now look at the list in Figure 3.3 again, reading each column from top to bottom, and see if you can figure out the underlying organizing principle. Take no more than 10 to 15 seconds to see if you can work it out. If after 10 to 15 seconds you are still unsure, turn this page, and read the top two lines on page 18 before turning back to this page and finishing the following instructions.

Set your timer again for 45 seconds, and this time, study the list and try to commit all 15 phrases to memory. When time is up, turn the page and list as many items as you can remember.

The list is organized according to number. Dollar bill corresponds to the number 1, dice corresponds to 2, tricycle corresponds to 3, and so forth.

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Again, look at the original list, and write down the number of items you were able to accurately remember here: _____. Divide that number by 15, multiply by 100, and that's your new score as a percentage. How did you do this time? A? B? C?

Typically, in workshops, the average number of correct responses for this part of the exercise is 12, or 80%, with many participants achieving 100%! Just as they can go from 20% to 100%, so can you.

Count the Vowels: What Made the Difference?

Obviously, between our first and second attempts to recall the list, we had not become any smarter. So what made the difference? Two things. Before you read further, try to figure out the two differences that made better performance possible.

First, we were aware of our goal. We knew that we needed to memorize the list instead of count the vowels. How does that pertain to your classes? Faculty will often give assignments such as, "Read chapter 1." Many students unknowingly interpret that assignment as, "I should skim chapter 1 while scrolling through Facebook, getting caught up on Instagram, checking out the newest Snapchat filter, and WhatsApping my bestie."

When I was in college and my professors gave me problem sets, I genuinely believed that my objective was to turn in correct solutions for all of the problems. Not until I began teaching did I realize that my college professors were actually more interested in how I solved the problems than in my final answers. They wanted me to understand the *concepts* relevant to each problem and to be able to apply those concepts to new contexts. Just as I totally missed that important point, you may be missing it too.

A brief, related word about practice tests: When professors give practice tests, students often think their goal should be to answer those specific questions. So they spend time memorizing specific information or problem-solving procedures required only for questions on the practice test. Well-intentioned instructors often give the practice tests without the answers, explaining to students that they should come talk to the instructor if they have questions. To their credit, these instructors are sincerely trying to prevent students from sidestepping meaningful learning. Unfortunately, though, the students usually just take the practice tests to the campus learning center or tutorial center and ask the professionals there to show them exactly how to answer the questions or do the problems.

The take-home message here is that many students can be very goal oriented and so focused on grades that they unintentionally avoid real learning. To correct for this tendency, you must give yourself precise goals and tasks, even if your instructor does not. You can use metacognition to take a vague instruction like, "Read chapter 5" and break it down into parts like, "Apply reading strategy to each section of chapter 5; Review notes; Give mini-lecture to empty chairs or best friend; Create practice quiz."

What was the second difference between our two attempts to remember the phrases in the Count the Vowels exercise? We had a very good system for learning the information. Notice the two aspects of that statement: We had not just a system—a way to recognize how the information was organized—but a *very good* system. What made it very good? We related the information to something very familiar to us—in this case, numbers. It is a basic learning principle that whenever the brain is trying to absorb something new, it tries to relate new information to something it already knows (Gregory & Parry, 2006).

From Finding Fault to Accepting Responsibility

When students learn about metacognition, gain learning strategies, and become active learners, it empowers them tremendously because they begin to understand that thinking and learning are processes that *they* can control.

My colleagues (Zhao, Wardeska, McGuire, & Cook, 2014) asked a group of students who had not learned about metacognition to give reasons for their lackluster performance on their first exam in a chemistry course. Take a look at their answers:

> I studied but blanked out during [the] exam. I thought I knew it but I didn't. It made perfect sense on [the] board [during the lecture], but not when I did it [in the exam]. I couldn't figure out why I didn't know it. (p. 51)

> There were not examples of problems like the ones on the test. I have never seen these problems before. [There were] a few problems [that] we never introduced in class. (p. 51)

> You [the instructor] went through materials fast in lecture, and people answered [questions] quickly [so] I didn't follow. (p. 51)

Do these reasons look familiar to you? These students thought their poor performance was the professor's fault, their classmates' fault, or their brain's fault.

Now take a look at some student observations about performance in the course after learning about metacognition and metacognitive learning strategies. Again, these responses are taken from Zhao and colleagues (2014).

> I have continued to look at the effective learning strategies you introduced to the class last week. I have been going to group tutoring sessions (offered from the learning center on campus) and they helped tremendously. (p. 53)

> I have taken a new approach to studying by using some of your suggestions and it does seem to be helping. By previewing the chapter before lecture and studying the notes online, I better understand the material as you go over it. (p. 53)

> Thank you for setting aside our class time for this, because I feel that it was really informative and helpful. I identified a few problems with my own study methods, and have since made some changes as you suggested. (p. 53)

Do you see the difference in these responses? The language now focuses on actions the students themselves are taking to improve their performance. Learning about metacognition has helped them to stop seeing themselves as victims and to take responsibility.

Bloom's Taxonomy as an Introduction to Metacognition

So what's the best way to learn about metacognition? Bloom's Taxonomy is an extremely efficient and effective way to help you take metacognitive control of your own learning. Chapter 4 presents a particular method for introducing Bloom's Taxonomy that I have been developing and refining since 2001. I hope it will blow your mind.

Questions to Ask Yourself

1. Describe metacognition in your own words.
2. Do you believe that an early failing grade means a student is not capable of making an A in a course? Why or why not?
3. What lessons did you take away from the Count the Vowels exercise?

Note

1. "'Metacognition' refers to one's knowledge concerning one's own cognitive processes and products or anything related to them, e.g., the learning-relevant properties of information or data" (Flavell, 1976, p. 232).

4

THE POWER OF BLOOM'S TAXONOMY AND THE STUDY CYCLE

"I had never heard of Bloom's Taxonomy and now that you have introduced me to it, I can see that I have been operating in the lower levels of the hierarchy and wondering why I've been struggling! . . . Reflecting upon where in the hierarchy I have been operating, I now understand that there are higher levels and ways of learning, and it motivated me SO MUCH to ascend the levels of higher and deeper learning!"

—David H., third-year student at Westmont College, Santa Barbara, California, personal communication, December 21, 2016

In this chapter, we unleash the power of Bloom's Taxonomy, often shortened to just Bloom's. Bloom's is a hierarchy of learning levels[1] that ascends from very shallow to very deep learning, from rote memorization to the highest levels of understanding and application. We will walk through a four-step formula for learning and absorbing Bloom's. Then we will discuss how to reach higher levels of learning using the study cycle and intense study sessions.

Learning Bloom's Taxonomy: A Four-Step Winning Formula

When I teach Bloom's Taxonomy to students, either in an individual consultation or to a group, I follow a four-step procedure that I have

Figure 4.1. Learning Bloom's Taxonomy: A Four-Step Process

1. What's the difference between studying and learning?

2. Would you study harder to make an A on a test or teach the material to the class?

3. Bloom's Taxonomy
Read about each level of the hierarchy and then apply Bloom's to an example like Goldilocks and the Three Bears (see p. 32).

4. At what level of Bloom's have you *been* operating? At what level do you *need* to be operating now?

been developing and refining since 2001 (see Figure 4.1). I find that this process leads students through several epiphanies, which leave them optimally motivated to use key learning strategies (see chapter 5) when they leave my presence.

Steps one and two involve reflection questions. First I ask, "What is the difference between studying and learning?" and then I ask, "For which task would you work harder: to make an A on a test or to teach the material to the class?" Step three is a presentation and explanation of Bloom's, whereas step four asks students to assess where they currently are in the hierarchy and where they need to be.

Studying Versus Learning

I begin the process outlined in Figure 4.1 by asking students to articulate the difference between studying and learning. Take a minute to think of your own answer and write it in the space provided.

What is the difference between studying and learning?

Here are some answers I've heard over the years:

- Studying is memorizing information for the exam; learning is when I understand it and can apply it.
- Studying is short term; learning is long term.
- Studying is like being force-fed a plate of gruel; learning is like being set in front of a gourmet table where you get to choose the delicacies you want to eat.
- Studying is what I do the night before the test to make an A; learning is what I do if I know I'm going to have to use that material later on. (My dear colleague from LSU, Pam Ball, often jokes to students, "That way of studying is like renting the information for the test and falling behind on your payments. Right after the test, the information is repossessed!" [personal communication, October 23, 2001])

A first-year dental school student described the difference this way: "Studying is focusing on the 'whats,' but learning is focusing on the 'hows,' 'whys,' and 'what ifs.'" I am particularly fond of this last response. The student who gave it went on to elaborate, "I find that when I focus on the 'whats,' if I forget them I can't re-create the information. But when I focus on the 'hows,' 'whys,' and 'what ifs,' even if I forget the 'whats,' I can re-create them."

I often hear from high school students, "Studying is when I go over what I've already learned." The first time I encountered this idea, I couldn't make sense of it. So I asked, "When did you learn what you are going to study?" The students responded, "In class." It took a few seconds, but then the lightbulb went on. I realized for the first time that some students believe they are actually *learning* information in class and only need to "go over it" in order to do well on exams. Suddenly I understood why so many students wait until the night or two before the test to begin studying. They genuinely believe they have already learned the material in class! Steps three and four will lead those students to a more accurate understanding of the learning process.

After hearing students articulate the difference between studying and learning, I ask them, "Up to this point, have you been operating

more in *study* mode or in *learn* mode?" Take a minute now to decide which mode you have been in, and circle one of the two options provided. Then look at the next page to see how most other students have responded.

STUDY MODE LEARN MODE

The practically unanimous response to this reflection is "study mode." In fact, before I pose the question, most students don't realize there is another mode available. I explain that they are not alone, that most students begin in "study mode," and that I'm going to show them how to switch to "learn mode" and stay there.

Learning It Well Enough to Teach It

Now that we've discussed the difference between studying and learning, I have a second question for you. For which of the following tasks would you work harder: to make an A on a test or to teach the material to the class? Take a second right now and choose one of the options provided. Then see the following page to find out how most students answer.

I WOULD WORK HARDER TO MAKE AN A ON A TEST

I WOULD WORK HARDER TO TEACH THE TEST MATERIAL TO MY CLASS

Although some students do choose the first option, most choose the second. When I ask them why they would work harder to teach the material, they say:

> Well, I have to really know it if I have to teach it!
>
> If I'm going to teach it, I have to think of questions I might be asked and make sure I can answer them. I don't want to look stupid in front of the class.
>
> I want to make sure everybody understands and is prepared for the test, so I need to figure out how to explain the information in more than one way.

Here's a fourth question: Until now, have you been in *make-an-A* mode or in *teach-the-material* mode? As before, choose the answer that best applies to you. Then look at the following page to find out how you compare with your fellow students.

MAKE-AN-A MODE TEACH-THE-MATERIAL MODE

You might not be surprised to learn that virtually everyone admits to being in the first mode. But guess what? You don't need to be an instructor or have your own class to be in "teach-the-material" mode. If you have empty chairs in your room, or stuffed animals, or a coat rack, that's all you need. You can also work with friends or teach the material to family members or pets.

Let's talk about why explaining the information to someone else (real or imagined) works so well. Have you ever found yourself explaining something you thought you totally understood only to discover, in the midst of your explanation, that you were still confused about some part of it? If you hadn't been explaining the information to someone else, then when do you think you would have realized you didn't completely understand the material? When I pose this question to groups of students, they usually respond, in unison, "On the test!" Immediately they see that they need to get out of "make-an-A" mode and into "teach-the-material" mode. In fact, this difference forms the basis of one of the most important learning strategies presented in chapter 5.

Students also report that preparing to teach the material works so well as a learning strategy because they anticipate the *questions* they might be asked. In other words, students aiming to teach the material automatically consider a topic from multiple perspectives because they are actively searching for any confusion that might arise for their "students" instead of reacting to only the biggest, most urgent gaps in their own understanding.

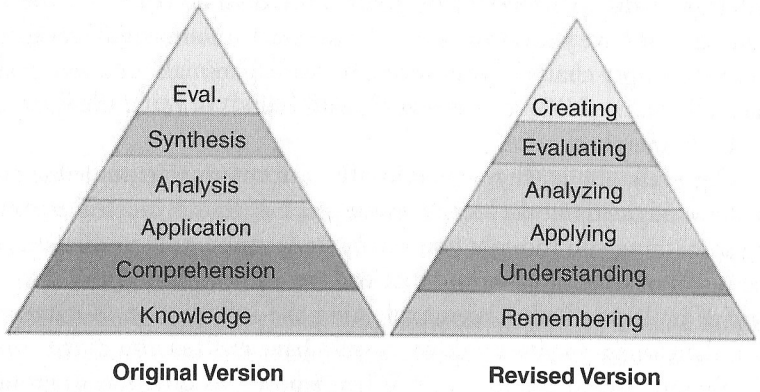
Now that we've completed steps one and two, we are ready to undertake step three, an examination of Bloom's Taxonomy.

Bloom's Taxonomy, Up Close and Personal

Figure 4.2 shows two versions of Bloom's: the original version (Bloom, Englehart, Furst, Hill, & Krathwohl, 1956) and an updated version created by one of the original authors, David Krathwohl, and one of Bloom's students, Lorin Anderson (Anderson et al., 2001).

The original hierarchy of levels (Figure 4.2, left image) ascends from rote memorization (Knowledge) to Comprehension, Application, Analysis, Synthesis, and finally Evaluation. In the revised hierarchy (Figure 4.2,

Figure 4.2. Two Versions of Bloom's Taxonomy: Original and Revised



Note. Figure 4.2 shows two versions of Bloom's Taxonomy: the original version published by Benjamin Bloom and colleagues (1956) and the revised version by a team of his graduate students and their colleagues (Anderson et al., 2001). Adapted with permission from "Bloom's Taxonomy," by R. Overbaugh and L. Schultz, n.d. Retrieved from www.odu.edu/educ/roverbau/Bloom/blooms_taxonomy.htm

right image), the names of the levels have been changed to appear more active and process oriented. Moreover, the top two levels have been reversed. The new taxonomy proceeds from Remembering to Understanding, Applying, Analyzing, Evaluating, and ultimately Creating.

It makes absolutely no difference which form of Bloom's you use, as long as you understand that there are differences between memorizing information, understanding something well enough to put it in your own words, and applying it so that you can answer questions you've never seen before. Bloom's is helpful for students at any level. In fact, after learning about Bloom's, most of my students say, "I wish I had known about Bloom's in high school."

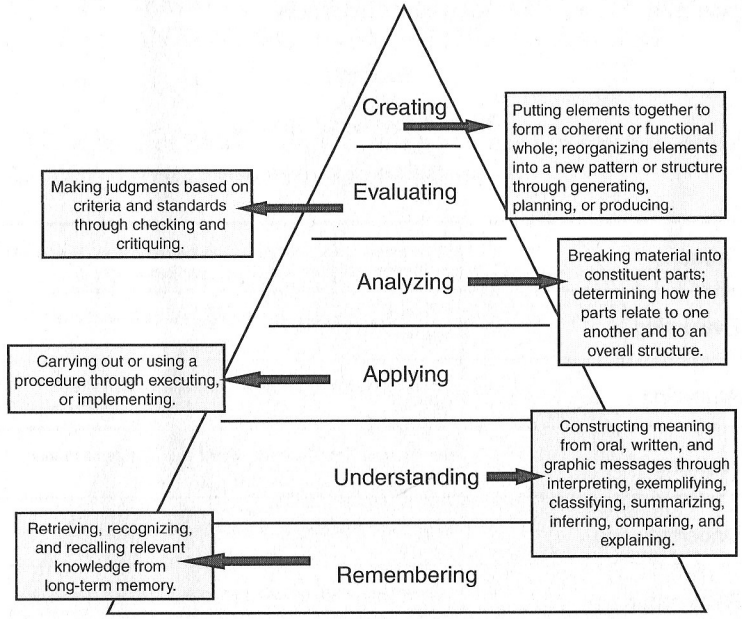
Bloom's in Layman's Terms

Using the new hierarchy, I often explain the six levels as follows: If you're at Remembering, then you have memorized verbatim definitions or formulas, and you could not put that information into your own words. If you're at Understanding, then you can paraphrase the material. You

could explain it to your 7-year-old nephew or your 70-year-old grandmother by creating analogies and examples that apply to their lives. If you're at Applying, then you could use the information you've learned to solve problems you've never seen before. If you're at Analyzing, you can take any concept you've learned and break it down into its component concepts. So if I asked you to give me a minilecture on empirical formulas, you could talk to me about the historical origins of empirical formulas, how to calculate them from percent composition data or CO_2 data, and how they differ from molecular formulas. If you're at Evaluating, you can look at two different processes—proposed by others—and determine which is likelier to be correct, efficient, or desirable. If you're at Creating, you could come up with your own ideas about solving different kinds of problems or designing different processes to accomplish the same goal.

Figure 4.3 shows the revised taxonomy with definitions for each level.

Figure 4.3. Bloom's Taxonomy



Note. This version of the revised Bloom's Taxonomy features definitions for each level. Adapted from "Image of Revised Versions of Bloom's Taxonomy Featuring Definitions," by R. Overbaugh, n.d. Definitions in boxes are taken from Anderson and colleagues (2001).

More Bloom's: "Goldilocks and the Three Bears"

Let's see how we can apply Bloom's to a familiar childhood story, "Goldilocks and the Three Bears" (see Figure 4.4). You could say that you have mastered Remembering if you can recall all of the things that Goldilocks used at the bears' home. If you can give the reason that Goldilocks preferred Baby Bear's chair, bed, or porridge, then you have mastered Understanding. Next, if you can reasonably predict what items Goldilocks would use when visiting another home, then you have reached the level of Applying. You have mastered Analyzing if you can think critically about the context of the story and call into question particular assumptions; for example, is it plausible that bears could eat porridge out of bowls? You have mastered Evaluating if you can generate reasons that Goldilocks's behavior might be considered justifiable by some and unconscionable by others. Finally, you have scaled the entire hierarchy and mastered Creating

Figure 4.4. Bloom's Taxonomy and Goldilocks

Example

~ Bloom's Levels of Learning ~

Applied to "Goldilocks and the Three Bears"

Creating	Write a story about "Goldilocks and the Three Fish". How would it differ from "Goldilocks and the Three Bears"?
Evaluating	Judge whether Goldilocks was good or bad. Defend your opinion.
Analyzing	Compare this story to reality. What events could not really happen?
Applying	Demonstrate what Goldilocks would use if she came to your house.
Understanding	Explain why Goldilocks liked Baby Bear's chair the best.
Remembering	List the items used by Goldilocks while she was in the Bears' house.

Note. Figure 4.4 applies Bloom's Taxonomy to "Goldilocks and the Three Bears" in a way that may be helpful for students. Adapted from *Practicing College Learning Strategies,* 6th ed., by C. Hopper, 2013.

if you can write your own story starring a character named Goldilocks but featuring very different themes and values—perhaps "Goldilocks and the Three Professors."

When you have a solid understanding of Bloom's, you can become an engaged, active learner.

Leveling Up

Now answer the following questions by circling one of the levels of Bloom's, and then turn the page to see how your answers compare to other students'.

Up to this point in your academic life, at what level of Bloom's have you been operating?

REMEMBERING UNDERSTANDING APPLYING
ANALYZING EVALUATING CREATING

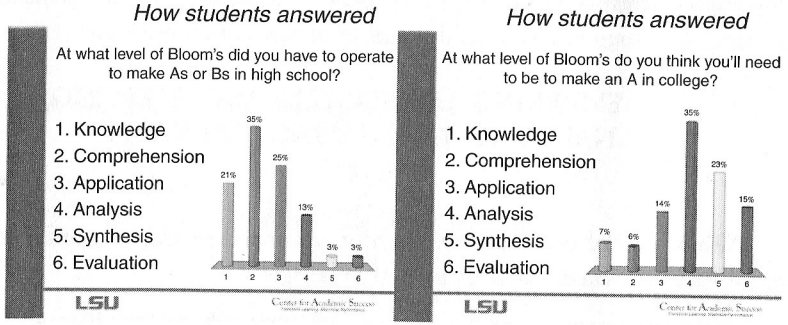
What level of Bloom's do you think you need to reach in order to make As in the classes you're currently taking?

REMEMBERING UNDERSTANDING APPLYING
ANALYZING EVALUATING CREATING

Most of your peers say that they have done very well in school at only the first or second level of Bloom's, Remembering or Understanding. But they recognize that in order to meet more intense academic challenges, they need to ascend to level four or above, Analyzing, Evaluating, or Creating.

Figure 4.5 depicts this phenomenon with two bar charts. In 2013, I taught learning strategies to a group of 250 general chemistry students, and after explaining Bloom's, I asked them the two questions on the previous page. Figure 4.5 shows the distribution of their answers. You can see that these two simple questions open students' eyes to what is required of them.

Figure 4.5. Bloom's Taxonomy in High School and College



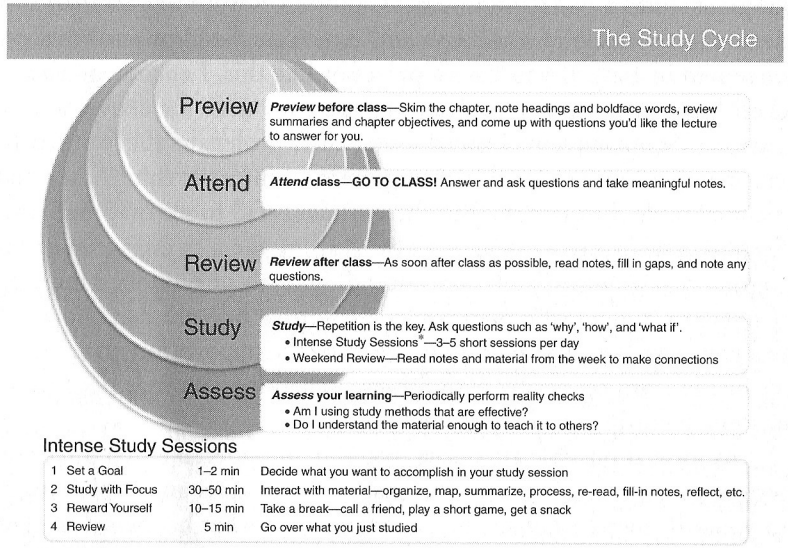
Note. Figure 4.5 demonstrates that, after learning about Bloom's Taxonomy, most students recognize that college courses will require them to operate at a higher level of learning than high school classes do. The categories are based on the original version of Bloom's Taxonomy (Bloom et al., 1956).

Ascending the Levels of Bloom's Taxonomy: Use the Study Cycle With Intense Study Sessions

Okay, so how do students go about pursuing deep learning goals and ascending the levels of Bloom's? They use the metacognitive strategies presented in chapter 5, all under the umbrella of the study cycle (Figure 4.6). The study cycle consists of five steps:

1. Preview
2. Attend class
3. Review
4. Do intense study sessions
5. Assess

Figure 4.6. The Study Cycle



Note. Figure 4.6 presents the study cycle given to students at LSU's CAS. The cycle is based on F. L. Christ's (1997) Learning Cycle. © 2010 Louisiana State University, Center for Academic Success. Used with permission. This work is reproduced and distributed with the permission of Louisiana State University. No other use is permitted without the express prior written permission of Louisiana State University. Contact cas@lsu.edu for permission.

The first step, preview reading, lays the foundation for what you will encounter in class. By previewing, you're making sure that your brain sees the big picture and understands how the concepts you're about to learn fit together. Previewing will be more fully explained in chapter 5. The next step in the cycle is to go to class. Even though missing class may not have been a big deal in high school and though your professors may post lecture notes online, it is imperative that you go

to class in college. College lectures are very different from high school classes, and a plethora of information will be presented in class that will not appear in the condensed, distilled lecture notes. Moreover, class time represents a golden opportunity to ask crucial questions. Only by attending class will you be able to keep up with your courses.

Here it may be worth noting that some professors have decided that instead of lecturing, they prefer a more active classroom requiring frequent student participation. These professors want to give their students the opportunity to *discover* and *experience* the ideas and concepts presented in class. If you have a professor like this, I encourage you to cherish the opportunity you have to use class time for active, lasting learning. Some students instead resent their professors for "not teaching them" or, worse, for distracting them from other things they had planned to do during class. But these students fail to see that their professor is actually saving them time by allowing them to engage in metacognition and immediately start ascending levels of Bloom's. However, if you are a student who prefers a lecture format because that's how you feel you learn best, try to jump in and take the opportunity to see what it's like to learn on the fly with others, something you may need to do at some point in your professional life.

As soon as possible after class, you should undertake step three and review your notes, recalling what happened in class and explaining it to yourself, thereby enhancing the memory of what happened in class (Medina, 2008). Have you ever seen a movie more than once? Did you notice that the second time you saw it, you noticed things that you didn't even know were there the first time? Reviewing is like watching the movie the second time. Your brain will see things that it didn't before. As you review, actively recall the instructor's voice, address any gaps in your notes, elaborate on details you had no time to write down during the lecture, and take note of any issues that need clarifying. If you want to know more about the cognitive science of memory and learning, *Brain Rules* (Medina, 2008) and *Make It Stick* (Brown, Roediger, & McDaniel, 2014) are great places to start.

Previewing and reviewing are powerful and efficient ways to support learning. Some students just get to class 10 minutes early and do their previewing immediately before the lecture. And if there's no class

following the lecture, they just review for 10 minutes after lecture. Lickety-split.

During the fourth step in the cycle, students use the framework of intense study sessions (see bottom of Figure 4.6). These sessions are effective because they enable students to break their work down into manageable chunks. Intense study sessions can be as short as 15 to 20 minutes (appropriate for students with attention-deficit/hyperactivity disorder) or as long as 75 to 90 minutes, though 50 to 60 minutes is a typical duration. An intense study session has four parts:

1. Set specific goals.
2. Do active learning tasks.
3. Take a break/have a reward.
4. Review.

Use the first few minutes of an intense study session to set a manageable number of achievable goals. Then engage in learning activities that have been proven to work, activities we will thoroughly explore in the next chapter. After doing the heavy lifting for 30 to 50 minutes, but not longer than a period for which you can maintain good focus, take a 10- to 15-minute break. The break is crucial for restoring energy and motivation, and for allowing the information you've just absorbed time to "sink in." In fact, Doyle and Zakrajsek (2013) encourage students to "engage in periods of wakeful rest, including daydreaming and thinking, following new learning" (p. 24), citing research from Dewar, Alber, Butler, Cowan, and Della Sala (2012) that suggests rest following learning is crucial for memory formation. Doyle and Zakrajsek also suggest napping for 20 to 30 minutes as an effective way to consolidate memories. Wouldn't you know it, a short nap fits right in with step 3 of a 60- to 90-minute study cycle. Whether you take your break asleep or awake, when you come back refreshed, take 5 minutes to review what you've just studied. During this final step in the study cycle, after intense study sessions, assess how well you have learned the material you studied by engaging in self-evaluation. Determine whether you need to tweak your learning strategies and adjust them accordingly. For example, perhaps flashcards did not quite do the trick, so you might decide to try concept mapping in subsequent intense study sessions.

If you do two or three sessions during the day between classes, and another couple of sessions at night, you will have studied 4 to 5 hours that day without breaking a sweat. In fact, when asked to specify what changes he'd made to turn around his academic performance, one student said, "I use that Power Hour thing." (Intense study session. Power Hour. Tomato, tomahto.)

I want to reiterate that short, intense study sessions, even as short as 10 minutes, are great for students who cannot imagine sitting down to study for an entire hour. During a 10-minute session, set goals in the first minute, work for 8 minutes, and take a minute to review. I know of students who do 10 to 20 of these short sessions per day, at a relaxed pace throughout the day, with great success.

Drum Roll, Please: 10 Metacognitive Strategies

In the next chapter, we will discuss specific active learning tasks that you can use to ace your courses.

Questions to Ask Yourself

1. What is the study cycle and what is it used for?
2. List the steps of the study cycle and why each step is important.
3. What is an intense study session and what is it used for?
4. What duration for an intense study session do you think might work best for you? Why?
5. List all of the courses or classes you are taking now, and next to each, write down the level of Bloom's you think you need to reach in order to do well in that particular course or class.

Note

1. Many people have expressed to me that they do not think of Bloom's Taxonomy as a hierarchy and believe it is a mistake to represent it as a pyramid. They argue that levels do not proceed in order and instead are constantly

intertwining. As support for their argument, they note that a student can create something without knowing basic foundational information. I do think that faction has a valid point. However, I like presenting Bloom's to students in hierarchy form because I want them to understand that they will likely not be able to *apply* concepts that they do not *understand* if they have not *memorized* particular facts. I like to illustrate this point with a story. Our older daughter is a professor in the allergy and immunology section of the department of pediatrics at Baylor College of Medicine. When she joined the faculty, her responsibilities included accompanying the residents on their rounds. One day, she asked a resident if it is advisable to prescribe pseudoepinephrine-based drugs like Sudafed or Actifed to pregnant women. She expected him to think critically about her question and answer accordingly. Instead, he whipped out his smartphone and looked it up in the *Physicians' Desk Reference*. He correctly answered, "No," but when she asked him why, he had no clue. She explained to the residents that drugs that constrict blood vessels are never a good idea for pregnant women. My point is that many students nowadays think that they do not need to know anything because they can just look up everything on the Internet. I try to help them see that no one can solve problems using information he or she has only just read. We can solve problems and do critical thinking only with information already stored in our brains. The pyramidal form of Bloom's handily makes this point.

5

METACOGNITIVE LEARNING STRATEGIES AT WORK

"Well, it's official. Doing my homework problems as if they were quiz questions, after studying my notes and practicing teaching the material works really well for me. Just wanted to share with you my grade on the second Chem 1421 exam: 95, A!"

—Sydnie L., first-year honors chemistry student at LSU, personal communication, October 17, 2013

In this chapter, I lay out the top 10 learning strategies that make possible the dramatic results you've heard about so far.

Ten Strategies to Optimize Your Academic Performance

The rest of this chapter lists and elucidates 10 metacognitive strategies, the first three of which are powerful reading strategies I have found particularly useful to teach my students:

1. Previewing
2. Preparing for active reading
3. Paraphrasing

4. Reading actively
5. Using the textbook even if it is not required
6. Going to class and taking notes by hand
7. Doing homework *without* using solved examples as a guide
8. Teaching material to a real or imagined audience
9. Working in pairs or groups
10. Creating practice exams

Keep in mind that you do not have to implement all of these strategies to see improvement in your grades or enjoy deeper understanding of the subjects you are studying. You can pick and choose what works for you, though there are some strategies that are so effective—namely, the reading and homework strategies—that everyone should use them. Finally, I want to acknowledge that you may already be using powerful and effective strategies other than the 10 presented here.

My Introduction to the Reading Strategies

Remember Travis, the psychology student who flunked his first two tests (Figure 3.1)? During my first conversation with Travis, I asked him what he thought his problem was. He began to tell me about all of the reading assignments he was responsible for completing. He told me, "I do the reading, but when I get to the test I don't really remember it. I know that I've read it, but I don't remember it when it counts, so I know I'm not really getting a lot out of my reading."

Long before I met with Travis, I had heard that same refrain from so very many students: undergraduates, graduate students, business, law, medical students, you name it. I didn't really know what to tell these students. I might have given vague advice like, "Slow down when you're reading," or "Answer the questions in the text." So in 2005, when I learned about a four-week workshop on reading strategies given by the Institute of Reading Development, I decided to see if I could learn some strategies to help my students.

Incidentally, because the institute runs this workshop all over the country, my first-grade grandson was attending that same workshop

in his hometown! I often joke that when I first learned that there were graduate degrees in "college reading," I thought it was an oxymoron because I just *knew* that I had learned to read in first grade. But what I learned in that workshop I definitely had not been taught in first grade or any grade after that. These strategies turned Travis's performance around (Figure 3.1), and they can do the same for you.

What's So Hard About Reading?

What happens when you read? Well, if you're like most people, you begin reading and all is well until your mind starts to wander. But your brain doesn't immediately realize that it is no longer paying attention because your eyes are still tracking the text. Plus, if you're a subvocalizer, like I am, you can hear the words as you read, even though you're thinking about something entirely unrelated. It's not until you get farther down the page that you realize, "Oh, I stopped paying attention ages ago and have no idea what I'm reading."

At this point, what do you usually do? If you're like most people, you go back and reread the text from the beginning, but this time around, you concentrate harder to keep yourself from running off the rails. And you will probably get a little farther, but only a little, before the same thing happens again. And then what do you do? Start over. Again. You can see where this is going.

But you can prevent this vicious cycle by engaging in particular practices before you start to read. The following three reading strategies should be used in concert for the biggest impact. Think of them as one big active reading strategy with three steps.

Active Reading, Step One: Previewing

For maximally engaged reading, you must give yourself a preview of what you're about to read **(strategy #1)**. We know the brain is much more efficient at learning when it has a big picture and then acquires individual details to fill in that big picture (e.g., Klingner & Vaughn, 1999). How do you give it that big picture? Look at the section headings, bold print, italicized words, and any charts or graphs in the

portion of reading you have chosen. If you are reading a novel, then read the first line of every paragraph.

To experience the power of previewing, let's do an exercise (Bransford, 1979). You're going to read the short passage that follows, and I'm going to ask you three questions about it. You can jot your answers down in the space provided. The first question will be, "What specific task is this passage about?" and the second and third questions will be asked after you've finished the reading.

> The procedure is actually quite simple. First you arrange things into different groups. Of course one pile may be sufficient depending on how much there is to do. If you have to go somewhere else due to lack of facilities that is the next step; otherwise, you are pretty well set. It is important not to overdo things. That is, it is better to do too few things at once than too many. In the short run this may not seem important but complications can easily arise. A mistake can be expensive as well. At first, the whole procedure will seem complicated. Soon, however, it will become just another facet of life. It is difficult to foresee any end to the necessity for this task in the immediate future, but, then, one can never tell. After the procedure is completed, one arranges the materials into different groups again. Then they can be put into their appropriate places. Eventually they will be used once more, and the whole cycle will then have to be repeated. However, that is a part of life. (pp. 134–135)

What specific task is this passage about?

Where can you go if you lack the facilities?

How can a mistake be expensive?

Give yourself a minute to think about it before moving on.

If you are stumped, you're not alone. I have never heard a correct answer to the first question during an individual consultation, and in my student and faculty workshops, occasionally 2 or 3 people out of 50 figure out the answer.

Now I will reveal to you that this passage is about doing laundry. Reread the passage and try to answer the questions, now that you have an idea of the subject matter.

Did the passage sound different to you? Were you able to engage with it more actively and derive much more meaning from its sentences? Do the questions now seem trivial rather than mystifying?

Knowing that the passage is about laundry is the equivalent of previewing and seeing "Laundry" as a bold heading. If you have some idea of what you are about to read, your brain can recognize and process much more information than if you just dive headlong into your reading.

Have you ever had the experience that you go to class and the information is going from the PowerPoint slides onto your notes without passing through your brain? That is a wasted hour. But I want you to make every hour count. If you've done the previewing, you have the skeleton you need so that during lecture you can put all the necessary meat on those bones. I have been gratified to hear in many conversations with individual students, "Wow, lecture makes so much more sense when I preview."

Active Reading, Step Two: Previewing on Steroids. Come Up With Questions the Reading Can Answer

Once you've looked at the bold and italicized text as well as charts and graphs, you still need to do one more thing before you begin to read. You need to give yourself a *reason* to read. Just like no four-year-old likes hearing, "You have to," neither does your brain. So you need to come up with questions that you want the reading to answer for you (**strategy #2**). Then you've tapped into your genuine curiosity and are much more motivated to read.

Let's say I'm reading a chapter in a general chemistry textbook about acids and bases. The terms *strong acid* and *weak acid* would

probably be in a distinctive font. My question might be, "What is the difference between strong acids and weak acids?" So now I've given myself motivation to read the text.

Or if I were going to read a chapter on buffer solutions, I might see "weak acids" in bold or italicized print. I might ask myself, "What do weak acids have to do with buffers? Are they different from strong acids?" When I start to read, my mind will be looking for the answers, and I will be able to stay focused longer.

Active Reading, Step Three: Paraphrasing the Correct Way

Now that you've previewed the text, and you've generated interesting questions that you hope the text will answer, you're ready to begin reading. Here is the crucial instruction: When you start, read only one paragraph at a time. Just read the first paragraph. Stop. Put the information in that first paragraph in your own words.

Now move on to the second paragraph and do the same thing, except this time when you paraphrase, fold in the information that was in the first paragraph. After you read the third paragraph, your paraphrase should contain all of the information from the beginning of the passage—and so on and so forth, ad infinitum (**strategy #3**). This way, you break a big task down into manageable chunks, yet the information from the chunks is integrated into a complete understanding of the topic at hand.

Does that process sound like it will take a very long time? Guess what? Every single one of my students who has discussed with me their use of this method reports that it takes less time to finish their reading assignments with this system than with the one they had been using. Graduate students in particular tell me that it helps them move briskly through research papers. When I ask my students, "Why do you think it works?" they say, "I'm not rereading or having a bunch of false starts." So although they are reading more slowly, they are only moving *forward*, so the end comes much more quickly and with much deeper understanding. The tortoise and the hare. Slow and steady wins the race.

Flashcards and Maps and Outlines, Oh My!

The previous three reading strategies should often be supplemented by activities like highlighting; taking notes; jotting down questions; and creating flashcards, concept or mind maps, and outlines (**strategy #4**). These tasks can be undertaken while reading the textbook, supplemental reading, or class notes. Appendix F provides descriptions of some of the most common and popular study tools used by students today.

I was surprised to learn from speaking with groups of students over the years that even as students are actively reading their textbooks many of them skip over example problems or assessment questions that appear in the text. However, it's important to always do these kinds of problems and questions in order to maximize one's comprehension.

Joshua, an engineering major who took general chemistry in his freshman year, learned to love active reading. This student came to me with a D average in general chemistry because he had scored 68, 50, and 50 on the first three tests. After working with me, he scored 87 on both of the next two tests and cranked out a 97 on the final exam. Joshua earned an A in the course and a 3.8 GPA that semester. When I asked him via e-mail which strategies worked for him, he responded, "I think what I did different was make sidenotes in each chapter, and as I progressed into the next chapter I was able to refer to these notes. I would say that in chemistry, everything builds from the previous topic." Indeed.

Textbooks, Please

We interrupt our regularly scheduled programming for a public service announcement. Please, please, please do whatever you need to do to make sure you have access to your course textbooks. I hear horror stories every week about students who did not have access to books in high school, or if they did, they couldn't take the books home. Many students have even told me that their professors have given explicit, blanket permission not to buy the book. These professors tell their students that everything they need to know is in their notes.

Let's do a brief exercise. Look at Figure 5.1 and tell me the first word that comes to mind.

Figure 5.1. Fill-in-the-Blank Exercise

C_T

Did you see the word *cat*? Or perhaps *cot* or *cut*? If you know something very well, then large chunks of it can be missing or misordered, and you can still recognize it. This fact is the basis of some of your ingenious texting abbreviations or clever personalized license plates.

But what if our culture had no cats, cots, or cuts? Or what if we used different words to describe those things? Then you would look at Figure 5.1 and it would mean nothing to you. *That is the experience of students who try to use lecture notes to learn complex subjects.* The notes are the C_T version of the information. That's why the textbook has so many more pages than the lecture notes. It has charts! It has graphs! Diagrams! Supplemental problems! It's there to help you (**strategy #5**). When your instructors read the lecture notes, their minds fill in everything that is missing, but your mind cannot yet fill in those gaps. You need the textbook.

Have you ever encountered an exam that covered material you didn't remember learning in class? But your instructor swore up and down that he or she distinctly remembered covering it? The phenomenon just described explains how you and your instructor are both correct. That material was in the notes, slides, or board work that your instructor saw but not in what you saw. You saw C_T, but your instructor thought he or she had presented CAT.

When I am trying to convince students to buy textbooks, I explain to them that their instructors' brains have all of the missing information to flesh out the lecture notes. Then I ask them, "But does your brain have all the information in organic chemistry or cell biology or philosophy or multivariable calculus to fill in the gaps?" They shake their heads no. I go on to ask, "When the professor writes the test, is he or she writing it based on what his or her brain sees in the notes or what your brain sees in the notes?" They quickly see my point.

To those who protest that textbooks are expensive, I ask, "What's more expensive, the textbook or not getting into medical school because you made a C in chemistry?" Most find the money for the textbook. To the holdouts I say, "Okay, buy the book and use it for a couple of weeks. If it isn't useful, return it to the bookstore for whatever they will give you, come back and see me, and I will write you a personal check for the difference." I have never, ever had to write a check. Every single student has come back and said something to the effect of, "Wow! I can't believe what a big difference the book makes! I had no idea it would be so helpful."

But please do not think I'm unsympathetic to the plight of cash-strapped students needing to shell out hundreds or thousands of dollars for books twice a year. There are several options for students who understand the importance of textbooks but who have no desire to pay full price for one:

- Use the textbook copies made available through your campus library or learning center.
- Take advantage of interlibrary loan. Your campus librarian can show you how.
- Borrow the textbook from a student who has previously taken the course.
- Rent your textbook online from a student who has just finished the course or through a service provided by your academic institution.
- Buy used textbooks online or from students who have recently finished the course.
- Get permission from the instructor to use an earlier, cheaper edition of the textbook.
- E-mail or call the textbook publishing company to see if they offer e-book rental for the duration of the semester.
- See if your student government has a textbook loan program whereby they collect or purchase textbooks and then loan them out for the semester. If there is no such program, ask your student government to sponsor one or take the initiative and start one yourself.

Remember to always get recommendations for used textbook vendors or rental services from your instructor, fellow students, academic

advisers, or campus learning center staff in order to avoid getting scammed.

The bottom line is that if you do not have your course textbooks, the four effective metacognitive strategies just presented are impossible for you to use. During my initial session with Joshua, I asked him if he had the textbook. He replied, "There is no textbook for the course." Then I asked him to show me his syllabus. Sure enough, the textbook was listed as "optional." Because it was optional, Joshua had not even seen it on the syllabus. (Chapter 7 contains indispensable information about how to get the most out of a syllabus.) I convinced Joshua to buy the textbook, and the rest is history. Without textbooks, neither Joshua nor Dana nor a host of other students would have soared in their classes or fulfilled their larger goals.

I implore you to buy and use the textbooks for all of your courses.

How to Use a Textbook

Permit me another story, if not an explicit strategy, if you would. About 10 years ago, I was working in the tutorial center at the LSU CAS, and a young woman arrived and said she was having problems arranging substances in order of increasing entropy. So I said, "Okay. Tell me what entropy is." She replied, "I don't know what it is." She had had the foresight to bring her book to the center, and it was sitting on the desk in front of her. So I said, "What if I told you that I would make you give me all of your tickets to the LSU football games left in the season if you do not give me a definition of *entropy* in the next five minutes. What would you do?" She said, "Well, I guess I'd just have to miss all the rest of the games."

"Noooo, no, no, no, no, you don't have to miss the rest of the games. In fact, there's something in this room that would keep you from having to give up all your tickets."

She looked around the room, scanned everything on each of the four walls, and then finally looked down at the table. It hit her:

"The book?"
"Yes!!! The book!"
"But I don't know what chapter it's in."
"How could you find out what chapter it's in?"

I tell this story to let you know that if you do not know how to use a textbook because you have never had to use one, you are not alone. Many students arrive on college campuses never having used a table of contents or an index. If you are one of them, just be aware that the table of contents is at the front of the book and lays out the content and location of all of the subjects covered in the book. The index is at the back of the book and contains an alphabetized list of terms and where they appear in the book. To look up a general topic, the table of contents is useful, but to find more specific terms or concepts, try the index.

Go to Class and Take Notes by Hand

Many students underestimate the value of going to class and have not learned how to be engaged in class. You should, without a shadow of a doubt, go to every single class and take notes by hand (**strategy #6**). Many students these days take notes on their laptops, tablets, or even smartphones. But recent studies show that taking notes by hand results in more learning than does taking notes with a laptop, partly because students are forced to paraphrase when they take notes by hand (Mueller & Oppenheimer, 2014). If you are afraid you will miss something important, you can record the lecture and listen to it at a later time.

If you have to miss class, get the notes from a reliable student rather than just downloading lecture slides or notes (Hoffmann & McGuire, 2010). A fellow student's notes will have explanations and additional material not present in the lecture notes.

I'll end this section with a few words about *where* to sit in class: If you want to maximize your impact, sit in one of the front rows or choose a seat farther back but near the center (Adams & Biddle, 1970). This area of the classroom or lecture hall is sometimes called "The T Zone" because it is shaped like a T with the top of the T corresponding to the front rows. The advantage of sitting in the T Zone is twofold. First, *you* can easily see the instructor and all of the teaching materials; plus you have a better shot at getting your questions answered as they arise. Second, even if you're silent as a stone, the *instructor* can't help but register you as someone who faithfully and conscientiously comes to class. This small but powerful choice to sit in the T Zone sets you up beautifully

to have pleasant and productive discussions with the instructor during office hours. Of course, there's no need to despair if, because of your schedule, you can't ever get to class early enough to catch a spot in the T Zone. Being in class is sufficient, and the instructor doesn't need to recognize you in order to establish good rapport during office hours. But if it is possible to sit in the T Zone, you won't regret it. In addition to the benefits already noted, it can sharpen your focus and help you stay alert and engaged in class (Staley, 2007).

Use Your Homework to Test Your Knowledge

Remember Dana, the undergraduate on the verge of leaving physics who now holds a master's degree in medical physics (chapter 3)? This strategy completely transformed her performance on physics exams. In fact, most of my science students who come to me when they are earning low Cs, Ds, or Fs, and who subsequently begin to make A grades, say that doing homework without using solved examples as a guide (**strategy #7**) is the one change that turned everything around.

When introducing this strategy, I ask students, "If there were a camera recording everything you do when you sit down to do your homework, tell me exactly what it would see."

"Okay, I sit down and I open my book and then I look at the first problem."

"Have you ever looked at a problem and immediately decided to flip back in the textbook to look for an example?"

"Yes, Dr. McGuire! How did you know?"

"Because everybody is doing it. I did it myself when I was in school."

Over the years, I have learned that most students do their homework by looking at example problems in the textbook or in their class notes and trying to copy the steps laid out there in order to arrive at the correct answer. *This method is exactly the wrong way to go about doing homework problems.*

Homework and example problems in the textbook and class notes should always be treated as an opportunity to test yourself. Study for the homework the way you would study for a quiz. Before looking at

the homework questions or problems, actively read the relevant part of the textbook or any class notes. As you encounter example problems, work those problems *without referring to the given solutions.* For each problem, even if you get stuck and don't know the next step, do your very best to power through and arrive at an answer. Then *check only the final answer* and not the steps taken to work out the solution. If your answer is incorrect, then reread the text or class notes to investigate why and where you made mistakes. Much important and deep learning takes place during that investigation process. When you arrive at the correct answer, compare your *approach* to that of the textbook or instructor. If the approaches are different, ask yourself whether both approaches are valid. Why or why not? If they are both valid, do you prefer your approach or the alternative approach? Why? This process provides many opportunities for reflection, metacognition, and deep learning. Additionally, sometimes someone else's method just doesn't immediately "click" with your brain. If you look at that method before trying your own, you may become locked into that way of thinking about the problem, which will be an unnecessary burden you carry throughout the rest of the course and perhaps beyond. Relying on others' methods restricts your creative flexibility and mental agility.

After working the example problems in this manner, then turn to the homework. Do two or three problems at a time, treating each problem like a quiz or test question, looking at answers or worked-out solutions only after having made your best attempt to solve the group of problems.

If you think you lack the confidence to try this strategy, convinced that if you do not look at complete solutions you will be endlessly staring at a blank page, I suggest you try the following: Spend at least five minutes going through the reading or class notes to see if you can figure out how to begin the problem. If after five minutes you are still stumped, you should look only at the first step of the worked example, and continue solving the problem. If you're still at a loss, spend another five minutes on step two, and continue in this way until you have solved the problem. Using this method, you maximize your opportunity to solve problems independently. I always tell my students, "Practice problems, wherever they come from, are your brain's best resource

for demonstrating that it can do all the problems likely to appear on a test without relying on an example as a guide."

Whenever I present this strategy to students, as soon as I explain to them that they should try to figure out where they made a mistake before looking at solutions, I ask them, "At this point in the process, do you think that mistakes are good or bad?" All of the student groups with whom I've worked collectively answer that mistakes are good. Mistakes represent a golden opportunity (Zull, 2011). When I ask students why mistakes are good, they answer:

> You learn from your mistakes.
>
> You can correct your mistakes.
>
> You never make the same mistake twice.
>
> You learn where your mind has a tendency to go wrong.
>
> You won't lose points if you make a mistake now.

Have you ever received a graded exam and thought, "Oh, no! I made so many careless mistakes!"? I believe there is almost no such thing as a careless mistake. Mistakes look careless only in retrospect. These kinds of mistakes *must* be made, sometimes repeatedly. "So," I tell students, "you're either going to make your mistakes now, during the homework process, or . . . where?" "On the test," they correctly answer. I was surprised to find that once students understand the importance of making mistakes during the homework process, they often stop using websites like cramster.com or chegg.com to complete their homework assignments. They understand that by doing homework in the correct way, they are training their brain for the task it will face during the exam: solving problems without any model or guide.

One final note. When you are moving through example problems and homework, or quizzes and tests, you should begin with simple problems and progress to more complex ones that test mastery of more than one concept. We will see in chapter 7 that early success is a powerful motivator, and early failure is a powerful discourager. So you need to give yourself opportunities for success. Often, but not always, homework or exam problems are arranged from easiest to most difficult. If

the easiest homework problems are too difficult, you can search for problems in the textbook easier than the homework and start with those. Even assessing the difficulty of problems requires metacognitive activity and helps you absorb the material more deeply.

Using homework as an opportunity to assess learning is an extremely powerful strategy. Alongside the reading strategies, it is one of the most effective and transformative strategies you can use.

Students as Teachers

You can also assess your understanding of material by teaching it to a friend, who may or may not be in the same course, or by pretending to teach it to an empty sofa, a pet, or even your own reflection (**strategy #8**). In trying to explain concepts in a way that others can understand, you become aware of the gaps in your understanding or of details that are not entirely clear to you. You can then try to clear up your confusion on your own or ask a fellow student or instructor. Students usually appreciate the power of this strategy due to our previous discussion about "make-an-A" mode versus "teach-the-material" mode (chapter 4).

Come Together, Right Now

Working in pairs or groups, in addition to working alone, can be a powerful supplement to the other learning strategies (**strategy #9**). In groups, students often have the opportunity to teach (see preceding section) and learn from each other. Working in groups helps students engage in one of the major aspects of metacognition, accurately judging their own learning (Figure 3.2). Cook, Kennedy, and McGuire (2013) assert that students in groups "evaluate each other's thinking [and are] more likely to be metacognitive about how they approach information" (p. 962) than when they work alone. When discussing study groups in student workshops, I sometimes ask, "Why are study groups helpful?" Students respond:

If I say something wrong other people can correct me.

I can hear the way other people think about the material.

Of course, you must actually be working rather than socializing. Vygotsky (1978) and Bruner (1985) have established that in order to be effective, study groups must engage in both discussion and problem-solving activities.[1]

Play Detective: Piece Together a Mock Exam Using Homework and Quizzes as Clues

Have you ever tried to find out what will be on an exam only to find yourself completely stonewalled by your instructor? I have good news for you. From the syllabus, lecture notes, homework assignments, and quizzes, you can deduce the topics and problem types that will appear on the exam. Then you can create an outline of an exam or create your own practice exam using the bank of problems in the textbook and, if applicable, supplemental optional problems provided throughout the unit by the instructor (**strategy #10**). Practice exams can also be made in groups, with each student responsible for a different topic.

There is powerful evidence demonstrating the effectiveness of testing as a way to reinforce, deepen, and enrich learning. In articles for the *New York Times*, science writer Benedict Carey (2010, 2014) shares evidence from Roediger and Karpicke (2006) and Pennebaker, Gosling, and Ferrell (2013) that illustrates the power of testing.

Roediger and Karpicke (2006) asked college students to study science passages in preparation for a later reading comprehension test. If students studied these passages in two sequential sessions, they performed well on a test given right after the study sessions, but the material did not stick. However, another group of students, who studied the passages only once and in the second session took a practice test, did well on an assessment two days later and another test a full week later. Testing is a powerful way to deepen and lengthen learning.

Pennebaker and colleagues (2013) did something radical with their introductory psychology course at the University of Texas. Instead of giving a final exam, they replaced it with "a series of short quizzes that students took on their laptops at the beginning of each class" (Carey, 2014, para. 3). The professors reported that the students groused and grumbled because they had to constantly prepare for these never-ending quizzes. But compared to another set of students taking the same course, these students not only boasted better course grades than their peers but also did better "on a larger quiz that included 17 of the same questions [from both] quizzes and on the other class's midterm" (Carey, 2014, para. 5). Carey (2014) correctly notes that "the quizzes were especially beneficial for the type of students—many from low-performing high schools—who don't realize how far behind they are until it's too late" (para. 5).

Practice testing works. If you want to ace the real exam, you should practice first.

The Strategies: A Recap

These 10 strategies make up the heart of my work and the heart of this book. You don't have to use all 10 strategies to see fast and dramatic results like the ones Travis, Dana, and Joshua enjoyed. I recommend you begin with the reading, classroom, and homework strategies, and add more as you continue on your metacognitive journey.

A Useful Resource

Appendix C contains the Learning Strategies Inventory (LSI), a tool to help you assess the current state of your academic health in a particular course. You indicate which strategies you are currently using via a true/false assessment, and the LSI predicts the grade you will earn in the course. The purpose of the LSI is not to shame you into recognizing what you are doing wrong. Its purpose is to further convince you that your performance directly correlates with your *behavior* rather than any innate fixed ability. In fact, one major purpose of everything I

have shared with you is to help you attribute your results only to your actions, to help you change your mindset. In the next chapter, we will discover the power of mindset.

Are You Convinced Yet?

When I present these strategies to a student in an individual consultation, at the end of the session, I usually ask two questions to determine the likelihood that the student will begin using the strategies. I'll ask you those questions right now. On a scale of 1 to 10, how different are the strategies we have talked about from the ones you have been using up to this point? (A response of 1 represents no difference at all; 10 is a difference as extreme as day and night.)

1 2 3 4 5 6 7 8 9 10

On a scale of 1 to 10, how *motivated* are you to start using the strategies? (1 is not at all; 10 is "I can't wait to start them today!")

1 2 3 4 5 6 7 8 9 10

In response to the first question, if you reported a number between 7 and 10, I know that you recognize the difference between what you have been doing and the actions I am encouraging you to take. In response to the second question, if you reported a number between 8 and 10, then I am confident that you will in fact try one or more of the strategies. If your numbers were lower, there's nothing wrong with that, but I would encourage you to look at the strategies again to try to find even more differences between what you've been doing up to this point and what the strategies recommend. For example, someone might look at the reading strategy and think, "Okay, I paraphrase in the margins; I'm doing that," but the strategy is more specific than that. The devil is in the details. That goes for all of the strategies. I would also encourage you to develop a plan, like getting a buddy to hold you accountable for making changes, in order to increase the chances that your understanding will deepen and your grades will improve.

I want to reinforce to you that no matter what your grades are now, your future performance will depend only on whether you use

the strategies and not at all on how "smart" you think you are or how "smart" other people think you are. I know with every fiber of my being that all students can be successful.

Activities for You

1. Name at least one strategy you would be interested in trying for a week or two.
2. Take a look at Appendix F and list one or more study tools you think might work for you.

Note

1. I often warn students against the "divide and conquer" strategy that some study groups use, in which each member of the study group is responsible for a portion of the material. The danger is that each member will learn his or her territory very well, but will have a significantly shallower understanding of the majority of the material.

WHY ABOU

although I once had a fixed mi
from students have converte
David Shenk (2010
support his assertion
But regardless of
have been repe
formance.

—Joshua, an en[illegible] major at LSU who finished a general chemistry course with an A, personal communication, May 13, 2011

This chapter is based on the work of Carol Dweck (2006), a professor of psychology at Stanford University. Her book *Mindset* has proved so important and the ideas within it have been so useful that they deserve their own chapter.

Fixed Intelligence or Intelligence That Can Grow?

Dweck (2006) found that people commonly hold one of two mindsets about intelligence: They believe intelligence is fixed, or they believe it can grow. Put differently, some people believe that each person is born holding a set of intellectual cards, and little can be done to augment that hand, whereas others believe that they can acquire a few aces through effort and action. You will not be surprised to hear that,