

MATH 15E - CONCURRENT SUPPORT FOR QUANTITATIVE REASONING

A purple hexagonal icon with a white border, containing a white Greek letter sigma (Σ), which is a common symbol for summation or statistics. Σ

Math 15E - Concurrent Support for Quantitative Reasoning

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This text was compiled on 06/09/2025

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1.1: The Power to Learn

Questions to consider

- What actually happens to me when I learn something?
- Am I aware of different types of learning?
- Do I approach studying or practicing differently depending on the desired outcome?

Welcome to one of the most empowering chapters in this book! While each chapter focuses on showing you clear paths to success as a student, this one deals specifically with what is at the core of being a student: the act of learning.

We humans have been obsessed with how we learn and understand things since ancient times. Because of this, some of our earliest recorded philosophies have tried to explain how we take in information about the world around us, how we acquire new knowledge, and even how we can be certain what we learn is correct. This obsession has produced a large number of theories, ideas, and research into how we learn. There is a great deal of information out there on the subject—some of it is very good, and some of it, while well intentioned, has been a bit misguided.

Because of this obsession with learning, over the centuries, people have continually come up with new ideas about how we acquire knowledge. The result has been that commonly held “facts” about education have been known to change frequently. Often, what was once thought to be the newest, greatest discovery about learning was debunked later on. One well-known example of this is that of corporal punishment. For most of the time formal education has existed in our society, educators truly believed that beating students when they made a mistake actually helped them learn faster. Thankfully, *birching* (striking someone with a rod made from a birch tree) has fallen out of favor in education circles, and our institutions of learning have adopted different approaches. In this chapter, not only will you learn about current learning theories that are backed by neuroscience (something we did not have back in the days of birching), but you will also learn other learning theories that did not turn out to be as effective or as thoroughly researched as once thought. That does not mean those ideas about learning are useless. Instead, in these cases you find ways to separate the valuable parts from the myths to make good learning choices.

“Research has shown that one of the most influential aids in learning is an understanding about learning itself.”

What Is the Nature of Learning?

To begin with, it is important to recognize that learning is work. Sometimes it is easy and sometimes it is difficult, but there is always work involved. For many years people made the error of assuming that learning was a passive activity that involved little more than just absorbing information. Learning was thought to be a lot like copying and pasting words in a document; the student’s mind was blank and ready for an instructor to teach them facts that they could quickly take in. As it turns out, learning is much more than that. In fact, at its most rudimentary level, it is an actual process that physically changes our brains. Even something as simple as learning the meaning of a new word requires the physical alteration of neurons and the creation of new paths to receptors. These new electrochemical pathways are formed and strengthened as we utilize, practice, or remember what we have learned. If the new skill or knowledge is used in conjunction with other things we have already learned, completely different sections of the brain, our nerves, or our muscles may be tied in as a part of the process. A good example of this would be studying a painting or drawing that depicts a scene from a story or play you are already familiar with. Adding additional connections, memories, and mental associations to things you already know something about expands your knowledge and understanding in a way that cannot be reversed. In essence, it can be said that every time we learn something new we are no longer the same.

In addition to the physical transformation that takes place during learning, there are also a number of other factors that can influence how easy or how difficult learning something can be. While most people would assume that the ease or difficulty would really depend on what is being learned, there are actually several other factors that play a greater role.

In fact, research has shown that one of the most influential factors in learning is a clear understanding about learning itself. This is not to say that you need to become neuroscientists in order to do well in school, but instead, knowing a thing or two about learning and how we learn in general can have strong, positive results for your own learning. This is called *metacognition* (i.e., thinking about thinking).

Some of the benefits to how we learn can be broken down into different areas such as

- attitude and motivation toward learning,
- types of learning,
- methods of learning, and
- your own preferences for learning.

In this chapter you will explore these different areas to better understand how they may influence your own learning, as well as how to make conscious decisions about your own learning process to maximize positive outcomes.

All Learning Is Not the Same

The first, fundamental point to understand about learning is that there are several types of learning. Different kinds of knowledge are learned in different ways. Each of these different types of learning can require different processes that may take place in completely different parts of our brain.

For example, simple memorization is a form of learning that does not always require deeper understanding. Children often learn this way when they memorize poems or verses they recite. An interesting example of this can be found in the music industry, where there have been several hit songs sung in English by vocalists who do not speak English. In these cases, the singers did not truly understand what they were singing, but instead they were taught to memorize the sounds of the words in the proper order.

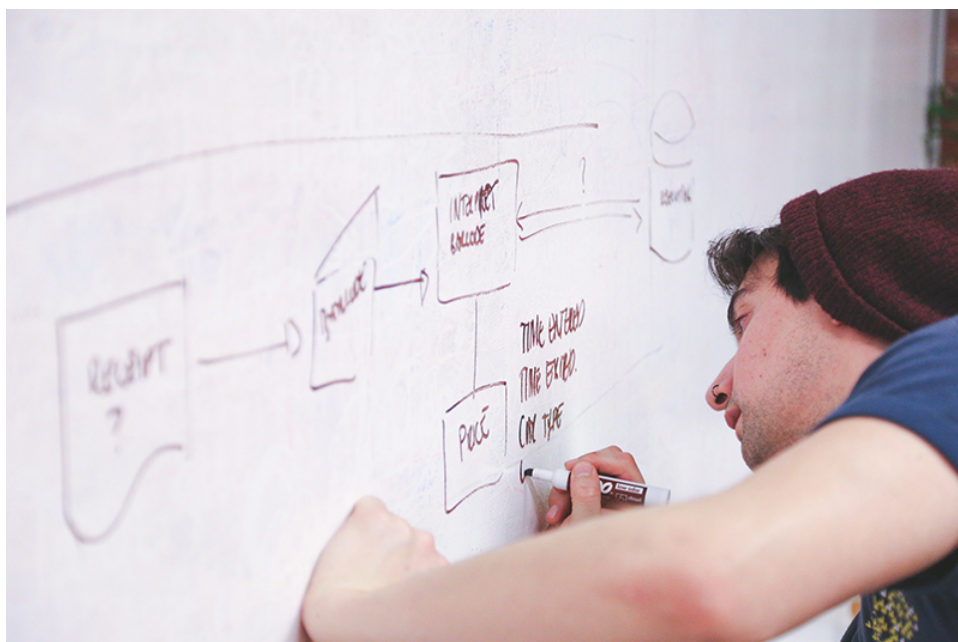


Figure 1.1.2 Learning has many levels and forms. For example, collaborative learning and showing your work require different skills and produce different results than reading or notetaking on your own. (Credit: StartUpStockPhotos / Pexels)

Memorizing sounds is a very different type of learning than, say, acquiring a deep understanding of Einstein’s general theory of relativity.

Notice in the comparative examples of music and physics that the different levels of learning are being defined by what they allow you to know or do. When classifying learning in this way, people usually agree on six different levels of learning. In this next section we will take a detailed look at each of these.

In the table below, the cells in the left column each contain one of the main levels of learning, categorized by what the learning allows you to do. To the right of each category are the “skill acquired” and a set of real-world examples of what those skills might be as applied to a specific topic. This set of categories is called Bloom’s Taxonomy, and it is often used as a guide for educators when they are determining what students should learn within a course.

Table 2.1

Category of Learning	Skill acquired	Example 1: Musical ability	Example 2: Historical information on Charles the Bald

Category of Learning	Skill acquired	Example 1: Musical ability	Example 2: Historical information on Charles the Bald
Create	Produce new or original work	Compose a piece of music	Write a paper on Charles that draws a new conclusion about his reign
Evaluate	Justify or support an idea or decision	Make critical decisions about the notes that make up a melody—what works, what doesn't, and why	Make arguments that support the idea that Charles was a good ruler
Analyze	Draw connections	Play the specific notes that are found in the key of A	Compare and contrast the historical differences between the reign of Charles and his grandfather, Charlemagne
Apply	Use information in new ways	Use knowledge to play several notes that sound good together	Use the information to write a historical account on the reign of Charles
Understand/ Comprehend	Explain ideas or concepts	Understand the relationship between the musical notes and how to play each on a musical instrument	Explain the historical events that enabled Charles to become Emperor
Remember	Recall facts and basic concepts	Memorize notes on a musical scale	Recall that Charles the Bald was Holy Roman Emperor from 875–877 CE

A review of the above table shows that actions in the left column (or what you will be able to do with the new knowledge) has a direct influence over what needs to be learned and can even dictate the type of learning approach that is best. For example, *remembering* requires a type of learning that allows the person basic memorization. In the case of Charles the Bald and his reign, it is simply a matter of committing the dates to memory. When it comes to *understanding and comprehension*, being able to explain how Charles came to power requires not only the ability to recall several events, but also for the learner to be able to understand the cause and effect of those events and how they worked together to make Charles emperor. Another example would be the ability to *analyze*. In this particular instance the information learned would not only be about Charles, but also about other rulers, such as Charlemagne. The information would have to be of such a depth that the learner could compare the events and facts about each ruler.

When you engage in any learning activity, take the time to understand what you will do with the knowledge once you have attained it. This can help a great deal when it comes to making decisions on how to go about it. Using flashcards to help memorize angles does not really help you solve problems using geometry formulas. Instead, practicing problem-solving with the actual formulas is a much better approach. The key is to make certain the learning activity fits your needs.

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1.2: The Motivated Learner

Questions to consider

- How do different types of motivation affect my learning?
- What is resilience and grit?
- How can I apply the Uses and Gratification Theory to make decisions about my learning?
- How do I prevent negative bias from hindering learning?

In this section, you will continue to increase your ability as an informed learner. Here you will explore how much of an influence motivation has on learning, as well as how to use motivation to purposefully take an active role in any learning activity. Rather than passively attempting to absorb new information, you will learn how to make conscious decisions about the methods of learning you will use (based on what you intend to do with the information), how you will select and use learning materials that are appropriate for your needs, and how persistent you will be in the learning activity.

There are three main motivation concepts that have been found to directly relate to learning. Each of these has been proven to mean the difference between success and failure. You will find that each of these is a strong tool that will enable you to engage with learning material in a way that not only suits your needs, but also gives you ownership over your own learning processes.

Resilience and Grit

While much of this chapter will cover very specific aspects about the act of learning, in this section, we will present different information that may at first seem unrelated. Some people would consider it more of a personal outlook than a learning practice, and yet it has a significant influence on the ability to learn.

What we are talking about here is called grit or resilience. Grit can be defined as personal perseverance toward a task or goal. In learning, it can be thought of as a trait that drives a person to keep trying until they succeed. It is not tied to talent or ability, but is simply a tendency to not give up until something is finished or accomplished.



Figure 1.2.3 U.S. Army veteran and captain of the U.S. Invictus team, Will Reynolds, races to the finish line. (Credit: DoD News / Flickr / Attribution 2.0 Generic (CC-BY 2.0))

The study showed that grit and perseverance were better predictors of academic success and achievement than talent or IQ.

This personality trait was defined as “grit” by the psychologist Angela Duckworth.¹ In a 2007 study Duckworth and colleagues found that individuals with high grit were able to maintain motivation in learning tasks despite failures. The study examined a cross section of learning environments, such as GPA scores in Ivy League universities, dropout rates at West Point, rankings in the National Spelling Bee, and general educational attainment for adults. What the results showed was that grit and perseverance were better predictors of academic success and achievement than talent or IQ.

Applying Grit

The concept of grit is an easy one to dismiss as something taken for granted. In our culture, we have a number of sayings and aphorisms that capture the essence of grit: “If at first you do not succeed, try, try again,” or the famous quote by Thomas Edison:

“Genius is one percent inspiration, ninety-nine percent perspiration.”

The problem is we all understand the concept, but actually applying it takes work. If the task we are trying to complete is a difficult one, it can take a lot of work.

The first step in applying grit is to adopt an attitude that looks directly to the end goal as the only acceptable outcome. With this attitude comes an acceptance that you may not succeed on the first attempt—or the nineteenth attempt. Failed attempts are viewed as merely part of the process and seen as a very useful way to gain knowledge that moves you toward success. An example of this would be studying for an exam. In your first attempt at studying you simply reread the chapters of your textbook covered in the exam. You find that while this reinforces some of the knowledge you have gained, it does not ensure you have all the information you will need to do well on the test. You know that if you simply read the chapters yet again, there is no guarantee you are going to be any more successful. You determine that you need to find a different approach. In other words, your first attempt was not a complete failure, but it did not achieve the end goal, so you try again with a different method.

On your second try, you copy down all of the main points onto a piece of paper using the section headlines from the chapters. After a short break you come back to your list and write down a summary of what you know about each item on your list. This accomplishes two things: first, you are able to immediately spot areas where you need to learn more, and second, you can check your summaries against the text to make certain what you know is correct and adequate. In this example, while you may not have yet achieved complete success, you will have learned what you need to do next.

In true grit fashion, for your next try, you study those items on your list where you found you needed a bit more information, and then you go through your list again. This time you are able to write down summaries of all the important points, and you are confident you have the knowledge you need to do well on the exam. After this, you still do not stop, but instead you change your approach to use other methods that keep what you have learned fresh in your mind.

Keeping Grit in Mind: Grit to GRIT

The concept of grit has been taken beyond the original studies of successful learning. While the concept of grit as a personality trait was originally recognized as something positive in all areas of activity, encouraging grit became very popular in education circles as a way to help students become more successful. In fact, many of those that were first introduced to grit through education have begun applying it to business, professional development, and their personal lives. Using a grit approach and working until the goal is achieved has been found to be very effective in not only academics, but in many other areas.²

The *New York Times* best-selling author Paul G. Stoltz has taken grit and turned it into an acronym (GRIT) to help people remember and use the attributes of a grit mindset.³ His acronym is Growth, Resilience, Instinct, and Tenacity. Each of these elements is explained in the table below.

Table 2.2 The GRIT acronym as outlined by Paul G. Stoltz

Growth	Your propensity to seek and consider new ideas, additional alternatives, different approaches, and fresh perspectives
Resilience	Your capacity to respond constructively and ideally make use of all kinds of adversity
Instinct	Your gut-level capacity to pursue the right goals in the best and smartest ways
Tenacity	The degree to which you persist, commit to, stick with, and go after whatever you choose to achieve

There is one other thing to keep in mind when it comes to applying grit (or GRIT) to college success. The same sort of persevering approach can not only be used for individual learning activities, but can be applied to your entire degree. An attitude of tenacity and “sticking with it” until you reach the desired results works just as well for graduation as it does for studying for an exam.

How Do You Get Grit?

A quick Internet search will reveal that there are a large number of articles out there on grit and how to get it. While these sources may vary in their lists, most cover about five basic ideas that all touch upon concepts emphasized by Duckworth. What follows is a brief introduction to each. Note that each thing listed here begins with a verb. In other words, it is an activity for you to do and keep doing in order to build grit.

1. Pursue what interests you.

Personal interest is a great motivator! People tend to have more grit when pursuing things that they have developed an interest in.

2. Practice until you can do it, and then keep practicing.

The idea of practicing has been applied to every skill in human experience. The reason everyone seems to be so fixated with practice is because it is effective and there is no “grittier” activity.

3. Find a purpose in what you do.

Purpose is truly the driver for anything we pursue. If you have a strong purpose in any activity, you have reason to persist at it. Think in terms of end goals and why doing something is worth it. Purpose answers the question of “Why should I accomplish this?”

4. Have hope in what you are doing.

Have hope in what you are doing and in how it will make things different for you or others. While this is somewhat related to purpose, it should be viewed as a separate and positive overall outlook in regard to what you are trying to achieve. Hope gives value to purpose. If purpose is the goal, hope is why the goal is worth attaining at all.

5. Surround yourself with gritty people.

Persistence and tenacity tend to rub off on others, and the opposite does as well. As social creatures we often adopt the behaviors we find in the groups we hang out with. If you are surrounded by people that quit early, before achieving their goals, you may find it acceptable to give up early as well. On the other hand, if your peers are all achievers with grit, you will tend to exhibit grit yourself.

Application

Get a Grit Partner

It is an unfortunate statistic that far too many students who begin college never complete their degree. Over the years a tremendous amount of research has gone into why some students succeed while others do not. After reading about grit, you will probably not be surprised to learn that the research has shown it to not only be a major contributor of learning but to be one of the strongest factors contributing to student graduation.

While that may seem obvious since, by definition, grit is a tendency to keep going until you reach your goal, there was something very significant that turned up in the details of a study conducted by American College Testing (also known as ACT). ACT is a nonprofit organization that administers the college admissions test by the same name, and they have been looking at over 50 years of student persistence data to figure out why some students complete college while others do not. What they have found is that the probability a student will stay in college is tied directly to social connections.⁴ In other words, students that found someone they connected with and that provided a sense of accountability dramatically increased their grit. It did not matter if the person was another student, an instructor, or someone else. What did matter is that they felt a strong motivation to keep working, even when their college experience was at its most difficult. It has been surmised that from a psychological perspective, the extra grit comes from not wanting to disappoint the person they have connected with. Regardless of the reason, the data show that having a grit partner is one of the most effective ways to statistically increase your chances of graduation.

A grit partner does not have to be a formal relationship. Your partner can simply be a classmate—someone that you can talk with. It can be an instructor you admire or someone else that you establish a connection with. It can even be a family member who will encourage you—someone you do not want to disappoint. What you are looking for is someone who will help motivate you, either by their example or by their willingness to give you a pep talk when you need it. The key is that it is someone you respect and who will encourage you to do well in school.

Right now, think about someone who could be your grit partner. Keep in mind that you may not have the same grit partner throughout your entire college experience. You may begin with another classmate but later find that a school staff member steps into the role. Later, as you near graduation, you may find that your favorite instructor motivates you more to do well in school than anyone else. Regardless, the importance of finding the social connection that helps your grit is important.

Uses and Gratification Theory and Learning

In the middle of the last century, experts held some odd beliefs that we might find exceptionally strange in our present age. For example, many scholars were convinced that not only was learning a passive activity, but that mass media such as movies, television, and newspapers held significant control over us as individuals. The thinking at that time was that we were helpless to think for ourselves or make choices about learning or the media we consumed. The idea was that we just simply ingested information fed to us and we were almost completely manipulated by it.

What changed this way of thinking was a significant study on audience motivations for watching different political television programs.⁵ The study found that not only did people make decisions about what information they consumed, but they also had preferences in content and how it was delivered. In other words, people were active in their choices about information. What is more important is that the research began to show that our own needs, goals, and personal opinions are bigger drivers for our choices in information than anything else. This gave rise to what became known as the Uses and Gratification Theory (UGT).

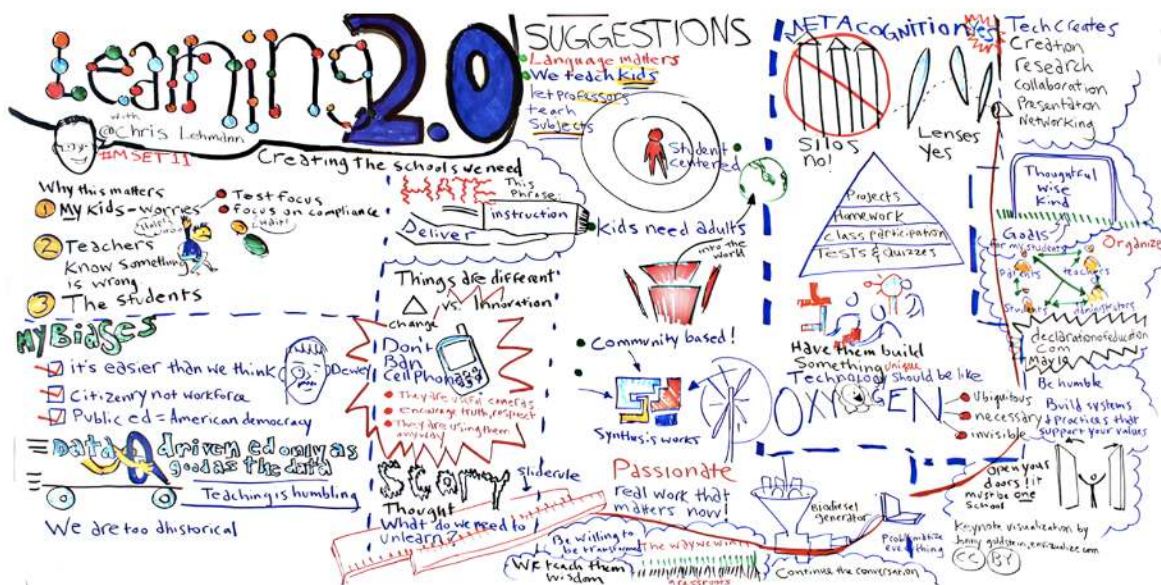


Figure 2.4 Concept maps, or idea clusters, are used to gather and connect ideas. The exercise of creating, recreating, and improving them can be an excellent way to build and internalize a deeper knowledge of subjects. (Credit: Johnny Goldstien / Flickr / Attribution 2.0 Generic (CC-BY 2.0))

At first, personal choices about television programs might seem a strange topic for a chapter on learning, but if you think about it, learning at its simplest is the consumption of information to meet a specific need. You choose to learn something so you can attain certain goals. This makes education and UGT a natural fit.

Applying UGT to education is a *learner-centered* approach that focuses on helping you take control of how and what you learn. Not only that, but it gives you a framework as an informed learner and allows you to choose information and learning activities with the end results in mind. The next section examines UGT a little more closely and shows how it can be directly applied to learning.

The Uses and Gratification Model

The Uses and Gratification model is how people are thought to react according to UGT. It considers individual behavior and motivation as the primary driver for media consumption. In education this means that the needs of the learner are what determine the interaction with learning content such as textbooks, lectures, and other information sources. Since any educational program is essentially content and delivery (the same as with any media), the Uses and Gratification model can be applied to meet student needs, student satisfaction, and student academic success. This is something that is not recognized in many other learning theories since they begin with the premise that it is learning content and how it is delivered that influences the learner more than the learner's own wants and expectations.

The main assumption of the Uses and Gratification model is that media consumers will seek out and return to specific media sources based on a personal need. For learners this is exceptionally useful since it gives an insight and the ability to positively influence their own motivations, expectations, and the perceived value of their education.



Figure 2.5 The Uses and Gratification model indicates that people will actively seek out and integrate specific media into their lives. (Credit: Garry Knight / Flickr / Attribution 2.0 Generic (CC-BY 2.0))

If you understand the key concepts of the Uses and Gratification model, you can make informed decisions about your own learning: how you learn, which materials you use to learn, and what motivates you to learn. An illustration of this was found in the example given in the previous section on grit. There, a series of exam study activities were presented—first reading the appropriate chapters, then making a list of chapter concepts and reviewing what was known, then returning to learn the information needed to fill the gaps. Each activity was chosen by the learner based on how well it fit their needs to help reach the goal of doing well on an exam.

Here we should offer a brief word of caution about being wary when choosing materials and media. There is a great deal of misleading and inaccurate information presented via the Internet and social media. Making informed decisions about your learning and the material you consume includes checking sources and avoiding information that is not credible.

"We are able to consciously make learning choices based on our own identified needs and what we hope to gain by that learning."

In his book *Key Themes in Media Theory*,⁶ Dan Laughey presents the UGT model according to its original authors as a single sentence that divides each area of influence into the following concerns:

1. Social and psychological origins of ...
2. needs, which generate ...
3. expectations of ...
4. the mass media or other sources, which lead to ...
5. differential patterns of media exposure, resulting in ...
6. needs gratification and ...
7. other unintended consequences.

Taken as a list or a single sentence, this can be a bit overwhelming to digest. There are many things being said at the same time, and they may not all be immediately clear. To better understand what each of the “areas of concern” are and how they can impact learning, each has been separated and explained in the table below.

Table 2.3

Area of Concern	What it means for you	How it applies to learning	Real-world example

Area of Concern	What it means for you	How it applies to learning	Real-world example
1. Social and psychological origins of ...	Your motivations, not only as a student but as a person, and both the social and psychological factors that influence you	This can be everything from the original motivation behind enrolling in school in the first place, down to more specific goals like why you want to learn to write and communicate well.	A drive to be self-supporting and to take on a productive role in society.
2. needs, which generate ...	Better job, increased income, satisfying career, prestige	This can include the area of study you select and the school you choose to attend.	Pursuing a degree to seek a career in a field you enjoy.
3. expectations of ...	Expectation and perception (preconceived and continuing) of educational material	What you expect to learn to fulfill goals and meet needs.	Understanding what you need to accomplish the smaller goals. An example would be “study for an exam.”
4. the mass media or other sources, which lead to...	The content and learning activities of the program	Selection of content aimed at fulfilling needs. Results are student satisfaction, perceived value, and continued enrollment.	Choosing which learning activities to use (e.g., texts, watch videos, research alternative content, etc.).
5. differential patterns of media exposure, resulting in ...	Frequency and level of participation	How you engage with learning activities and how often. Results are student satisfaction and perceived value, and continued enrollment.	When, how often, and how much time you spend in learning activities.
6. needs gratification and ...	Better job, increased income, satisfying career, prestige, more immediate goals like pass an exam, earn a good grade, etc.	Needs fulfillment and completion of goals.	Learning activities that meet your learning needs, including fulfillment of your original goals.
7. other unintended consequences.	Increased skills and knowledge, entertainment, social involvement and networking	Causes positive loop-back into 4, 5, and 6, reinforcing those positive outcomes.	Things you learn beyond your initial goals.

What to Do with UGT

On the surface, UGT may seem overly complex, but this is due to its attempt to capture everything that influences how and why we take in information. At this point in your understanding, the main thing to focus on is the bigger idea that our motivations, our end goals, and our expectations are what drive us to learn. If we are aware of these motivations, we can use them to make influential decisions about what we learn and how we learn.

One of the things that will become apparent as you continue reading this chapter and doing the included activities is that all of it fits within the UGT model. Everything about learning styles, your own attitude about learning, how you prefer to learn, and what you get out of it are covered in UGT. Being familiar with it gives you a way to identify and apply everything else you will learn about learning. As you continue in this chapter, rather than looking at each topic as a stand-alone idea, think about where each fits in the Uses and Gratification model. Does it influence your motivations, or does it help you make decisions about the way you learn? This way UGT can provide a way for you to see the value and how to apply everything you learn from this point forward and for every learning experience along the way.

If you were going to define how UGT applies to learning with a few quick statements, it would look something like this:

UGT asks:

- What is it that motivates you to learn something?
- What need does it fulfill?
- What do you expect to have happen with certain learning activities?
- How can you choose the right learning activities to better ensure you meet your needs and expectations?
- What other things might result from your choices?

Analysis Question

Take a moment to think about your own choices when it comes to consuming media. Are there certain sources you prefer? Why? What needs or gratifications do those particular sources fulfill in a way that others do not? Now, use the same process to analyze your current college experience. Are there certain classes or activities you like more than others? Why? Do any of your reasons have to do with the needs or gratifications the classes or learning activities fulfill?

After you have answered those questions, you can always step beyond mere analysis and determine what you could change to make the classes or activities you enjoy less better fulfill your needs.

Combating Negative Bias

In addition to being a motivated learner through the use of grit and UGT, there is a third natural psychological tendency you should be aware of. It is a tendency that you should guard against. Ignoring the fact that it exists can not only adversely affect learning, but it can set up roadblocks that may prevent you from achieving many goals. This tendency is called *negative bias*.

Negative bias is the psychological trait of focusing on the negative aspects of a situation rather than the positive. An example of this in a learning environment would be earning a 95 percent score on an assignment but obsessing over the 5 percent of the points that were missed. Another example would be worrying and thinking negative thoughts about yourself over a handful of courses where you did not do as well as in others—so much so that you begin to doubt your abilities altogether.



Figure 1.2.6 Some level of worry and concern is natural, but an overwhelming amount of negative thoughts about yourself, including doubt in your abilities and place in school, can impede your learning and stifle your success. You can develop strategies to recognize and overcome these feelings. (Credit: Inzmam Kahn / Pexels)

Unfortunately, this is a human tendency that can often overwhelm a student. As a pure survival mechanism it does have its usefulness in that it reminds us to be wary of behaviors that can result in undesirable outcomes. Imagine that as a child playing outside, you have seen dozens if not hundreds of bees over the years. But once, out of all those other times, you were stung by a single bee. Now, every time you see a bee you recall the sting, and you now have a negative bias toward bees in general. Whenever possible you avoid bees altogether.

It is easy to see how this psychological system could be beneficial in those types of situations, but it can be a hindrance in learning since a large part of the learning process often involves failure on early attempts. Recognizing this is a key to overcoming negative bias. Another way to combat negative bias is to purposefully focus on successes and to acknowledge earlier attempts that fail as just a part of the learning.

What follows are a few methods for overcoming negative bias and negative self-talk. Each focuses on being aware of any negative attitude or emphasizing the positive aspects in a situation.

- **Be aware of any negative bias.** Keep an eye out for any time you find yourself focusing on some negative aspect, whether toward your own abilities or on some specific situation. Whenever you recognize that you are exhibiting a negative bias toward

something, stop and look for the positive parts of the experience. Think back to what you have learned about grit, how any lack of success is only temporary, and what you have learned that gets you closer to your goal.

- **Focus on the positive before you begin.** While reversing the impact of negative bias on your learning is helpful, it can be even more useful to prevent it in the first place. One way to do this is to look for the positives before you begin a task. An example of this would be receiving early feedback for an assignment you are working on. To accomplish this, you can often ask your instructor or one of your classmates to look over your work and provide some informal comments. If the feedback is positive then you know you are on the right track. That is useful information. If the feedback seems to indicate that you need to make a number of corrections and adjustments, then that is even more valuable information, and you can use it to greatly improve the assignment for a much better final grade. In either case, accurate feedback is what you really want most, and both outcomes are positive for you.
- **Keep a gratitude and accomplishment journal.** Again, the tendency to recall and overemphasize the negative instances while ignoring or forgetting about the positive outcomes is the nature of negative bias. Sometimes we need a little help remembering the positives, and we can prompt our memories by keeping a journal. Just as in a diary, the idea is to keep a flowing record of the positive things that happen, the lessons you learned from instances that were “less than successful,” and all accomplishments you make toward learning. In your journal you can write or paste anything that you appreciated or that has positive outcomes. Whenever you are not feeling up to a challenge or when negative bias is starting to wear on you, you can look over your journal to remind yourself of previous accomplishments in the face of adversity.

Analysis Question

Building the Foundation

In this section you read about three major factors that contribute to your motivation as a learner: grit and perseverance, your own motivations for learning (UGT), and the pitfalls of negative bias. Now it is time to do a little self-analysis and reflection.

Which of these three areas do you feel strongest in? Are you a person that naturally has grit, or do you better understand your own motivations for learning (using UGT)? Do you struggle with negativity bias, or is it something that you rarely have to deal with?

Determine in which of these areas you are strongest, and think about what things make you so strong. Is it a positive attitude (you always see the glass as half full as opposed to half empty), or do you know exactly why you are in college and exactly what you expect to learn?

After you have analyzed your strongest area, then do the same for the two weaker ones. What makes you susceptible to challenges in these areas? Do you have a difficult time sticking with things or possibly focus too much on the negative? Look back at the sections on your two weakest areas, and put together a plan for overcoming them. For each one, choose a behavior you intend to change and think of some way you will change it.

Footnotes

- Duckworth, A.L.; Peterson, C.; Matthews, M.D.; Kelly, D.R. (June 2007). "Grit: Perseverance and passion for long-term goals". *Journal of Personality and Social Psychology*. **92** (6): 1087–1101. doi:10.1037/0022-3514.92.6.1087. PMID 17547490.
- Neisser, U.; Boodoo, G.; Bouchard, T.J.; Boykin, A.W.; Brody, N.; et al. (1996). "Intelligence: Knowns and unknowns" (PDF). *American Psychologist*. **51** (2): 77–101. doi:10.1037/0003-066x.51.2.77.
- Stoltz, Paul G. (2014). "GRIT The New Science of What It Takes To Persevere, Flourish, Succeed". ClimbStrong Press
- King, David R., NduM, Edwin, Can Psychosocial Factors Predict First-to Second Year College Retention Above and Beyond Standard Variables, ACT (2017) <https://www.act.org/content/dam/act/...on-2017-12.pdf>
- Blumler, J. G., & McQuail, D. (1969). *Television in politics: Its uses and influence*. University of Chicago Press.
- Dan Laughey, (2007). *Key Themes in Media Theory*, Open University Press

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Questions to consider

- What is a growth mindset, and how does it affect my learning?
- What are performance goals versus learning goals?

Figure 1.3.7 Many fields of study and work create

intersections of growth and fixed mindset. People may feel great ability to grow and learn in some areas, like art and communication, but feel more limited in others, such as planning and financials. Recognizing these intersections will help you approach new topics and tasks. (Credit: mentatdgt / Pexels)

Performance vs. Learning Goals

As you have discovered in this chapter, much of our ability to learn is governed by our motivations and goals. What has not yet been covered in detail has been how sometimes hidden goals or mindsets can impact the learning process. In truth, we all have goals that we might not be fully aware of, or if we are aware of them, we might not understand how they help or restrict our ability to learn. An illustration of this can be seen in a comparison of a student that has *performance*-based goals with a student that has *learning*-based goals.

If you are a student with strict performance goals, your primary psychological concern might be to appear intelligent to others. At first, this might not seem to be a bad thing for college, but it can truly limit your ability to move forward in your own learning. Instead, you would tend to play it safe without even realizing it. For example, a student who is strictly performance-goal-oriented will often only say things in a classroom discussion when they think it will make them look knowledgeable to the instructor or their classmates. For example, a performance-oriented student might ask a question that she knows is beyond the topic being covered (e.g., asking about the economics of Japanese whaling while discussing the book *Moby Dick* in an American literature course). Rarely will they ask a question in class because they actually do not understand a concept. Instead they will ask questions that make them look intelligent to others or in an effort to “stump the teacher.” When they do finally ask an honest question, it may be because they are more afraid that their lack of understanding will result in a poor performance on an exam rather than simply wanting to learn.

If you are a student who is driven by learning goals, your interactions in classroom discussions are usually quite different. You see the opportunity to share ideas and ask questions as a way to gain knowledge quickly. In a classroom discussion you can ask for

clarification immediately if you don't quite understand what is being discussed. If you are a person guided by learning goals, you are less worried about what others think since you are there to learn and you see that as the most important goal.

Another example where the difference between the two mindsets is clear can be found in assignments and other coursework. If you are a student who is more concerned about performance, you may avoid work that is challenging. You will take the "easy A" route by relying on what you already know. You will not step out of your comfort zone because your psychological goals are based on approval of your performance instead of being motivated by learning.

This is very different from a student with a learning-based psychology. If you are a student who is motivated by learning goals, you may actively seek challenging assignments, and you will put a great deal of effort into using the assignment to expand on what you already know. While getting a good grade is important to you, what is even more important is the learning itself.

If you find that you sometimes lean toward performance-based goals, do not feel discouraged. Many of the best students tend to initially focus on performance until they begin to see the ways it can restrict their learning. The key to switching to learning-based goals is often simply a matter of first recognizing the difference and seeing how making a change can positively impact your own learning.

What follows in this section is a more in-depth look at the difference between performance- and learning-based goals. This is followed by an exercise that will give you the opportunity to identify, analyze, and determine a positive course of action in a situation where you believe you could improve in this area.

WHAT STUDENTS SAY

1. In the past, did you feel like you had control over your own learning?
 - a. No. Someone has always dictated how and what I learned.
 - b. Yes. I always look for ways to take control of what and how I learned.
 - c. I am uncertain. I never thought about it before.
2. Have you ever heard of learning styles or do you know your own learning style?
 - a. No. I have never heard of learning styles.
 - b. Yes. I have heard of learning styles and know my own.
 - c. Yes. I have heard of learning styles, but I don't think they're accurate or relate to me.
3. Which factors other than intelligence do you think have the greatest influence on learning?
 - a. Motivation
 - b. Perseverance
 - c. Understanding how I learn
 - d. Good teachers and support

You can also take the anonymous [What Students Say](#) surveys to add your voice to this textbook. Your responses will be included in updates.

Students offered their views on these questions, and the results are displayed in the graphs below.

In the past, did you feel like you had control over your own learning?

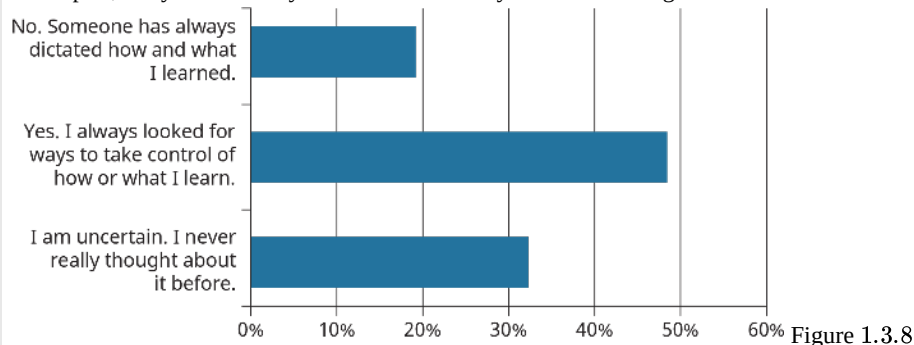
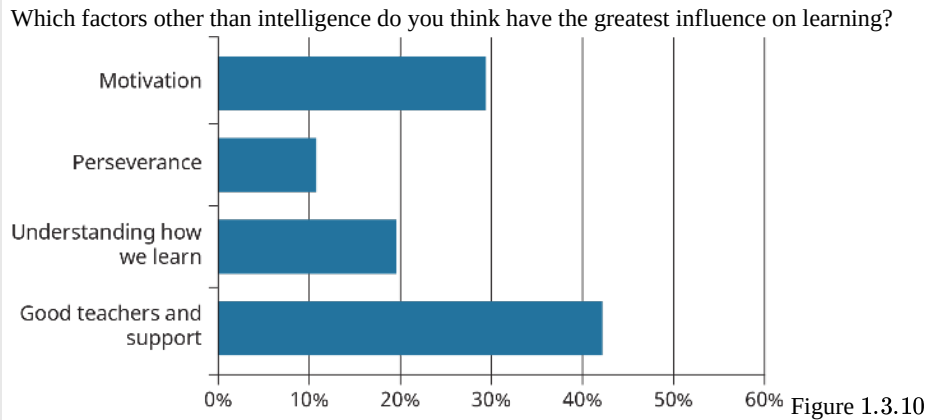
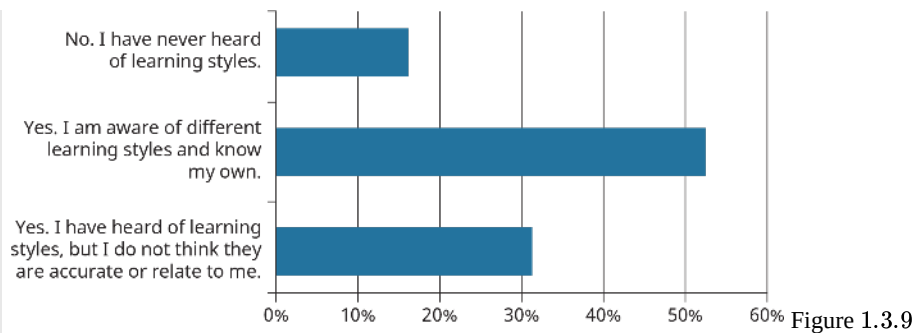


Figure 1.3.8

Have you ever heard of learning styles or do you know your own learning style?



Fixed vs. Growth Mindset

The research-based model of these two mindsets and their influence on learning was presented in 1988 by Carol Dweck.² In Dr. Dweck's work, she determined that a student's perception about their own learning accompanied by a broader goal of learning had a significant influence on their ability to overcome challenges and grow in knowledge and ability. This has become known as the Fixed vs. Growth Mindset model. In this model, the *performance*-goal-oriented student is represented by the *fixed* mindset, while the *learning*-goal-oriented student is represented by the *growth* mindset.

In the following graphic, based on Dr. Dweck's research, you can see how many of the components associated with learning are impacted by these two mindsets.

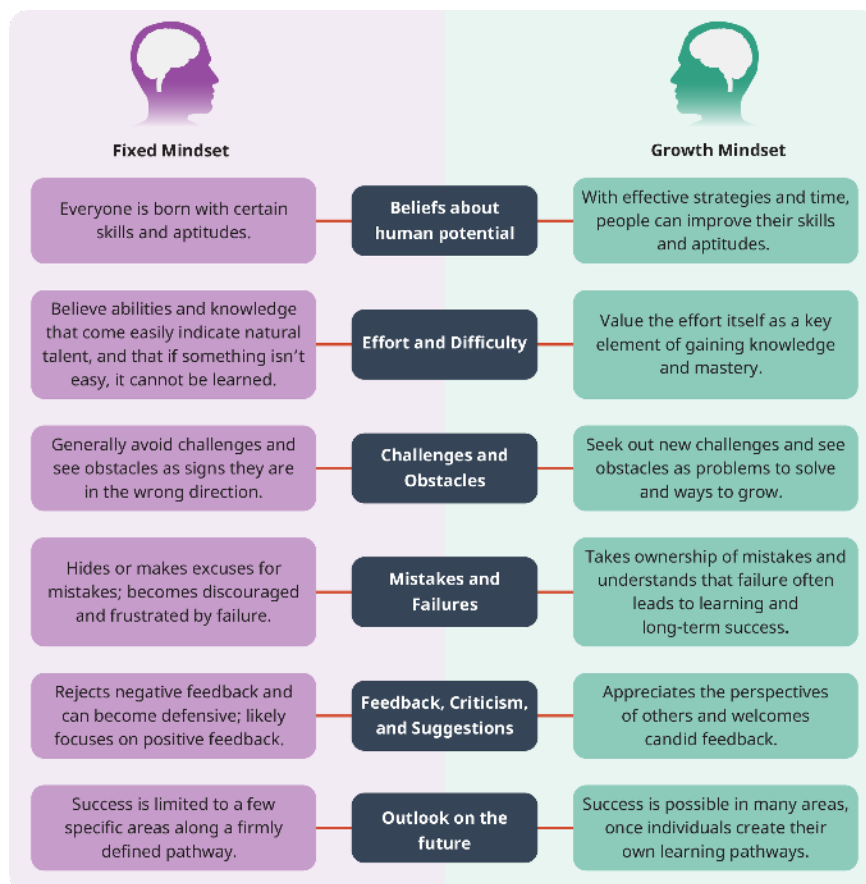


Figure 1.3.11: The differences between fixed and growth mindset are clear when aligned to key elements of learning and personality. (Credit: Based on work by Dr. Carol Dweck)

The Growth Mindset and Lessons About Failing

Something you may have noticed is that a growth mindset would tend to give a learner grit and persistence. If you had learning as your major goal, you would normally keep trying to attain that goal even if it took you multiple attempts. Not only that, but if you learned a little bit more with each try you would see each attempt as a success, even if you had not achieved complete mastery of whatever it was you were working to learn.

With that in mind, it should come as no surprise that Dr. Dweck found that those people who believed their abilities could change through learning (growth vs. a fixed mindset) readily accepted learning challenges and persisted despite early failures.

Improving Your Ability to Learn

As strange as it may seem, research into fixed vs. growth mindsets has shown that if you believe you can learn something new, you greatly improve your ability to learn. At first, this may seem like the sort of feel-good advice we often encounter in social media posts or quotes that are intended to inspire or motivate us (e.g., *believe in yourself!*), but in looking at the differences outlined between a fixed and a growth mindset, you can see how each part of the growth mindset path would increase your probability of success when it came to learning.

ACTIVITY

Very few people have a strict fixed or growth mindset all of the time. Often we tend to lean one way or another in certain situations. For example, a person trying to improve their ability in a sport they enjoy may exhibit all of the growth mindset traits and characteristics, but they find themselves blocked in a fixed mindset when they try to learn something in another area like computer programming or arithmetic.

In this exercise, do a little self-analysis and think of some areas where you may find yourself hindered by a fixed mindset. Using the outline presented below, in the far right column, write down how you can change your own behavior for each of the parts of the learning process. What will you do to move from a fixed to a growth mindset? For example, say you were trying to

learn to play a musical instrument. In the *Challenges* row, you might pursue a growth path by trying to play increasingly more difficult songs rather than sticking to the easy ones you have already mastered. In the *Criticism* row, you might take someone's comment about a weakness in timing as a motivation for you to practice with a metronome. For *Success of others* you could take inspiration from a famous musician that is considered a master and study their techniques.

Whatever it is that you decide you want to use for your analysis, apply each of the Growth characteristics to determine a course of action to improve.

Table 2.4

Parts of the learning process	Growth characteristic	What will you do to adopt a growth mindset?
Challenges	Embraces challenges	
Obstacles	Persists despite setbacks	
Effort	Sees effort as a path to success	
Criticism	Learns from criticism	
Success of Others	Finds learning and inspiration in the success of others	

Footnotes

- Dweck, C.S. & Leggett, E.L. (1988). A Social-Cognitive Approach to Motivation and Personality

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1.4: Learning Preferences

Questions to consider

- What are learning styles, and do they really work?
- How do I take advantage of learning styles in a way that works for me?
- How can I combine learning styles for better outcomes?
- What opportunities and resources are available for students with disabilities?

Several decades ago, a new way of thinking about learning became very prominent in education. It was based on the concept that each person has a preferred way to learn. It was thought that these preferences had to do with each person's natural tendencies toward one of their senses. The idea was that learning might be easier if a student sought out content that was specifically oriented to their favored sense. For example, it was thought that a student who preferred to learn visually would respond better to pictures and diagrams.

Over the years there were many variations on the basic idea, but one of the most popular theories was known as the VAK model. VAK was an acronym for the three types of learning, each linked to one of the basic senses thought to be used by students: visual, aural, and kinesthetic. What follows is an outline of each of these and the preferred method.

- **Visual:** The student prefers pictures, images, and the graphic display of information to learn. An example would be looking at an illustration that showed how to do something.
- **Aural:** The student prefers sound as a way to learn. Examples would be listening to a lecture or a podcast.
- **Kinesthetic:** The student prefers using their body, hands, and sense of touch. An example would be doing something physical, such as examining an object rather than reading about it or looking at an illustration.

The Truth about Learning Styles

In many ways these ideas about learning styles made some sense. Because of this, educators encouraged students to find out about their own learning styles. They developed tests and other techniques to help students determine which particular sense they preferred to use for learning, and in some cases learning materials were produced in multiple ways that focused on each of the different senses. That way, each individual learner could participate in learning activities that were tailored to their specific preferences.

While it initially seemed that dividing everyone by learning styles provided a leap forward in education, continued research began to show that the fixation on this new model might not have been as effective as it was once thought. In fact, in some cases, the way learning styles were actually being used created roadblocks to learning. This was because the popularization of this new idea brought on a rush to use learning styles in ways that failed to take into account several important aspects that are listed below:

- A person does not always prefer the same learning style all the time or for each situation. For example, some learners might enjoy lectures during the day but prefer reading in the evenings. Or they may prefer looking at diagrams when learning about mechanics but prefer reading for history topics.
- There are more preferences involved in learning than just the three that became popular. These other preferences can become nearly impossible to make use of within certain styles. For example, some prefer to learn in a more social environment that includes interaction with other learners. Reading can be difficult or restrictive as a group effort. Recognized learning styles beyond the original three include: **social** (preferring to learn as a part of group activity), **solitary** (preferring to learn alone or using self-study), or **logical** (preferring to use logic, reasoning, etc.).
- Students that thought they were limited to a single preferred learning style found themselves convinced that they could not do as well with content that was presented in a way that differed from their style.⁸ For example, a student that had identified as a visual learner might feel they were at a significant disadvantage when listening to a lecture. Sometimes they even believed they had an even greater impairment that prevented them from learning that way at all.
- Some forms of learning are extremely difficult in activities delivered in one style or another. Subjects like computer programming would be almost impossible to learn using an aural learning style. And, while it is possible to read about a subject such as how to swing a bat or how to do a medical procedure, actually applying that knowledge in a learning environment is difficult if the subject is something that requires a physical skill.

Knowing and Taking Advantage of Learning Styles in a Way That Works for You

The problem with relying on learning styles comes from thinking that just one defines your needs. Coupling what you know about learning styles with what you know about UGT can make a difference in your own learning. Rather than being constrained by a single learning style, or limiting your activities to a certain kind of media, you may choose media that best fit your needs for what you are trying to learn at a particular time.

Following are a couple of ways you might combine your learning style preference with a given learning situation:

- You are trying to learn how to build something but find the written instructions confusing so you watch a video online that shows someone building the same thing.
- You have a long commute on the bus but reading while riding makes you dizzy. You choose an aural solution by listening to pre-recorded podcasts or a mobile device that reads your texts out loud.

These examples show that by recognizing and understanding what different learning styles have to offer, you can use the techniques that are best suited for you and that work best under the circumstances of the moment. You may also find yourself using two learning styles at the same time - as when you watch a live demonstration or video in which a person shows you how to do something while verbally explaining what you are being shown. This helps to reinforce the learning as it utilizes different aspects of your thinking. Using learning styles in an informed way can improve both the speed and the quality of your learning.

Get Connected

Finding content related to a subject or topic can be relatively easy, but you must use caution and rely on reputable sources. Relatively little of the material on the Web provides a way to ensure accuracy or balance.

Below are descriptions of common informational sites with varying degrees of reliability:

- [Khan Academy](#): This site is full of useful tutorials and videos on a wide range of subjects.
- [Wikipedia](#): Wikipedia is often frowned upon in some academic circles, because review of its content takes place *after* publication, potentially resulting in inaccurate or misleading information being available. But Wikipedia can provide a brief overview of a topic, and its lists of references is often quite extensive. You probably shouldn't rely Wikipedia as your only source, but it can be useful.
- Government website: Most items that governments administer are referenced on informational websites. In the United States, these include [educational statistics](#), [economic data](#), [health information](#), and many other topics.

When choosing alternate content, it is imperative to compare it to the content that is being provided to you as a part of your course. If the alternate content does not line up, you should view it with a healthy skepticism. In those cases, it is always a good idea to share the content with your instructor and ask their opinion.

Activity

In this activity you will try an experiment by combining learning styles to see if it is something that works for you. The experiment will test the example of combining reading/writing and aural learning styles for better memorization.

To begin, you will start with a short segment of numbers. You will read the numbers only one time without saying them aloud. When you are finished, wait 10 seconds and try to remember the numbers in sequence by writing them down.

67914528

After you have finished you will repeat the experiment with a new set of numbers, but this time you will read them aloud, wait 10 seconds, and then see how easy they are to remember. During this part of the experiment you are free to say the numbers in any way you like. For example, the number 8734 could be read as eight-seven-three-four, eighty-seven thirty-four, or any combination you would like.

10387264

Did you find that there was a difference in your ability to memorize a short sequence of numbers for 10 seconds? Even if you were able to remember both, was the example that combined learning styles easier? What about if you had to wait for a full minute before attempting to rewrite the numbers? Would that make a difference?

What about Students with Disabilities?

Students with disabilities are sometimes the most informed when it comes to making decisions about their own learning. They should understand that it is in their best interest to take ownership of their own approach to education, especially when it comes to leveraging resources and opportunities. In this section, you will learn about the laws that regulate education for students with disabilities as well as look at some resources that are available to them.

Just like anyone else, under the law, qualified students with disabilities are entitled to the same education colleges and universities provide to students without disabilities. Even though a particular disability may make attending college more difficult, awareness on the part of the government, learning institutions, and the students themselves has brought about a great deal of change over the years. Now, students with disabilities find that they have available appropriate student services, campus accessibility, and academic resources that can make school attendance and academic success possible.

Due to this increased support and advocacy, colleges have seen an increase of students with disabilities. According to the National Center for Education Statistics, in 2012, 11.1 percent of the total undergraduate population in the United States was made up of people with disabilities.⁹

The Legal Rights of Students with Disabilities

Section 504 of the Rehabilitation Act of 1973 protects students “with a physical or mental impairment which substantially limits one or more major life activities.”¹⁰ Learning definitely falls within the definition of major life activities.

In addition to Section 504, another set of laws that greatly help learners with disabilities is the Americans with Disabilities Act of 1990 (also known as ADA). Both of these acts have been driving forces in making certain that students with disabilities have equal access to higher education, and they have been instrumental in helping educators looking for new ways and resources to provide services that do just that.

What follows is a list of services that schools commonly provide to help students with disabilities. These are often referred to as *ADA accommodations* and are named after the American with Disabilities Act:

- Recordings of class lectures or lecture transcription by in-class note takers
- Text readers or other technologies that can deliver content in another format
- Test or assessment accommodations
- Interpreter services and Braille transcriptions
- Physical access accommodations
- Accommodations of time and due dates

Most colleges will have policies and staff that are designated to help arrange for these types of accommodations. They are often found within the Department of Student Services or in related departments within your college campus. If you are a student with disabilities protected under these acts, it is in your best interest to contact the person responsible for ADA accommodations at your school. Even if you decide that you do not need accommodations, it is a good idea to find out about any services and policies the school has in place.

Organizations

In addition to the accommodations that schools commonly provide, there are also a number of national and local organizations that can provide assistance and advice when it comes to being a student with a disability. If you fit into this category, it is recommended that you make contact with one or more of these organizations in order to find out how they can help. These can be tremendously beneficial resources that offer everything from information and support to simple social connections that can make pursuing a formal education easier.

Footnotes

- Harold Pashler, Mark McDaniel, Doug Rohrer and Robert Bjork. *Learning Styles: Concepts and Evidence*. Psychological Science in the Public Interest, Vol. 9, No. 3 (December 2008).
- U.S. Department of Education, National Center for Education Statistics. (2019). *Digest of Education Statistics, 2017* (2018-070), Chapter 3.
- U.S. Department of Education. Protecting Students with Disabilities: Frequently Asked Questions.
<https://www2.ed.gov/about/offices/li...cr/504faq.html>

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1.5: The Hidden Curriculum

Questions to consider

- What is the hidden or invisible curriculum?
- How can I work within the hidden curriculum to prevent negative results?

The *hidden curriculum* is a phrase used to cover a wide variety of circumstances at school that can influence learning and affect your experience. Sometimes called the invisible curriculum, it varies by institution and can be thought of as a set of unwritten rules or expectations.

Situation: According to your syllabus, your history professor is lecturing on the chapter that covers the stock market crash of 1929 on Tuesday of next week.

Sounds pretty straightforward and common. Your professor lectures on a topic and you will be there to hear it. However, there are some unwritten rules, or hidden curriculum, that are not likely to be communicated. Can you guess what they may be?

- What is an unwritten rule about what you should be doing before attending class?
- What is an unwritten rule about what you should be doing in class?
- What is an unwritten rule about what you should be doing after class?
- What is an unwritten rule if you are not able to attend that class?

Some of your answers could have included the following:

Table 2.8

Before class:	<i>read the assigned chapter, take notes, record any questions you have about the reading</i>
During class:	<i>take detailed notes, ask critical thinking or clarifying questions, avoid distractions, bring your book and your reading notes</i>
After class:	<i>reorganize your notes in relation to your other notes, start the studying process by testing yourself on the material, make an appointment with your professor if you are not clear on a concept</i>
Absent:	<i>communicate with the professor, get notes from a classmate, make sure you did not miss anything important in your notes</i>

The expectations before, during, and after class, as well as what you should do if you miss class, are often unspoken because many professors assume you already know and do these things or because they feel you should figure them out on your own. Nonetheless, some students struggle at first because they don't know about these habits, behaviors, and strategies. But once they learn them, they are able to meet them with ease.

While the previous example may seem obvious once they've been pointed out, most instances of the invisible curriculum are complex and require a bit of critical thinking to uncover. What follows are some common but often overlooked examples of this invisible curriculum.

One example of a hidden curriculum could be found in the beliefs of your professor. Some professors may refuse to reveal their personal beliefs to avoid your writing toward their bias rather than presenting a cogent argument of your own. Other professors may be outspoken about their beliefs to force you to consider and possibly defend your own position. As a result, you may be influenced by those opinions which can then influence your learning, but not as an official part of your study.

Other examples of how this hidden curriculum might not always be so easily identified can be found in classroom arrangements or even scheduling. To better understand this, imagine two different classes on the exact same subject and taught by the same instructor. One class is held in a large lecture hall and has over 100 students in it, while the other meets in a small classroom and has fewer than 20 students. In the smaller class, there is time for all of the students to participate in discussions as a learning activity, and they receive the benefit of being able to talk about their ideas and the lessons through direct interaction with each other and the professor. In the larger class, there is simply not enough time for all 100 students to each discuss their thoughts. On the flip side, most professors who teach lecture classes use technology to give them constant feedback on how well students understand a

given subject. If the data suggests more time should be spent, these professors discover this in real time and can adapt the class accordingly.

Another instance where class circumstances might heavily influence student learning could be found in the class schedule. If the class was scheduled to meet on Mondays and Wednesdays and the due date for assignments was always on Monday, those students would benefit from having the weekend to finalize their work before handing it in. If the class met on a different day, students might not have as much free time just before handing in the assignment. The obvious solution would be better planning and time management to complete assignments in advance of due dates, but nonetheless, conditions caused by scheduling may still impact student learning.

Working Within the Hidden Curriculum

The first step in dealing with the hidden curriculum is to recognize it and understand how it can influence your learning. After any specific situation has been identified, the next step is to figure out how to work around the circumstances to either take advantage of any benefits or to remove any roadblocks.

To illustrate this, here are some possible solutions to the situations given as examples earlier in this section:

Prevailing Opinions—Simply put, you are going to encounter instructors and learning activities that you sometimes agree with and sometimes do not. The key is to learn from them regardless. In either case, take ownership of your learning and even make an effort to learn about other perspectives, even if it is only for your own education on the matter. There is no better time to expose yourself to other opinions and philosophies than in college. In fact, many would say that this is a significant part of the college experience. With a growth mindset, it is easy to view everything as a learning opportunity.

Classroom Circumstances—These kinds of circumstances often require a more structured approach to turn the situation to your advantage, but they also usually have the most obvious solutions. In the example of the large class, you might find yourself limited in the ability to participate in classroom discussions because of so many other students. The way around that would be to speak to several classmates and create your own discussion group. You could set up a time to meet, or you could take a different route by using technology such as an online discussion board, a Skype session, or even a group text. Several of the technologically based solutions might even be better than an in-class discussion since you do not all have to be present at the same time. The discussion can be something that occurs all week long, giving everyone the time to think through their ideas and responses.

Again, the main point is to first spot those things in the hidden curriculum that might put your learning at a disadvantage and devise a solution that either reduces the negative impact or even becomes a learning advantage.

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CHAPTER OVERVIEW

2: Thinking

[2.1: What Thinking Means](#)

[2.2: Metacognition](#)

[2.3: Bloom's Taxonomy](#)

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2.1: What Thinking Means

Thinking is one of those hard-to-pinpoint aspects of life we typically don't analyze much—like breathing or walking or sleeping. We constantly think, and becoming more attuned to how we think and what we do when we encounter new ideas is an excellent habit to pursue.

“If you’re going to do anything as much as you think, you might just as well learn about it and hone this skill.”

You may have read quotes or inspirational slogans that claim *you are what you think*. What does that mean? Can you *think* yourself into a good mood? Can you *think* you have a million dollars in your pocket? Does that mean you are the next music sensation if you often sing at parties? Not necessarily, but consider Jose, for instance. He isn't a rock and roll star, but Jose spends a lot of his leisure time thinking about music, analyzing performances, memorizing his favorite musicians' characteristics, buying fan clothing, and even designing a creative means to explain his excitement for music to his friends through a homemade video. Jose certainly could allow his fascination to seep into other aspects of his life. Do you have a hobby or interest you spend a lot of time thinking about?

Many people go to great lengths to attend a concert by a favorite music star. They think creatively about how to save enough money for tickets; they think analytically about scheduling their other obligations to have time off work to attend or how to make up work in their college classes. This much planning involves a great deal of thinking, and not all about music. In the example about Jose, thinking directs the actions of the person doing the thinking. So, in fact, what we think *does* influence who we are and how we act. We have many resources available to be more effective thinkers, and learning about these resources gives us options.

GET CONNECTED

Apps and search engines literally bring thinking to our fingertips. Consider how often you visit Google. The use of this familiar site has become so commonplace as to render the proper name of the company into a verb—to *google* a topic. Basic calculators or word-processing software programs are other simple examples of technology we often use without recognizing them as thinking aids.

While apps, software programs, thinking games, and thought exercises may help you stretch your brain, don't let their simplicity fool you into thinking that cultivating an inquisitive, thoughtful mind is easy or automatic. Thinking is as complex as it is necessary for our success in life. Some tools you may find useful are applications that provide challenges using mind puzzles are [Peak](#) and [Elevate](#). These training apps offer brain training that varies from quick matching memory games to more sophisticated thought-processing speed scenarios. You can even use a straightforward tool like a flashcard app, such as [Cue](#) or [Prep](#), to create your own thinking games -- using word associations or pictures to help you connect topics and build your skills.

A familiar element of the thinking apps is a progression tracker to help thinkers improve their focus and memory as well as to learn and practice math and verbal skills over time. Researchers are still investigating the correlation between thought-invoking game playing and the decrease in mental agility, memory, and cognitive vitality. Early studies have produced numerous findings, including a long-term investigation of the onset of Alzheimer's disease conducted with nuns; you can look up the *Nun Study* to learn more, or go to [this article](#).

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2.2: Metacognition

Questions to consider:

- How can you become more aware of your own thinking?
- What is the benefit of thinkers using their thoughts deliberately?

For many of us, it was in kindergarten or first grade when our teacher asked our class to “put on our thinking caps.” That may partially have been a clever way for a harried teacher to get young scholars to calm down and focus, but the idea is an apt depiction of how we think. Depending on the situation, we may have to don several very different caps to do our best thinking. Knowing which cap to wear in which situation so we are most prepared, effective, and efficient becomes the work of a lifetime. When you can handle more than one complex thought at a time or when you need to direct all your focus on one crucial task is highly individual. Some people study well with music on in the background while others need absolute silence and see any noise as a distraction. Many chefs delight in creating dinners for hundreds of people in a chaotic kitchen but don’t care for making a meal for two at home.

When an individual thinks about how he or she thinks, this practice is called *metacognition*. Developmental psychiatrist John Flavell coined the term metacognition and divided the theory into three processes of planning, tracking, and assessing your own understanding.²

“Becoming aware of your thought processes and using this awareness deliberately is a sign of mature thinking.”

For example, you may be reading a difficult passage in a textbook on chemistry and recognize that you are not fully understanding the meaning of the section you just read or its connection to the rest of the chapter. Students use metacognition when they practice self-awareness and self-assessment. You are the best judge of how well you know a topic or a skill. In college especially, thinking about your thinking is crucial so you know what you don't know and how to fix this problem, i.e., what you need to study, how you need to organize your calendar, and so on.

If you stop and recognize this challenge with the aim of improving your comprehension, you are practicing metacognition. You may decide to highlight difficult terms to look up, write a summary of each paragraph in as few sentences as you can, or join a peer study group to work on your comprehension. If you know you retain material better if you hear it, you may read out loud or watch video tutorials covering the material. These are all examples of thinking about how you think and adapting your behavior based on this metacognition. Likewise, if you periodically assess your progress toward a goal, such as when you check your grades in a course every few weeks during a long semester so you know how well you are doing, this too is metacognition.

Beyond just being a good idea, thinking about your own thinking process allows you to reap great benefits from becoming more aware of and deliberate with your thoughts. If you know how you react in a specific thinking or learning situation, you have a better chance to improve how well you think or to change your thoughts altogether by tuning into your reaction and your thinking. You can plan how to move forward because you recognize that the way you think about a task or idea makes a difference in what you do with that thought. The famous Greek philosopher Socrates allegedly said, “The unexamined life isn’t worth living.” Examine your thoughts and be aware of them.

Becoming Aware of Your Thinking

Just as elite athletes watch game footage and work with coaches to improve specific aspects of their athletic performance, students can improve their mindset and performance reliant upon their thinking by starting to be aware of what they think. If a baseball pitcher recognizes that the curveball that once was so successful in producing strikeouts has not worked as well recently, the pitcher may break down every step of the physical movement required for the once-successful pitch. He and his coaches may notice a slight difference they can remedy during practice to improve the pitch.



Figure 2.2.12 Baseball pitchers and coaches analyze

every component of their motion using video and other technology. (Credit: West Point, The US Military Academy / Flickr / Attribution 2.0 Generic (CC-BY 2.0))

Likewise, if Shamika, for instance, wants to be more generally optimistic and not dwell on negative thoughts, she may ask her friends to mention every time she adds a negative post on social media. Shamika may go even further by stopping herself when she says something that is not in line with her new, optimistic mindset. She could jot down the instance in a journal and capture her feelings at the time so that later she could analyze or think through why she was negative at that time. If you procrastinate on assignments, you may ask a friend to be your accountability buddy to help keep you on track. Thinking about how to focus on the positive, in Shamika's case, or avoid procrastination doesn't magically change the situation. It does, however, allow the owner of the thought to contemplate alternatives instead of becoming frustrated or mindlessly continuing to sabotage sincere goals. Think now of a personal example of a habit you may want to change, such as smoking, or an attribute such as patience or perseverance you may want to improve in yourself. Can you determine what steps you may need to undertake to change this habit or to develop a stronger awareness of the need to change?

Using Thought Deliberately

If you need to plan, track, and assess your understanding to engage in metacognition, what strategies do you need to employ? Students can use metacognition strategies before, during, and after reading, lectures, assignments, and group work.

Planning

Students can plan and get ready to learn by asking questions such as:

- What am I supposed to learn in this situation?
- What do I already know that might help me learn this information?
- How should I start to get the most out of this situation?
- What should I be looking for and anticipating as I read or study or listen?

As part of this planning stage, students may want to jot down the answers to some of the questions they considered while preparing to study. If the task is a writing assignment, prewriting is particularly helpful just to get your ideas down on paper. You may want to start an outline of ideas you think you may encounter in the upcoming session; it probably won't be complete until you learn more, but it can be a place to start.

Tracking

Students can keep up with their learning or track their progress by asking themselves:

- How am I doing so far?
- What information is important in each section?
- Should I slow down my pace to understand the difficult parts more fully?
- What information should I review now or mark for later review?

In this part of metacognition, students may want to step away from a reading selection and write a summary paragraph on what the passage was about without looking at the text. Another way to track your learning progress is to review lecture or lab notes within a

few hours of the initial note-taking session. This allows you to have a fresh memory of the information and fill in gaps you may need to research more fully.

Assessing

Students can assess their learning by asking themselves:

- How well do I understand this material?
- What else can I do to understand the information better?
- Is there any element of the task I don't get yet?
- What do I need to do now to understand the information more fully?
- How can I adjust how I study (or read or listen or perform) to get better results moving forward?

Looking back at how you did on assignments, tests, and reading selections isn't just a means to getting a better grade the next time, even if that does sometimes happen as a result of this sort of reflection. If you rework the math problems you missed on a quiz and figure out what went wrong the first time, you will understand that mathematical concept better than if you ignore the opportunity to learn from your errors. Learning is not a linear process; you will bring knowledge from other parts of your life and from your reading to understand something new in your academic or personal learning for the rest of your life. Using these planning, tracking, and assessing strategies will help you progress as a learner in all subjects.

Have you ever been in a situation where a series of events transpired that on reflection you wish you had handled differently? For instance, what if you were tired after a long day at work or school and snapped at your roommates over an insignificant problem and that heated exchange ruined your weekend plans? You'd been anticipating a fun outing with a large group, but now several people don't want to go because of the increased tension. Afterwards, you come up with several other ways you wish you had acted—you might have explained how tired you were, ignored the irritation, or even asked if you could continue your discussion of the problem at another time when you were less tired. You could call that wish metacognition after the fact. How much more effective could you be in general if instead of *reacting* to events and then contemplating better alternatives later, you were able to do the thinking *proactively* before the situation arises? Just the act of pausing to think through the potential consequences is a good first step to accomplishing the goal of using metacognition to reduce negative results. Can you think of a situation in which you reacted to events around you with less than ideal results? How about a time when you thought through a situation beforehand and reaped the benefits of this proactive approach?

Let's look at two seemingly ordinary examples of this concept. Think about your reaction and the eventual long- and short-term results of you walking into your math class on Tuesday afternoon to recall only then that you have a major closed-book exam that class session. You look around to see nervous classmates reading notecards or working practice problems. You choose to stay and take the exam wholly unprepared. You end up with a low D on the exam and now must contemplate the consequences of that result.



Figure 2.2.13 Self-awareness and self-assessment are critical in preparing for tests. (Credit: Magharebia / Flickr / Attribution 2.0 Generic (CC-BY 2.0))

Scoring such a low exam grade may not be the end of the world, certainly, but you may not maintain the GPA you had hoped to post, you may need to repeat the course, or you may get further behind in this subject because you didn't master the skills on this test. This is quite a bit of awareness about your thinking. Now you need to decide what actions to take as a result of your self-

awareness thinking. Contemplating this negative consequence may lead you to make an appointment with your instructor to discuss your situation, which is always a good idea. Could you take an alternate exam to replace this atypical low score? Even if the answer is no, you have still made a connection and shown your instructor that you are seriously thinking about your coursework.

Now consider the opposite scenario. What if you had entered your exam schedule onto your calendar beforehand and devised a viable plan to be prepared? You likely would have prepared in advance of exam days, studied the required materials, worked through similar problems, and come to the exam session more prepared than you did in the first example. Because you know you need a set amount of time to prepare for exams, you would have blocked that time on your calendar, possibly changing your work schedule for the week, declining social invitations, and otherwise altering your daily routine to accommodate this significant event. Consider how much better your results would be with this amount of preparation and how this would improve your overall performance in the course. You can take advantage of thinking about consequences before they happen so you can employ specific strategies to improve your learning.

Footnotes

- [2](#) Flavell, J. H. (1976). Metacognitive aspects of problem solving. In L. B. Resnick (Ed.), *The nature of intelligence* (pp. 231–236). Hillsdale, NJ: Erlbaum

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2.3: Bloom's Taxonomy

In 1956, educational psychologist Benjamin Bloom and his associates conceptualized a taxonomy to classify aspects of human learning that included three basic domains: cognitive, affective, and psychomotor. The cognitive domain of this taxonomy represents a continuum of thinking that can be useful for teachers as they develop curricula for students, but also for students as they try to determine what a professor may be asking them to do on a particular test question or writing assignment. Bloom's Taxonomy can also help students challenge themselves as they are creating active learning study strategies and/ or developing questions for self-testing for an exam. In addition, once students have taken an exam in a particular course, conducting a post-test review of the levels of thinking required by exam questions will provide clues regarding how to effectively study for future exams.

Table 5-1: Bloom's Taxonomy: Cognitive Domain (1956)

Level of Cognitive Domain	Thinking Level	Generic Activity	Question Cues	Sample Questions	Example Activities of Products
Remembering	Basic thinking (lowest level)	Recalls facts, patterns, settings, etc.; remembers previously learned material	Cite, label, name, list, state, quote, reproduce, define, identify, describe(who, what, where, when)	Who is...? What is...? Where is...? Where was...?	List items. Make a timeline. Recite a passage. List certain memorized facts.
Understanding	Basic thinking	Understands what is being communicated; grasps the meaning of material and can state in own words; can infer causes and predict consequences	Explain, restate, paraphrase, summarize, describe, illustrate, give examples, discuss, distinguish, interpret	How would you put this into your own words? What is an example of ____? How would you translate ____ to a visual form? What was the main idea?	Create a flowchart to illustrate the sequence of events. Retell the story in your words. Write a summary.
Applying	Higher-level thinking	Uses the information in new concrete situations	Apply, classify, solve, demonstrate, calculate, illustrate(how it looks in new situation), complete, employ	Can you apply this idea to your own life? Can you come up with another example? What does "x" equal in this case?	Use this method to apply to a new case study. Solve different types of math problems.

Analyzing	Higher-level thinking	Breaks new information into parts to understand relationships; sees patterns and organizational structure	Diagram, analyze, diagnose, conclude, outline, separate, explain(relationships), infer, find, classify, discriminate, compare, contrast, why	Why did this happen? What were some of the motives behind ____? What was the problem with ____? Why did ____ changes occur? Can you explain what happened when ____? What difference exists between ____ and ____?	Construct a diagram that shows the relationships between the parts. Research the issue to find information that supports a view. Write a biography.
Evaluating	Higher-level thinking	Make judgement of the value of an idea, method, resource, etc.; assess the value of theories, presentations, texts; make choices based on argument; recognize subjectivity	Assess, appraise, critique, judge, weigh, recommend, convince, support, evaluate,rank, decide, select, grade, defend, justify, compare, contrast	Is this a good or bad thing? Can you defend your position on ____? What do you believe and why? What would you have done differently? How effective is ____? What do you think about ____? Is this a credible source?	Debate an issue from multiple perspectives.State your opinion and evidence for your opinion. Prepare a list of criteria used to judge something and apply it.
Creating	Higher-level thinking	Creates something new from the elements of the old information; generalizes from given facts; relates knowledge from different areas	Create, design, compose, develop, plan, propose, integrate, invent, generalize, combine, rewrite	What would happen if ____? How can we improve ____? Can you design a ____ to accomplish ____? How can this idea be combined with that idea to develop a better understanding of ____? How can we solve questions?	Invent a new machine. Write a story. Compose a new piece of music or work of art. Devise a new way to do something.

Students who challenge themselves to engage in higher-level thinking such as Applying, Analyzing, Evaluating, and Creating are using what professors on our campus would commonly characterize as “critical thinking.”

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CHAPTER OVERVIEW

3: Time Management

[3.1: Time Management in College](#)

[3.2: Procrastination- The Enemy Within](#)

[3.3: How to Manage Time](#)

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3.1: Time Management in College

Questions to consider:

- Is time management different in college from what I am used to?
- How different is college schoolwork from high school work?

You may find that time management in college is very different from anything you have experienced previously. For the last 12 years, almost all your school time was managed by educators and your parents. What you did and when you did it was controlled by others. In many cases, even after-school time was set by scheduled activities (such as athletics) and by nightly homework that was due the next day.

In the workplace, the situation is not very different, with activities and time on task being monitored by the company and its management. This is so much a part of the working environment that many companies research how much time each task should take, and they hold employees accountable for the time spent on these job functions. In fact, having these skills will help you stand out on the job and in job interviews.

K-12	College
Many class activities are planned.	Class time is given to receiving information.
Homework is often similar for each student.	You may have freedom in homework choices.
Time is managed by others more often.	Time is managed by the student.

In college, there is a significant difference because a great deal of time management is left up to you. While it is true that there are assignment due dates and organized classroom activities, learning at the college level requires more than just the simple completion of work. It involves decision-making and the ability to evaluate information. This is best accomplished when you are an active partner in your own learning activities.



Figure 3.1.2 Students may set aside specific times and

specific places to study.

As an example of how this works, think about a college assignment that involves giving a classroom presentation. To complete the assignment, you are given time to research and reflect on the information found. As a part of the assignment, you must reach your own conclusions and determine which information that you have found is best suited for the presentation. While the date of the actual presentation and how long it will last are usually determined by the instructor, how much time you spend gathering information, the sources you use, and how you use them are left to you.

WHAT STUDENTS SAY

1. How difficult is it for you to keep track of multiple tasks over the course of a term?
 - a. Extremely easy
 - b. Somewhat easy

- c. Somewhat difficult
- d. Extremely difficult

2. Do you use a particular app to help you manage your time?

- a. I use Google calendar
- b. I use the calendar on my phone
- c. I use a paper/notebook planner
- d. I use the calendar on my learning management system
- e. I use another app or system
- f. I don't use any type of planner or app

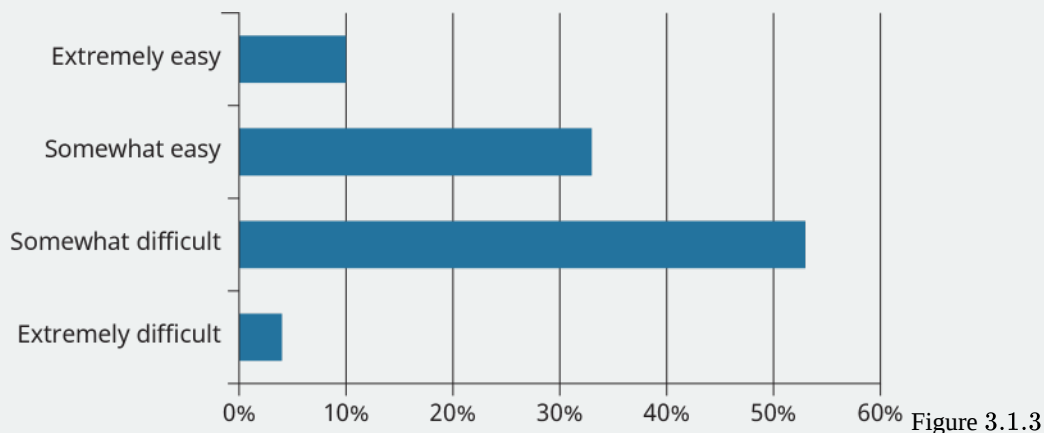
3. Rank the following in terms of what you would most like to improve regarding your time management skills.

- a. My ability to predict how much time my tasks will take.
- b. My ability to balance various obligations.
- c. My ability to avoid procrastination.
- d. My ability to limit distractions.

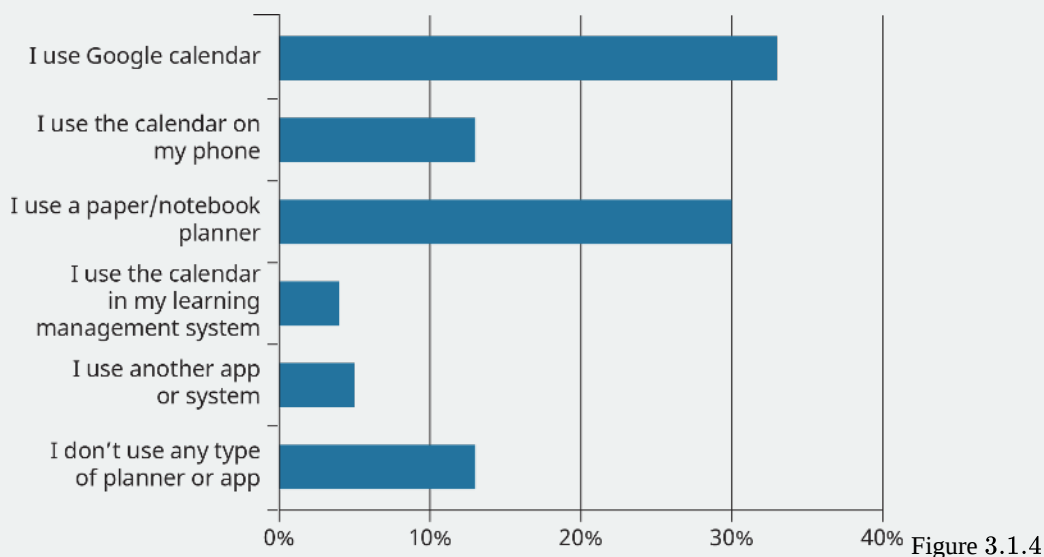
You can also take the anonymous [What Students Say](#) surveys to add your voice to this textbook. Your responses will be included in updates.

Students offered their views on these questions, and the results are displayed in the graphs below.

How difficult is it for you to keep track of multiple tasks over the course of a term?



Do you use a particular app to help you manage your time?



Rank the following in terms of what you would most like to improve regarding your time management skills.

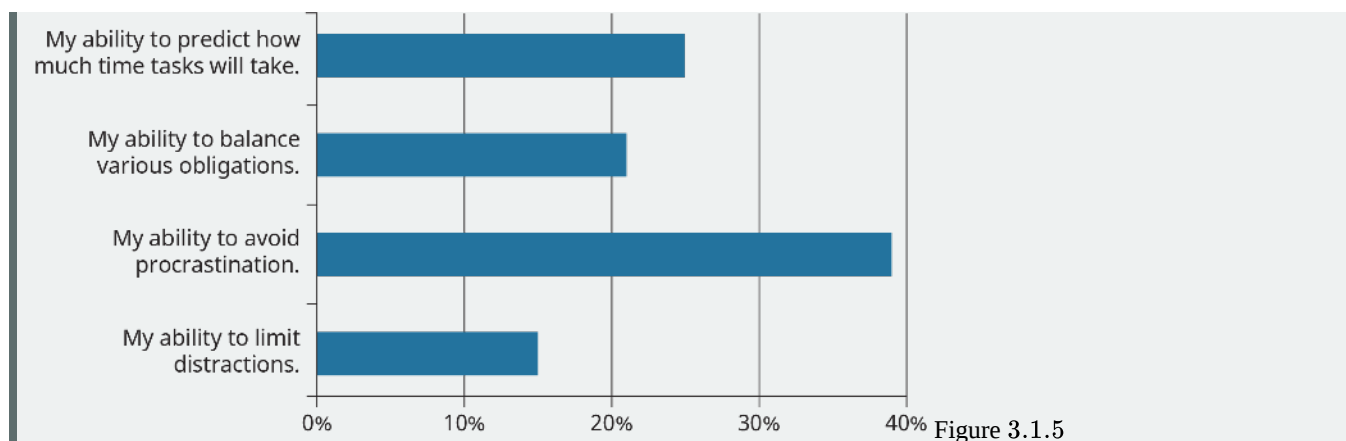


Figure 3.1.5

You Have Lots of Time to Manage

For college-level learning, this approach is important enough that you can expect to spend much more time on learning activities outside the classroom than you will in the classroom. In fact, the estimated time you should spend will be at least two hours of outside learning for every one hour of lecture. Some weeks may be more intense, depending on the time of the semester and the courses you are taking. If those hours are multiplied over several courses in a given session, you can see how there is a significant amount of time to manage. Unfortunately, many students do not always take this into consideration, and they spend far less time than is needed to be successful. The results of poor time management are often a shock to them.

“In college, as an active participant in your own education, what you do and when you do it is largely determined by you.”

The Nature of What You Have to Do Has Changed

Returning to our example of the classroom-presentation assignment, you can see that the types of learning activities in college can be very different from what you have experienced previously. While there may have been similar assignments in high school, such as presentations or written papers, the level of expectation with length and depth is significantly different in college. This point is made very clear when comparing facts about the requirements of high school work to the type of work students produce in college. One very strong statistic that underscores this comes from a study conducted by the Pew Research Center. They found that 82 percent of teens report that their typical high school writing assignments were only a single paragraph to one page in length.² (Writing Technology and Teens, 2004, Pew Research Center) This is in stark contrast to a number of sources that say that writing assignments in lower-level college courses are usually 5–7 pages in length, while writing assignments in upper-level courses increase to 15–20 pages.

It is also interesting to note that the amount of writing done by a college student can differ depending on their program of study. The table below indicates the estimated average amount of writing assigned in several disciplines. To estimate the number of pages of assigned writing, the average number of writing assignments of a given page length was multiplied by an approximate number of pages for the assignment type (see **Estimating Number of Pages Written** for calculation details).

Table 3.2 Credit: Updated NSSE (Since 2013)³

Writing Assignments Vary in Length	
Discipline	Number of Pages Assigned in Introductory Course
Arts & Humanities	49
Biological Sciences, Agriculture, & Natural Resources	47
Physical Sciences, Mathematics, & Computer Science	44
Social Sciences	52
Business	48
Communications, Media, & Public Relations	50

Writing Assignments Vary in Length	
Education	46
Engineering	46
Health Professions	43
Social Service Professions	47

High school homework often consists of worksheets or tasks based on reading or classroom activities. In other words, all the students are doing the same tasks, at relatively the same time, with little autonomy over their own education.

Using the earlier example of the presentation assignment, not only will what you do be larger in scale, but the depth of understanding and knowledge you will put into it will be significantly more than you may have encountered in previous assignments. This is because there are greater expectations required of college graduates in the workplace. Nearly any profession that requires a college degree has with it a level of responsibility that demands higher-level thinking and therefore higher learning. An often-cited example of this is the healthcare professional. The learning requirements for that profession are strict because we depend on those graduates for our health and, in some cases, our lives. While not every profession may require the same level of study needed for healthcare, most do require that colleges maintain a certain level of academic rigor to produce graduates who are competent in their fields.

Footnotes

- [2](http://www.pewinternet.org/2008/04/2...ogy-and-teens/) <http://www.pewinternet.org/2008/04/2...ogy-and-teens/>
- [3](http://nsse.indiana.edu/html/sample...of_writing.cfm) nsse.indiana.edu/html/sample...of_writing.cfm

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3.2: Procrastination- The Enemy Within

Questions to consider:

- Why do we procrastinate?
- What are the effects of procrastination?
- How can we avoid procrastination?



Figure 3.2.6 We can think of many creative ways to procrastinate, but the outcome is often detrimental. (Credit: University of the Fraser Valley / Flickr / Attribution 2.0 Generic (CC BY 2.0))

Simply put, procrastination is the act of delaying some task that needs to be completed. It is something we all do to greater and lesser degrees. For most people, a little minor procrastination is not a cause for great concern. But there are situations where procrastination can become a serious problem with a lot of risk. These include: when it becomes a chronic habit, when there are a number of tasks to complete and little time, or when the task being avoided is very important.

Because we all procrastinate from time to time, we usually do not give it much thought, let alone think about its causes or effects. Ironically, many of the psychological reasons for why we avoid a given task also keep us from using critical thinking to understand why procrastination can be extremely detrimental, and in some cases difficult to overcome.

To succeed at time management, you must understand some of the hurdles that may stand in your way. Procrastination is often one of the biggest. What follows is an overview of procrastination with a few suggestions on how to avoid it.

The Reasons behind Procrastination

There are several reasons we procrastinate, and a few of them may be surprising. On the surface we often tell ourselves it is because the task is something we do not want to do, or we make excuses that there are other things more important to do first. In some cases this may be true, but there can be other contributors to procrastination that have their roots in our physical well-being or our own psychological motivations.

Lack of Energy

Sometimes we just do not feel up to a certain task. It might be due to discomfort, an illness, or just a lack of energy. If this is the case, it is important to identify the cause and remedy the situation. It could be something as simple as a lack of sleep or improper diet. Regardless, if a lack of energy is continually causing you to procrastinate to the point where you are beginning to feel stress over not getting things done, you should definitely assess the situation and address it.

Lack of Focus

Much like having low physical energy, a lack of mental focus can be a cause of procrastination. This can be due to mental fatigue, being disorganized, or allowing yourself to be distracted by other things. Again, like low physical energy, this is something that may have farther-reaching effects in your life that go beyond the act of simply avoiding a task. If it is something that is recurring, you should properly assess the situation.

Fear of Failure

This cause of procrastination is not one that many people are aware of, especially if they are the person avoiding tasks because of it. To put it in simple words, it is a bit of trickery we play on ourselves by avoiding a situation that makes us psychologically uncomfortable. Even though they may not be consciously aware of it, the person facing the task is afraid that they cannot do it or will not be able to do it well. If they fail at the task, it will make them appear incompetent to others or even to themselves. Where the self-trickery comes in is by avoiding the task. In the person's mind, they can rationalize that the reason they failed at the task was because they ran out of time to complete it, not that they were incapable of doing it in the first place.

It is important to note that a fear of failure may not have anything to do with the actual ability of the person suffering from it. They could be quite capable of doing the task and performing well, but it is the fear that holds them back.

ANALYSIS QUESTION

Consider something right now that you may be procrastinating about. Are you able to identify the cause?

The Effects of Procrastination

In addition to the causes of procrastination, you must also consider what effects it can have. Again, many of these effects are obvious and commonly understood, but some may not be so obvious and may cause other issues.

Loss of Time

The loss of time as an effect of procrastination is the easiest to identify since the act of avoiding a task comes down to not using time wisely. Procrastination can be thought of as using the time you have to complete a task in ways that do not accomplish what needs to be done.

Loss of Goals

Another of the more obvious potentially adverse effects of procrastination is the loss of goals. Completing a task leads to achieving a goal. These can be large or small (e.g., from doing well on an assignment to being hired for a good job). Without goals you might do more than delay work on a task—you may not complete it at all. The risk for the loss of goals is something that is very impactful.

Loss of Self-Esteem

Often, when we procrastinate we become frustrated and disappointed in ourselves for not getting important tasks completed. If this continues to happen, we can begin to develop a low opinion of ourselves and our own abilities. We begin to suffer from low self-esteem and might even begin to feel like there is something wrong with us. This can lead to other increasingly negative mental factors such as anger and depression. As you can see, it is important for our own well-being to avoid this kind of procrastination effect.

Stress

Procrastination causes stress and anxiety, which may seem odd since the act of procrastination is often about avoiding a task we think will be stressful in itself! Anyone who has noticed that nagging feeling when they know there is something else they should be doing is familiar with this.

On the other hand, some students see that kind of stress as a boost of mental urgency. They put off a task until they feel that surge of motivation. While this may have worked in the past, they quickly learn that procrastinating when it comes to college work almost always includes an underestimation of the tasks to be completed— sometimes with disastrous results.

Strategies for Psyching Ourselves Out and Managing Procrastination

Now that you understand a few of the major problems procrastination can produce, let's look at methods to manage procrastination and get you on to completing the tasks, no matter how unpleasant you think they might be.

Get Organized

Much of this chapter is dedicated to defining and explaining the nature of time management. The most effective way to combat procrastination is to use time and project management strategies such as schedules, goal setting, and other techniques to get tasks accomplished in a timely manner.

Put Aside Distractions

Several of the methods discussed in this chapter deal specifically with distractions. Distractions are time-killers and are the primary way people procrastinate. It is too easy to just play a video game a little while longer, check out social media, or finish watching a movie when we are avoiding a task. Putting aside distractions is one of the primary functions of setting priorities.

Reward Yourself

Rewarding yourself for the completion of tasks or meeting goals is a good way to avoid procrastination. An example of this would be rewarding yourself with the time to watch a movie you would enjoy *after* you have finished the things you need to do, rather than using the movie to keep yourself from getting things done.

Be Accountable—Tell Someone Else

A strong motivational tool is to hold ourselves accountable by telling someone else we are going to do something and when we are going to do it. This may not seem like it would be very effective, but on a psychological level we feel more compelled to do something if we tell someone else. It may be related to our need for approval from others, or it might just serve to set a level of commitment. Either way, it can help us stay on task and avoid procrastination—especially if we take our accountability to another person seriously enough to warrant contacting that person and apologizing for not doing what we said we were going to do.

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3.3: How to Manage Time

Questions to consider:

- How can I use time-on-task estimates to improve time management?
- What behaviors can help or hinder when it comes to managing time?

In this next section you will learn about managing time and prioritizing tasks. This is not only a valuable skill for pursuing an education, but it can become an ability that follows you through the rest of your life, especially if your career takes you into a leadership role.

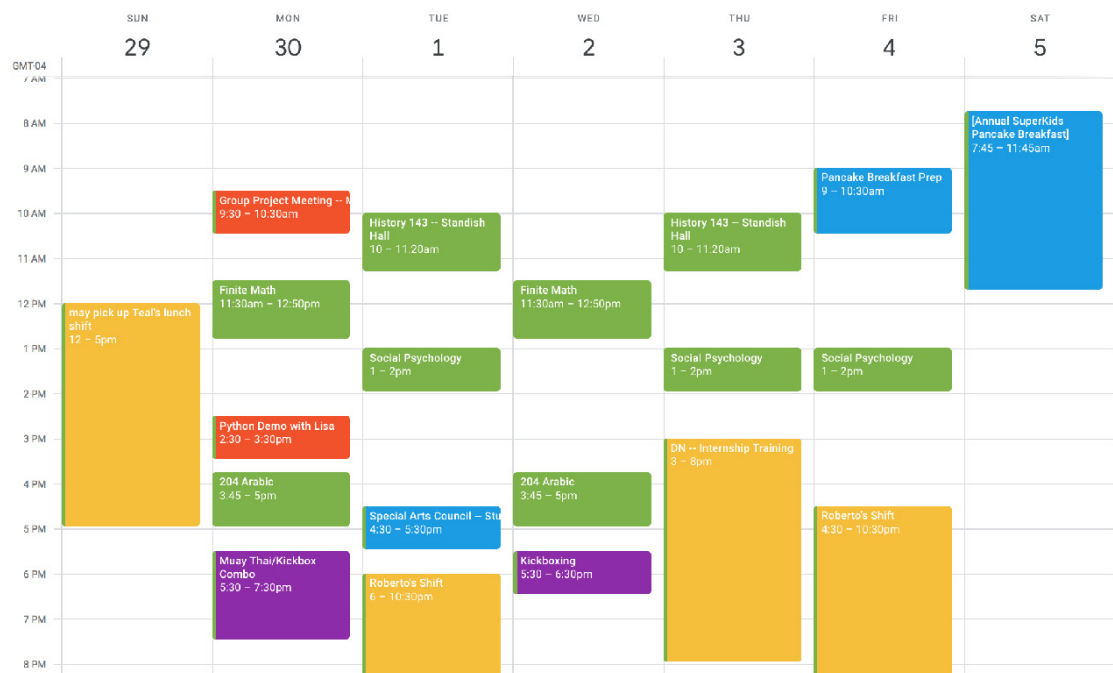


Figure 3.3.7 An

online calendar is a very useful tool for keeping track of classes, meetings, and other events. Most learning management systems contain these features, or you can use a calendar application.

ANALYSIS QUESTION

Read each statement in the brief self-evaluation tool below, and check the answer that best applies to you. There are no right or wrong answers.

Table 3.3

	Always	Usually	Sometimes	Rarely	Never
I like to be given strict deadlines for each task. It helps me stay organized and on track.					
I would rather be 15 minutes early than 1 minute late.					
I like to improvise instead of planning everything out ahead of time.					

	Always	Usually	Sometimes	Rarely	Never
I prefer to be able to manage when and how I do each task.					
I have a difficult time estimating how long a task will take.					
I have more motivation when there is an upcoming deadline. It helps me focus.					
I have difficulty keeping priorities in the most beneficial order.					

This exercise is intended to help you recognize some things about your own time management style. The important part is for you to identify any areas where you might be able to improve and to find solutions for them. This chapter will provide some solutions, but there are many others that can be found by researching time management strategies.

After you have decided your best response to each statement, think about what they may mean in regard to potential strengths and/or challenges for you when it comes to time management in college. If you are a person that likes strict deadlines, what would you do if you took a course that only had one large paper due at the end? Would you set yourself a series of mini deadlines that made you more comfortable and that kept things moving along for you? Or, if you have difficulty prioritizing tasks, would it help you to make a list of the tasks to do and order them, so you know which ones must be finished first?

How to Manage Time

The simplest way to manage your time is to accurately plan for how much time it will take to do each task, and then set aside that amount of time. How you divide the time is up to you. If it is going to take you five hours to study for a final exam, you can plan to spread it over five days, with an hour each night, or you can plan on two hours one night and three hours the next. What you would not want to do is plan on studying only a few hours the night before the exam and find that you fell very short on the time you estimated you would need. If that were to happen, you would have run out of time before finishing, with no way to go back and change your decision. In this kind of situation, you might even be tempted to “pull an all-nighter,” which is a phrase that has been used among college students for decades. In essence it means going without sleep for the entire night and using that time to finish an assignment. While this method of trying to make up for poor planning is common enough to have a name, rarely does it produce the best work.

Table 3.4 Sample Time Estimate Table

Activity	Estimated Time	Actual Time
Practice Quiz	5 minutes	15 minutes
Lab Conclusions	20 minutes	35 minutes
Food shopping	45 minutes	30 minutes
Drive to work	20 minutes	20 minutes
Physical Therapy	1 hour	50 minutes

Of all the parts of time management, accurately predicting how long a task will take is usually the most difficult—and the most elusive. Part of the problem comes from the fact that most of us are not very accurate timekeepers, especially when we are busy applying ourselves to a task. The other issue that makes it so difficult to accurately estimate time on task is that our estimations must also account for things like interruptions or unforeseen problems that cause delays.?

When it comes to academic activities, many tasks can be dependent upon the completion of other things first, or the time a task takes can vary from one instance to another, both of which add to the complexity and difficulty of estimating how much time and effort are required.

For example, if an instructor assigned three chapters of reading, you would not really have any idea how long each chapter might take to read until you looked at them. The first chapter might be 30 pages long while the second is 45. The third chapter could be only 20 pages but made up mostly of charts and graphs for you to compare. By page count, it might seem that the third chapter would take the least amount of time, but actually studying charts and graphs to gather information can take longer than regular reading.?

To make matters even more difficult, when it comes to estimating time on task for something as common as reading, not all reading takes the same amount of time. Fiction, for example, is usually a faster read than a technical manual. But something like the novel *Finnegan's Wake* by James Joyce is considered so difficult that most readers never finish it.

ACTIVITY

To better understand how much time different kinds of material can take to read, try this experiment. You will use two examples of famous texts that are very close to being the same number of words: *The Gettysburg Address* and the opening paragraphs from *A Christmas Carol*. Before you begin, estimate how long it will take you to read each, and predict which you think will take longer. When you do the reading, use a stopwatch function on a device such as a phone or some other timer to see how long it actually takes.

Make certain that you are reading for understanding, not just skimming over words. If you must reread a section to better comprehend what is being said, that is appropriate. The goal here is to compare reading of different texts, not to see how fast you can sight-read the words on a page.

After you have finished *The Gettysburg Address*, read and time *A Christmas Carol* and compare both of your times.

The Gettysburg Address

Abraham Lincoln

Gettysburg, Pennsylvania November 19, 1863

Word count: 278

Four score and seven years ago our fathers brought forth on this continent, a new nation, conceived in Liberty, and dedicated to the proposition that all men are created equal.

Now we are engaged in a great civil war, testing whether that nation, or any nation so conceived and so dedicated, can long endure. We are met on a great battle-field of that war. We have come to dedicate a portion of that field, as a final resting place for those who here gave their lives that that nation might live. It is altogether fitting and proper that we should do this.

But, in a larger sense, we can not dedicate -- we can not consecrate -- we can not hallow -- this ground. The brave men, living and dead, who struggled here, have consecrated it, far above our poor power to add or detract. The world will little note, nor long remember what we say here, but it can never forget what they did here. It is for us the living, rather, to be dedicated here to the unfinished work which they who fought here have thus far so nobly advanced. It is rather for us to be here dedicated to the great task remaining before us -- that from these honored dead we take increased devotion to that cause for which they gave the last full measure of devotion -- that we here highly resolve that these dead shall not have died in vain -- that this nation, under God, shall have a new birth of freedom -- and that government of the people, by the people, for the people, shall not perish from the earth.

A Christmas Carol

Charles Dickens

Chapman & Hall, 1843

Word count: 260

Marley was dead: to begin with. There is no doubt whatever about that. The register of his burial was signed by the clergyman, the clerk, the undertaker, and the chief mourner. Scrooge signed it: and Scrooge's name was good upon 'Change, for anything he chose to put his hand to. Old Marley was as dead as a door-nail.

Mind! I don't mean to say that I know, of my own knowledge, what there is particularly dead about a door-nail. I might have been inclined, myself, to regard a coffin-nail as the deadest piece of ironmongery in the trade. But the wisdom of our ancestors is in the simile; and my unhallowed hands shall not disturb it, or the Country's done for. You will therefore permit me to repeat, emphatically, that Marley was as dead as a door-nail.

Scrooge knew he was dead? Of course he did. How could it be otherwise? Scrooge and he were partners for I don't know how many years. Scrooge was his sole executor, his sole administrator, his sole assign, his sole residuary legatee, his sole friend, and sole mourner. And even Scrooge was not so dreadfully cut up by the sad event, but that he was an excellent man of business on the very day of the funeral, and solemnised it with an undoubted bargain.

The mention of Marley's funeral brings me back to the point I started from. There is no doubt that Marley was dead. This must be distinctly understood, or nothing wonderful can come of the story I am going to relate.

In comparing the two, was one or the other easier to understand or faster to read? Was it the piece you predicted you would read faster?

It is important to note that in this case both readings were only three paragraphs long. While there may have only been half a minute or so between the reading of each, that amount of time would multiply greatly over an entire chapter.

Knowing Yourself

While you can find all sorts of estimates online as to how long a certain task may take, it is important to know these are only averages. People read at different speeds, people write at different speeds, and those numbers even change for each individual depending on the environment.

If you are trying to read in surroundings that have distractions (e.g., conversations, phone calls, etc.), reading 10 pages can take you a lot longer than if you are reading in a quiet area. By the same token, you may be reading in a quiet environment (e.g., in bed after everyone in the house has gone to sleep), but if you are tired, your attention and retention may not be what it would be if you were refreshed.

In essence, the only way you are going to be able to manage your time accurately is to know yourself and to know how long it takes you to do each task. But where to begin?

Below, you will find a table of common college academic activities. This list has been compiled from a large number of different sources, including colleges, publishers, and professional educators, to help students estimate their own time on tasks. The purpose of this table is to both give you a place to begin in your estimates and to illustrate how different factors can impact the actual time spent.

You will notice that beside each task there is a column for the *unit*, followed by the average *time on task*, and a column for notes. The *unit* is whatever is being measured (e.g., pages read, pages written, etc.), and the *time on task* is an average time it takes students to do these tasks. It is important to pay attention to the notes column, because there you will find factors that influence the time on task. These factors can dramatically change the amount of time the activity takes.

Table 3.5 Time on task for common college activities.

Time on Task			
Activity	Unit	Time on task	Notes
General academic reading (textbook, professional journals)	1 page	5–7 minutes	Be aware that your personal reading speed may differ and may change over time.
Technical reading (math, charts and data)	1 page	10–15 minutes	Be aware that your personal reading speed may differ and may change over time.

Time on Task			
Simple Quiz or homework question: short answer—oriented toward recall or identification type answers	Per question	1–2 minutes	Complexity of question will greatly influence the time required.
Complex Quiz or homework question: short answer—oriented toward application, evaluation, or synthesis of knowledge	Per question	2–3 minutes	Complexity of question will greatly influence the time required.
Math problem sets, complex	Per question	15 minutes	For example, algebra, complex equations, financial calculations
Writing: short, no research	Per page	60 minutes	Short essays, single-topic writing assignments, summaries, freewriting assignments, journaling—includes drafting, writing, proofing, and finalizing
Writing: research paper	Per page	105 minutes	Includes research time, drafting, editing, proofing, and finalizing (built into per-page calculation)
Study for quiz	Per chapter	60 minutes	45–90 minutes per chapter, depending upon complexity of material
Study for exam	Per exam	90 minutes	1–2 hours, depending upon complexity of material

Again, these are averages, and it does not mean anything if your times are a little slower or a little faster. There is no “right amount of time,” only the time that it takes you to do something so you can accurately plan and manage your time.

There is also another element to look for in the table. These are differentiations in the similar activities that will also affect the time you spend. A good example of this can be found in the first four rows. Each of these activities involves reading, but you can see that depending on the material being read and its complexity, the time spent can vary greatly. Not only do these differences in time account for the different types of materials you might read (as you found in the comparative reading exercise earlier in this chapter), but also they also take into consideration the time needed to think about what you are reading to truly understand and comprehend what it is saying.

GET CONNECTED

Which apps help you best prepare for success when managing your time?

Do you have trouble keeping track of multiple tasks over the course of a term?

[Trello](#) lets you organize all your obligations in helpful boards. You can share them with others (project collaborators), set alerts as reminders, and mark tasks off as you complete them.

Do you use a particular app to help you manage your time?

Sticky note apps are available for PC, Mac, and mobile devices. They let you post quick reminders, reorganize them as needed, and view them separately or as a full to-do list.

What do you wish you could improve about your time management skills?

[Toggl](#) helps you keep track of how and where you are spending your time so you can budget better and make time management changes that free you up for the really important stuff.

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CHAPTER OVERVIEW

4: Studying and Test-Taking

4.1: Memory

4.2: Studying

4.3: Test Taking

4.4: Pre- Mid- and Post-Test-Taking Strategies

4.5: Collaborative Student Learning- The Art of Study Groups

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4.1: Memory

Questions to consider

- How does working memory work, exactly?
- What's the difference between working and short-term memory?
- How does long-term memory function?
- What obstacles exist to remembering?
- When and how should you memorize things?

In what situations is it best to memorize, and what do you memorize?

What can you do consistently to improve both your short- and long-term memory?

Memory is one of those cherished but mysterious elements in life. Everyone has memories, and some people are very good at rapid recall, which is an enviable skill for test takers. We know that we seem to lose the capacity to remember things as we age, and scientists continue to study how we remember some things but not others and what memory means, but we don't know that much about memory, really.

Nelson Cowan is one researcher who is working to explain what we do know about memory. His article “What Are the Differences between Long-Term, Short-Term, and Working Memory?” breaks down the different types of memory and what happens when we recall thoughts and ideas. When we remember something, we actually do quite a lot of thinking.¹

We go through three basic steps when we remember ideas or images: we encode, store, and retrieve that information. Encoding is how we first perceive information through our senses, such as when we smell a lovely flower or a putrid trash bin. Both make an impression on our minds through our sense of smell and probably our vision. Our brains encode, or label, this content in short-term memory in case we want to think about it again.

If the information is important and we have frequent exposure to it, the brain will store it for us in case we need to use it in the future in our aptly named long-term memory. Later, the brain will allow us to recall or retrieve that image, feeling, or information so we can do something with it. This is what we call remembering.



Figure 4.1.2

Analysis Question

Take a few minutes to list ways you create memories on a daily basis. Do you think about how you make memories? Do you do anything that helps you keep track of your memories?

Foundations of Memory

William Sumrall et al. in the *International Journal of Humanities and Social Science* explain the foundation of memory by noting: “Memory is a term applied to numerous biological devices by which living organisms acquire, retain, and make use of skills and knowledge. It is present in all forms of higher order animals. The most evolutionary forms of memory have taken place in human beings. Despite much research and exploration, a complete understanding of human memory does not exist.”²

Working Memory

Working memory is a type of short-term memory, but we use it when we are actively performing a task. For example, nursing student Marilyn needs to use her knowledge of chemical reactions to suggest appropriate prescriptions in various medical case studies. She does not have to recall every single fact she learned in years of chemistry classes, but she does need to have a working memory of certain chemicals and how they work with others. To ensure she can make these connections, Marilyn will have to review and study the relevant chemical details for the types of drug interactions she will recommend in the case studies.

In working memory, you have access to whatever information you have stored in your memory that helps you complete the task you are performing. For instance, when you begin to study an assignment, you certainly need to read the directions, but you must also remember that in class your professor reduced the number of problem sets the written instructions indicated you needed to finish. This was an oral addition to the written assignment. The change to the instructions is what you bring up in working memory when you complete the assignment.

Short-Term Memory

Short-term memory is a very handy thing. It helps us remember where we set our keys or where we left off on a project the day before. Think about all the aids we employ to help us with short-term memory: you may hang your keys in a particular place each evening so you know exactly where they are supposed to be. When you go grocery shopping, do you ever choose a product because you recall an advertising jingle? You see the box of cereal and you remember the song on the TV commercial. If that memory causes you to buy that product, the advertising worked. We help our memory along all the time, which is perfectly fine. In fact, we can modify these everyday examples of memory assistance for purposes of studying and test taking. The key is deliberate use of strategies that are not so elaborate that they are too difficult to remember in our short-term memory.

Activity

Consider this list of items. Look at the list for no more than 30 seconds. Then, cover up the list and use the spaces below to complete an activity.

Baseball	Picture frame	Tissue	Paper clip
Bread	Pair of dice	Fingernail polish	Spoon
Marble	Leaf	Doll	Scissors
Cup	Jar of sand	Deck of cards	Ring
Blanket	Ice	Marker	String

Without looking at the list, write down as many items as you can remember.

Now, look back at your list and make sure that you give yourself credit for any that you got right. Any items that you misremembered, meaning they were not in the original list, you won't count in your total. TOTAL ITEMS REMEMBERED

_____.

There were 20 total items. Did you remember between 5 and 9 items? If you did, then you have a typical short-term memory and you just participated in an experiment, of sorts, to prove it.

Harvard psychology professor George A. Miller in 1956 claimed humans can recall about five to nine bits of information in our short-term memory at any given time. Other research has come after this claim, but this concept is a popular one. Miller's article is entitled "The Magical Number Seven, Plus or Minus Two" and is easily accessible online if you're interested in learning more about this seminar report.³

Considering the vast amount of knowledge available to us, five to nine bits isn't very much to work with. To combat this limitation, we clump information together, making connections to help us stretch our capacity to remember. Many factors play into how much we can remember and how we do it, including the subject matter, how familiar we are with the ideas, and how interested we are in the topic, but we certainly cannot remember absolutely everything, for a test or any other task we face. As such, we have to use effective strategies, like those we cover later in this chapter, to get the most out of our memories.

Activity

Now, let's revisit the items above. Go back to them and see if you can organize them in a way that you would have about five groups of items. See below for an example of how to group them.

Row 1: Items found in a kitchen

Row 2: Items that a child would play with

Row 3: Items of nature

Row 4: Items in a desk drawer/school supplies

Row 5: Items found in a bedroom

Cup	Spoon	Ice	Bread	
Baseball	Marble	Pair of dice	Doll	Deck of cards
Jar of sand	Leaf			
Marker	String	Scissors	Paper clip	
Ring	Picture frame	Fingernail polish	Tissue	Blanket

Now that you have grouped items into categories, also known as chunking, you can work on remembering the categories and the items that fit into those categories, which will result in remembering more items. Check it out below by covering up the list of items again and writing down what you can remember.

Now, look back at your list and make sure that you give yourself credit for any that you got right. Any items that you misremembered, meaning they were not in the original list, you won't count in your total. TOTAL ITEMS REMEMBERED _____. Did you increase how many items you could remember?

Long-Term Memory

Long-term memory is exactly what it sounds like. These are things you recall from the past, such as the smell of your elementary school cafeteria or how to pop a wheelie on a bicycle. Our brain keeps a vast array of information, images, and sensory experiences in long-term memory. Whatever it is we are trying to keep in our memories, whether a beautiful song or a list of chemistry vocabulary terms, must first come into our brains in short-term memory. If we want these fleeting ideas to transfer into long-term memory, we have to do some work, such as causing frequent exposure to the information over time (such as studying the terms every day for a period of time or the repetition you performed to memorize multiplication tables or spelling rules) and some relevant manipulation for the information.

According to Alison Preston of the University of Texas at Austin's Center for Learning and Memory, "A short-term memory's conversion to a long-term memory requires changes within the brain . . . and result[s] in changes to neurons (nerve cells) or sets of neurons. . . . For example, new synapses—the connections between neurons through which they exchange information—can form to allow for communication between new networks of neurons. Alternatively, existing synapses can be strengthened to allow for increased sensitivity in the communication between two neurons."⁴

When you work to convert your thoughts into memories, you are literally *changing your mind*. Much of this brain work begins in the part of the brain called the *hippocampus*. Preston continues, "Initially, the hippocampus works in concert with sensory-processing regions distributed in the neocortex (the outermost layer of the brain) to form the new memories. Within the neocortex, representations of the elements that constitute an event in our life are distributed across multiple brain regions according to their content. . . . When a memory is first formed, the hippocampus rapidly combines this distributed information into a single memory, thus acting as an index of representations in the sensory-processing regions. As time passes, cellular and molecular changes allow for the strengthening of direct connections among the neocortical regions, enabling access to the memory independent of the hippocampus."

We learn the lyrics of a favorite song by singing and/or playing the song over and over. That alone may not be enough to get that song into the coveted long-term memory area of our brain, but if we have an emotional connection to the song, such as a painful breakup or a life-changing proposal that occurred while we were listening to the song, this may help. Think of ways to make your study session memorable and create connections with the information you need to study. That way, you have a better chance of keeping your study material in your memory so you can access it whenever you need it.

Analysis Question

What are some ways you convert short-term memories into long-term memories?

Do your memorization strategies differ for specific courses (e.g., how you remember for math or history)?

Obstacles to Remembering

If remembering things we need to know for exams or for learning new disciplines were easy, no one would have problems with it, but students face several significant obstacles to remembering, including a persistent lack of sleep and an unrealistic reliance on cramming. Life is busy and stressful for all students, so you have to keep practicing strategies to help you study and remember successfully, but you also must be mindful of obstacles to remembering.

Lack of Sleep

Let's face it, sleep and college don't always go well together. You have so much to do! All that reading, all those papers, all those extra hours in the science lab or tutoring center or library! And then we have the social and emotional aspects of going to school, which may not be the most critical aspect of your life as you pursue more education but are a significant part of who you are. When you consider everything you need to attend to in college, you probably won't be surprised that sleep is often the first thing we give up as we search for more time to accomplish everything we're trying to do. That seems reasonable—just wake up an hour earlier or stay up a little later. But you may want to reconsider picking away at your precious sleep time.

Sleep benefits all of your bodily functions, and your brain needs sleep time to dream and rest through the night. You probably can recall times when you had to do something without adequate sleep. We say things like “I just can't wake up” and “I'm walking around half asleep.”

In fact, you may actually be doing just that. Lack of sleep impairs judgment, focus, and our overall mood. Do you know anyone who is always grumpy in the morning? A fascinating medical study from the University of California Los Angeles (UCLA) claims that sleep deprivation is as dangerous as being drunk, both in what it does to our bodies and in the harm we may cause to ourselves and others in driving and performing various daily tasks.⁵⁶

If you can't focus well because you didn't get enough sleep, then you likely won't be able to remember whatever it is you need to recall for any sort of studying or test-taking situation. Most exams in a college setting go beyond simple memorization, but you still have a lot to remember for exams. For example, when Saanvi sits down to take an exam on introductory biology, she needs to recall all the subject-specific vocabulary she read in the textbook's opening chapters, the general connections she made between biological studies and other scientific fields, and any biology details introduced in the unit for which she is taking the exam.

Trying to make these mental connections on too little sleep will take a large mental toll because Saanvi has to concentrate even harder than she would with adequate sleep. She isn't merely tired; her brain is not refreshed and primed to conduct difficult tasks. Although not an exact comparison, think about when you overtax a computer by opening too many programs simultaneously. Sometimes the programs are sluggish or slow to respond, making it difficult to work efficiently; sometimes the computer shuts down completely and you have to reboot the entire system. Your body is a bit like that on too little sleep.

On the flip side, though, your brain on adequate sleep is amazing, and sleep can actually assist you in making connections, remembering difficult concepts, and studying for exams. The exact reasons for this is still a serious research project for scientists, but the results all point to a solid connection between sleep and cognitive performance.

If you're interested in learning more about this research, the American Academy of Sleep Medicine (AASM) is a good place to start. One article is entitled “College Students: Getting Enough Sleep Is Vital to Academic Success.”

Analysis Question

How long do you sleep every night on average? Do you see a change in your ability to function when you haven't had enough sleep? What could you do to limit the number of nights with too little sleep?

Downside of Cramming

At least once in their college careers, most students will experience the well-known pastime called *cramming*. See if any of this is familiar: Shelley has lots of classes, works part-time at a popular restaurant, and is just amazingly busy, so she puts off serious study sessions day after day. She isn't worried because she has set aside time she would have spent sleeping to cram just before the exam. That's the idea anyway. Originally, she planned to stay up a little late and study for four hours from 10 p.m. to 2 a.m. and still get several hours of refreshing sleep. But it's Dolphin Week or Beat State Day or whatever else comes up, and her study session doesn't start until midnight—she'll pull an *all-nighter* (to be more precise, this is actually an *all-really-early-morning-er*, but it doesn't quite have the same ring to it). So, two hours after her original start time, she tries to *cram* all the lessons, problems,

and information from the last two weeks of lessons into this one session. Shelley falls asleep around 3 a.m. with her notes and books still on her bed. After her late night, she doesn't sleep well and goes into the morning exam tired.

Shelley does OK but not great on the exam, and she is not pleased with her results. More and more research is showing that the stress Shelley has put on her body doing this, combined with the way our brains work, makes cramming a seriously poor choice for learning.

One sleep researcher, Dr. Susan Redline from Boston, says, "Sleep deficiency can affect mood and the ability to make memories and learn, but it also affects metabolism, appetite, blood pressure, levels of inflammation in the body and perhaps even the immune response."⁷

Your brain simply refuses to cooperate with cramming—it sounds like a good idea, but it doesn't work. Cramming causes stress, which can lead to paralyzing test anxiety; it erroneously supposes you can remember and understand something fully after only minimal exposure; and it overloads your brain, which, however amazing it is, can only focus on one concept at a time and a limited number of concepts all together for learning and retention.

Leading neuroscientist John Medina claims that the brain begins to wander at about 10 minutes, at which point you need a new stimulus to spark interest.⁸ That doesn't mean you can't focus for longer than 10 minutes; you just have to switch gears a lot to keep your brain engaged. Have you ever heard a speaker drone on about one concept for, say, 30 minutes without somehow changing pace to engage the listeners? It doesn't take much to re-engage—pausing to ask the listeners questions or moving to a different location in the room will do it—but without these subtle attention markers, listeners start thinking of something else. The same thing happens to you if you try to cram all reading, problem-solving, and note reviewing into one long session; your brain will wander.

WHAT STUDENTS SAY

1. Which of the following is your most common method of studying?
 - a. Reading or rereading the text or my class notes.
 - b. Watching videos of my instructor's lecture or other people discussing the topics.
 - c. Taking practice quizzes/tests.
 - d. Creating/using study tools (flashcards, mnemonic devices, etc.)
 - e. Working with a study group, tutor, or academic support.
2. Which of the following do you have the most difficulty remembering?
 - a. Vocabulary and facts (such as Biology vocab, Historical facts.)
 - b. Problem-solving methods (such as in Math)
 - c. Details from text and literature
 - d. Skills and processes (such as a lab technique or a building process)
 - e. Computer functions/locations/processes
 - f. Which formulas, processes, or categories to apply in situations (such as in Physics or Accounting)
3. How much anxiety do you feel when an exam or other major course evaluation is approaching?
 - a. A great deal
 - b. A lot
 - c. A moderate amount
 - d. A little
 - e. None at all

You can also take the anonymous What [Students Say](#) surveys to add your voice to this textbook. Your responses will be included in updates.

Students offered their views on these questions, and the results are displayed in the graphs below.

Which of the following is your most common method of studying?

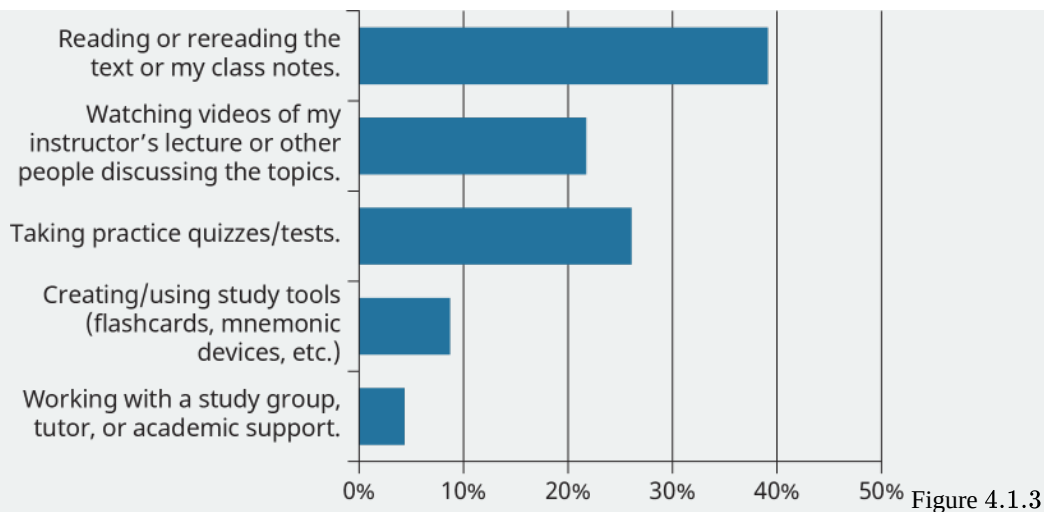


Figure 4.1.3

Which of the following do you have the most difficulty remembering?

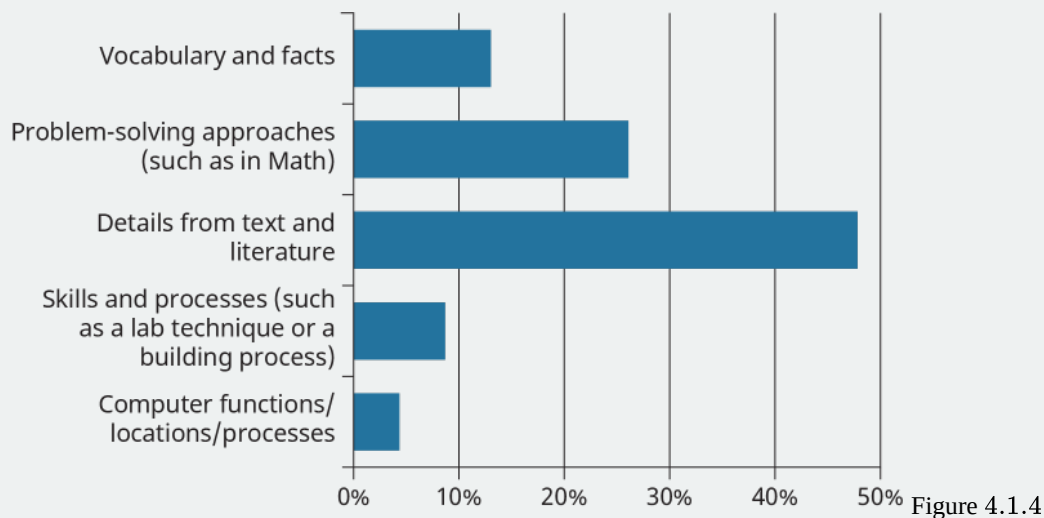


Figure 4.1.4

How much anxiety do you feel when an exam or other major course evaluation is approaching?

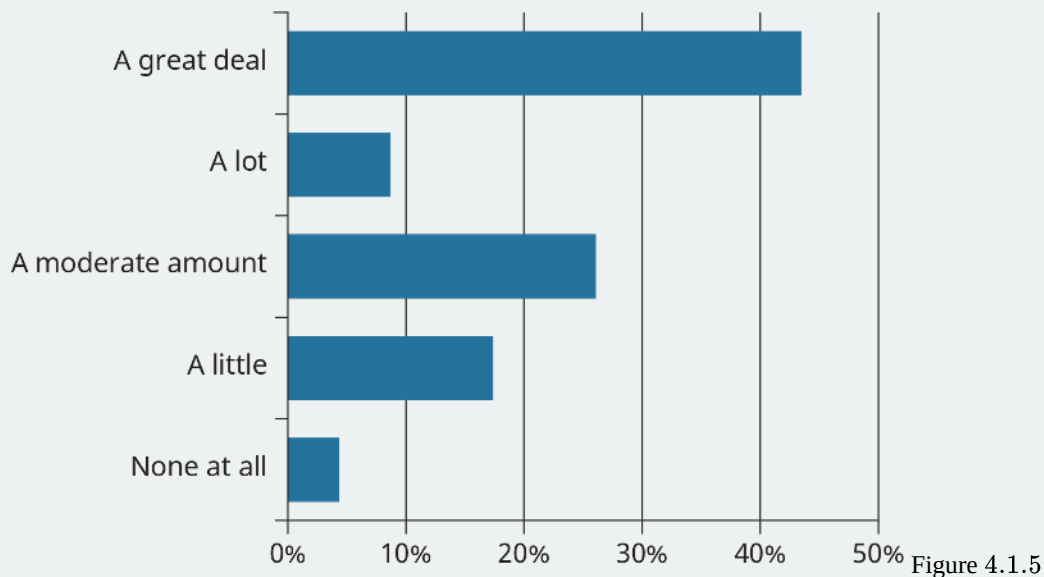


Figure 4.1.5

Determining When/What to Memorize

In the realm of learning and studying, some conditions warrant memorization as the most effective way to work with information. For instance, if you are expected to have a working knowledge of conversational French or Spanish, you will have to memorize some words. Simply knowing a long list of terms isn't going to help you order food in a café or ask for directions in a foreign country because you also need to understand the other language's grammar and have some sort of context for what needs to be said from your vocabulary list. But you cannot say the words in a different language if you cannot remember your vocabulary. From this scenario, you can assume that memorization is a good fit for some parts of language acquisition.

A worthwhile book on memory, thinking, and learning is a short study called *Make It Stick: The Science of Successful Learning* by Peter Brown, Henry Roediger, and Mark McDaniel. The authors conclude, after extensive research, that our attempts to speed up learning and make studying easier are not good ideas. Studying is hard work, and it should be. For learning to *stick*, we need to work hard to pull the information out of our memory and use it by continually pushing ourselves to accomplish increasingly difficult tasks.⁹

Footnotes

- NCBI. "What are the differences between long-term, short-term, and working memory?" www.ncbi.nlm.nih.gov/pmc/articles/PMC2657600/
- Sumrall, William, et. al. "A Review of Memory Theory." International Journal of Humanities and Social Science, 2016. Vol. 6. No. 5.
- Miller, George A. "The Magical Number Seven, Plus or Minus Two: Some Limits on Our capacity for Processing Information." Psychological Review, 1956.
- Preston, Alison. "Ask the Experts: How do short-term memories become long-term memories?" Scientific American, Dec. 2017. <https://www.scientificamerican.com/a...ries-become-l/>
- Nir, Yuval, et. al. "Selective neuronal lapses precede human cognitive lapses following sleep deprivation," Nature Medicine volume23, pages 1474–1480 (2017).
- UCLA Health. "Drowsy Driving." <https://www.uclahealth.org/sleepcenter/drowsy-driving>
- Redline, Susan <https://abcnews.go.com/Health/Sleep/...ry?id=16524313>
- Medina, John. Brain Rules. 2018, Pear Press.
- Brown, Peter, et. al. Make It Stick: The Science of Successful Learning. Brown, Roediger, Daniel, 2014.

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4.2: Studying

Questions to consider

- How do you prepare yourself and your environment for successful studying?
- What study strategies will be most beneficial to you?
- What are learning preferences and strategies, and how can you leverage those to your advantage?

Preparing to Study

Studying is hard work, but you can still learn some techniques to help you be a more effective learner. Two major and interrelated techniques involve avoiding distractions to the best of your ability and creating a study environment that works to help you concentrate.

Avoiding Distractions

We have always had distractions—video games, television shows, movies, music, friends—even housecleaning can distract us from doing something else we need to do, like study for an exam. That may seem extreme, but sometimes vacuuming is the preferred activity to buckling down and working through calculus problems! Cell phones, tablets, and portable computers that literally bring a world of possibilities to us anywhere have brought *distraction* to an entirely new level. When was the last time you were with a large group of people when you didn't see at least a few people on devices?



Figure 4.2.6 Video games are a common distraction, but we need to be aware that even tedious activities like cleaning can be a distraction from studying.

When you study, your biggest challenge may be to block out all the competing noise. And letting go of that connection to our friends and the larger world, even for a short amount of time, can be difficult. Perhaps the least stressful way to allow yourself a distraction-free environment is to make the study session a definite amount of time: long enough to get a significant amount of studying accomplished but short enough to hold your attention.

You can increase that attention time with practice and focus. Pretend it is a professional appointment or meeting during which you cannot check e-mail or texts or otherwise engage with your portable devices. We have all become very attached to the ability to check in—anonously on social media or with family and friends via text, chat, and calls. If you set a specific amount of time to study without interruptions, you can convince your wandering mind that you will soon be able to return to your link to the outside world. Start small and set an alarm—a 30-minute period to review notes, then a brief break, then another 45-minute study session to quiz yourself on the material, and so on.

When you prepare for your optimal study session, remember to do these things:

- Put your phone out of sight—in another room or at least some place where you will not see or hear it vibrate or ring. Just flipping it over is not enough.
- Turn off the television or music (more on that in the next section).

- Unless you are deliberately working with a study group, study somewhere alone if possible or at least away from others enough to not hear them talking.

If you live with lots of other people or don't have access to much privacy, see if you can negotiate some space alone to study. Ask others to leave one part of the house or an area in one room as a quiet zone during certain hours. Ask politely for a specific block of time; most people will respect your educational goals and be willing to accommodate you. If you're trying to work out quiet zones with small children in the house, the bathtub with a pillow can make a fine study oasis.

Study Environment

You may not always be in the mood or inspired to study. And if you have a long deadline, maybe you can blow off a study session on occasion, but you shouldn't get into the habit of ignoring a strong study routine. Jane Austen once wrote in a letter, "I am not at all in a humor for writing; I must write on till I am." Sometimes just starting is the hard part; go ahead and begin. Don't wait around for your study muse; start working, and she'll show up.

Sometimes you just need to plop down and study whenever and wherever you can manage—in the car waiting for someone, on the bus, at the Little League field as you cheer on your shortstop. And that's OK if this is the exception. For long-term success in studying, though, you need a better study setting that will help you get the most out of your limited study time. Whatever your space limitations, carve out a place that you can dedicate to reading, writing, note taking, and reviewing. This doesn't need to be elaborate and expensive—all you truly need is a flat surface large enough to hold either your computer or writing paper, book or notes, pens/pencils/markers, and subject-specific materials you may need (e.g., stand-alone calculators, drawing tools, and notepads). Your space should be cool or warm enough for you to be comfortable as you study. What do you have now that you consider your study space? Is it set up for your optimal success?



Figure 4.2.7 Which is before, and

which is after? (Credit: Ali West / Flickr / Attribution 2.0 Generic (CC-BY 2.0))

If it is at all possible, try to make this area exclusive to your study sessions and something you can leave set up all the time and a place out of the way of family or roommate traffic. For example, Martina thought setting up her study station on the dining room table was a good idea at first. The view was calming, and the table was big enough to spread out and could even hold all her materials to study architectural drawings, her favorite subject. But then she needed the table for a small family dinner party, so she had to find a cubbyhole to hide away her supplies with some needing to go into a closet in the next room. Now she was spread out over multiple study spaces. And the family TV was in an adjacent room, not visible from the table but certainly an auditory distraction. Martina ultimately decided to forgo her view and create a smaller station in an unused bedroom so she could leave her supplies out and have a quieter area. You may have to try out numerous places to determine what works best for you.

Wherever you study, try to make it a welcoming place you want to be in—not an uncomfortable environment that makes you want to just do the minimum you must complete and leave. You should include the basics: a good chair, a work surface, and whatever materials, books, notes, and other supplies you need for the subject you are studying. If you want to make it even more of a productive place, you can look in magazines for ideas or search the web to see how others have set up simple areas or more elaborate arrangements. Don't let decorating your workspace be an excuse to get out of studying!

You don't need an elaborate setting, but you may want to consider including a few effective additions if you have the space:

- small bulletin board for often-used formulas
- encouraging quotes or pictures of your goal
- whiteboard for brainstorming
- sticky notes for reminders in texts and notes

- file holder for most-used documents
- bookshelf for reference books

Activity

Describe every element in your ideal study environment and explain why it's there as well as how it will make more efficient use of your time, limit distractions, or in some other way strengthen your ability to study.

After you have described your ideal study environment, think about how you can adapt that environment if you cannot be in your favorite place to study. How do you *make your own space* in the library, a student lounge, or a dedicated space on campus for student studying?

Debunking Study Myths

MYTH #1: You can multitask while studying.

How many times do you eat in the car? Watch TV while you write out a grocery list? Listen to music while you cook dinner? What about type an e-mail while you're on the phone with someone else and jot down notes about the call? The common term for this attempt to do more than one thing at a time is multitasking, and almost everyone does it at some point. On some days, you simply cannot accomplish all that you want to get done, so you double up. The problem is, multitasking doesn't really work. Of course, it exists, and we do it. For instance, we walk and chew gum or drive and talk, but we are not really thinking about two or more distinct things or doing multiple processes simultaneously.

MYTH #2: Highlighting main points of a text is useful.

Another myth of studying that seems to have a firm hold is that the idea of highlighting text—in and of itself—is the best way to review study material. It is one way, and you can get some benefit from it, but don't trick yourself into spending too much time on this surface activity and consider your study session complete. Annotating texts or notes is a first-step type of study practice. If you allow it to take up all your time, you may want to think you are fully prepared for an exam because you put in the time. Actually, you need much more time reviewing and retrieving your lessons and ideas from the text or class lecture as well as quizzing yourself to accomplish your goal of learning so you can perform well on the exam. Highlighting is a task you can do rather easily, and it makes you feel good because you are actively engaging with your text, but true learning needs more steps.

MYTH #3: Studying effectively is effortless.

There is nothing effortless, or even pleasant at times, about studying. This is why so many students don't put in the time necessary to learn complex material: it takes time, effort, and, in some cases, a little drudgery. This is not to say that the outcome, learning—and maybe making an A—is not pleasant and rewarding. It is just that when done right, learning takes focus, deliberate strategies, and time. Think about a superstar athlete who puts in countless hours of drills and conditioning so that she makes her work on the field look easy. If you can also *enjoy* the studying, the skill development, and the knowledge building, then you will most likely be more motivated to do the work.

Analysis Question

When are you most liable to multitask? How could you be more aware of this practice and try to eliminate it, especially when it comes to studying? How can you make your initial text highlighting more time efficient so you can include other study practices?

Study Strategies

Everyone wishes they had a better memory or a stronger way to use memorization. You can make the most of the memory you have by making some conscious decisions about how you study and prepare for exams. Incorporate these ideas into your study sessions:

Practicing effective memorization is when you use a trick, technique, or strategy to recall something—for another class, an exam, or even to bring up an acquaintance's name in a social situation. Really whatever works for you to recall information is a good tool to have. You can create your own quizzes and tests to go over material from class. You can use mnemonics to jog your memory. You can work in groups to develop unique ways to remember complex information. Whatever methods you choose to enhance your memory, keep in mind that repetition is one of the most effective tools in any memory strategy. Do whatever you do over and over for the best results.

Using Mnemonics

Mnemonics (pronounced new-monics) are a way to remember things using reminders. Did you learn the points of the compass by remembering NEWS (north, east, west, and south)? Or the notes on the music staff as FACE or EGBDF (every good boy does fine)? These are mnemonics. When you're first learning something and you aren't familiar with the foundational concepts, these help you bring up the information quickly, especially for multistep processes or lists. After you've worked in that discipline for a while, you likely don't need the mnemonics, but you probably won't forget them either.

Here are some familiar mnemonics you may find useful:



Figure 4.2.8

You can certainly make up your own mnemonics, but be careful that your reminder isn't so complex and convoluted that it is more difficult to remember than the information you were relating it to!

Analysis Question

Do you have other mnemonics that help you remember difficult material? What are they? How have they helped you with remembering important things?

Practicing Concept Association

When you study, you're going to make connections to other things—that's a good thing. It shows a highly intelligent ability to make sense of the world when you can associate like and even somewhat unlike components. If, for instance, you were reading Martin Luther King Jr.'s "Letter from a Birmingham Jail," and you read the line that he had been in Birmingham, you may remember a trip you took with your family last summer through Alabama and that you passed by and visited the civil rights museum in Birmingham. This may remind you of the different displays you saw and the discussions you had with your family about what had happened concerning civil rights in the 1950s, '60s, and '70s in the United States.

This is a good connection to make, but if your assignment is to critique the literary aspects of King's long epistle, you need to be able to come back to the actual words of the letter and see what trends you can see in his writing and why he may have used his actual words to convey the powerful message. The connection is fine, but you can't get lost in going down rabbit holes that may or may not be what you're supposed to be doing at the time. Make a folder for this assignment where you can put things such as a short summary of your trip to Alabama. You may eventually include notes from this summary in your analysis. You may include something from a website that shows you information about that time period. Additionally, you could include items about Martin Luther King Jr.'s life and death and his work for civil rights. All of these elements may help you understand the significance of this one letter, but you need to be cognizant of what you're doing at the time and remember it is not usually a good idea to just try to

keep it all in your head. The best idea is to have a way to access this information easily, either electronically or in hard copy, so that if you are able to use it, you can find it easily and quickly.

Generating Idea Clusters

Like mnemonics, idea clusters are nothing more than ways to help your brain come up with ways to recall specific information by connecting it to other knowledge you already have. For example, Andrea is an avid knitter and remembers how to create complicated stitches by associating them with nursery rhymes she read as a child. A delicate stitch that requires concentration because it makes the yarn look like part of it is hiding brings to mind Red Riding Hood, and connecting it to that character helps Andrea recall the exact order of steps necessary to execute the design. You can do the same thing with song lyrics, lines from movies, or favorite stories where you draw a connection to the well-known phrase or song and the task you need to complete.

Application

Choose one of the following, and create an idea cluster to group and organize:

- Example A: aviation jobs in North America
- Example B: the use of analytics in sports to determine team rosters
- Example C: how social media affects political campaigns

Start the idea cluster with the topic circled in the middle of the page. For Example A, you might make one cluster off the main circle for specific positions; you could add another cluster for salary ranges and another for geographic regions.

Three Effective Study Strategies

There are more than three study strategies, but focusing on the most effective strategies will make an enormous difference in how well you will be able to demonstrate learning (also known as “acing your tests”). Here is a brief overview of each of the three strategies:

- Spacing—This has to do with *when* you study. Hint: Don’t cram; study over a period of days, preferably with “breaks” in between.
- Interleaving—This has to do with *what* you study. Hint: Don’t study just one type of content, topic, chapter, or unit at a time; instead, mix up the content when you study.
- Practice testing—This has to do with *how* you study. Hint: Don’t just reread content. You must quiz or test your ability to retrieve the information from your brain.

Spacing

We all know that cramming is not an effective study strategy, but do we know why? Research on memory suggests that giving yourself time in between study sessions actually helps you forget the information. And forgetting, which sounds like it would be something you *don’t* want to do, is actually good for your ability to remember information long-term. That’s because every time you forget something, you need to relearn it, leading to gains in your overall understanding and “storage” of the material. The table below demonstrates how spacing works. Assume you are going to spend about four hours studying for a Sociology exam. Cramming would have you spending most of those four hours the night before the exam. With spacing, on the other hand, you would study a little bit each day.

Table 6.1

Spacing							
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Cramming				Study for 1 hour	Study for 3		
Spacing	Study for 1 hour		Study for 30 minutes	Study for 1 hour	Study for 90 minutes		

Interleaving

One particular studying technique is called interleaving, which calls for students to mix up the content that is being studied. This means not just spending the entire study session on one sort of problem and then moving on to a different sort of problem at a later

time.

If you take the schedule we used for the spacing example above, we can add the interleaving concepts to it. Notice that interleaving includes revisiting material from a previous chapter or unit or revisiting different types of problems or question sets. The benefit is that your brain is “mixing up” the information, which can sometimes lead to short-term forgetting but can lead to long-term memory and learning.

Table 6.2

Interleaving					
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday
Reread Sociology, Chapter 1. Reorganize notes		Reread Sociology, Chapter 1 and 2 Take Ch 1 online quiz. Create Chapter 2 concept map	Reread Sociology, Chapters 1-3. Take online quizzes for chapters 2 and 3. Reorganize notes. Create practice test	Reread notes. Review items missed on online quizzes. Take practice test and review challenge areas.	TEST in sociology, Chapters 1-3

Practice Testing

You can do a practice “test” in two ways. One is to test yourself as you are reading or taking in information. This is a great way to add a little variety to your studying. You can ask yourself what a paragraph or text section means as you read. To do this, read a passage in a text, cover up the material, and ask yourself, “What was the main idea of this section?” Recite aloud or write down your answer, and then check it against the original information.

Another, more involved, way to practice test is to create flashcards or an actual test by writing a test. This takes more time, but there are online programs such as Quizlet that make it a little easier. Practice testing is an effective study strategy because it helps you practice *retrieving* information, which is what you want to be able to do when you are taking the real test.

One of the best ways to learn something is to teach it to someone else, so ask a friend or family member if you can explain something to them, and *teach* them the lesson. You may find you know more about the subject than you thought . . . or you may realize quickly that you need to do more studying. Why does teaching someone else rank as one of the most effective ways to learn something? It is a form of practice testing that requires you to demonstrate you know something in front of someone else! No one wants to look like they don’t know what they are talking about, even if it your audience is another classmate.

Recognizing Strengths/Weaknesses of Preferred Study Approaches

Most children don’t learn to ride a bicycle by reading a manual; they learn by watching other kids, listening to instructions, and getting up on the seat and learning to balance—sometimes with training wheels or a proud parent holding on, but ultimately without any other support. They may fall over and feel insecure, but usually, they learn to make the machine go. Most of us employ multiple methods of study all the time. You usually only run into trouble if you stubbornly rely on just one way to learn or study and the material you’re studying or the task you want to accomplish doesn’t lend itself to that preference. You can practice specific strategies to help you learn in your preferred learning approach. Can you think of a time when the way you usually study a situation didn’t work?

When deciding on a study approach, consider what you know about the material and the type of knowledge it involves. Is it a group of concepts related to problem-solving methods, such as those you’d find in a physics class? Or is it a literary analysis of a novel? Consider as many elements as possible about the material -- and the way the material will be assessed -- to help choose a study approach.

You should also consider your instructor’s preferred method of teaching and learning. Watching the way they teach lessons or convey necessary course information to the class. Do they almost always augment lessons with video clips to provide examples or create a memorable narrative? Do they like to show you how something works by demonstrating and working with their hands—for instance, assembling a piece of equipment by taking it apart and putting it back together again? Echoing their teaching approach may help your study. That doesn’t mean you have to change your entire learning approach to match your instructors’ methods. Many instructors understand that their students will have different ways of learning and try to present information in multiple ways.

Practicing Active Continuous Improvement for All Preferences

You can certainly learn through specific approaches or according to specific preferences, but you will also need to adapt to different situations, skills, and subject areas. Don't limit yourself to thinking you can *only* learn one way or another. That mindset induces anxiety when you encounter a learning situation that doesn't match your preference. What if your instructor *only* uses a spoken lecture to teach concepts in your chemistry class, and you consider yourself a visual learner? Or what if the only method presented to you for learning mathematical computations is to see videos of others working problems, and you're more hands-on? You may have to concentrate in a different way or devise other strategies to learn, but you can do it. In fact, you should sometimes work on the styles/preferences that you feel are your least favorite; it will actually strengthen your overall ability to learn and retain information.¹⁰

Dr. Stephen Covey, famous leadership coach and businessman, called this attention to knowing and honing all your skill sets, not just your favorites, *sharpening the saw*. He advised that people should be aware of their strengths but should always hone their weaknesses by saying, "We must never become too busy sawing to take time to sharpen the saw."¹¹ For instance, in the chemistry lecture example, you may need to take good notes from the spoken lecture and then review those notes as you sketch out any complex ideas or formulas. If the math videos are not enough for you to grasp difficult problems, you may ask for or find your own problems for additional practice covering that particular mathematical concept to solve on your own.

Footnotes

- Newton, Phillip M., & Miah, Mahallad. "Evidence-Based Higher Education—Is the Learning Style 'Myth' Important?" *Frontiers in Psychology* 8:444 (2017) DOI: 10. 3389/FPSYG. 2017.00444.
- Covey, Stephen. The 7 Habits of Highly Effective People ® www.franklincovey.com/the-7-habits.html

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4.3: Test Taking

Questions to consider

- What are the differences between test prep and taking the actual test?
- How can you take a *whole person* approach to test taking?
- What can you do on test day to increase your confidence and success?
- What should you know about test anxiety?

Once you are practicing good study habits, you'll be better prepared for actual test taking. Since studying and test taking are both part of learning, honing your skills in one will help you in the other.

Probably the most obvious differences between your preparation for an exam and the actual test itself is your level of urgency and the time constraints. A slight elevation in your stress level can actually be OK for testing—it keeps you focused and *on your game* when you need to bring up all the information, thinking, and studying to show what you've learned. Properly executed, test preparation mixed in with a bit of stress can significantly improve your actual test-taking experience.

Preparation vs. Actual Test

You can replicate the effective sense of urgency an actual test produces by including timed writing into your study sessions. You don't need all of your study time to exactly replicate the test, but you would be well served to find out the format of the exam in advance and practice the skills you'll need to use for the various test components. On one early exam in history, Stuart learned the prof was going to include several short-answer essay questions—one for each year of the time period covered. Stuart set up practice times to write for about 15 to 20 minutes on significant events from his notes because he estimated that would be about how much time he could devote out of the hour-long testing session to write one or two required short-answer questions. He would write a prompt from his notes, set a timer, and start writing. If you're ready and you have practiced and know the material, 20 minutes is adequate to prepare, draft, and revise a short response, but you don't have a lot of extra time.

Likewise, in a math exam, you will need to know what kinds of problems you will have to solve and to what extent you'll need to show your computational work on the exam. If you are able to incorporate this sort of timed problem-solving into your study time, you'll be more prepared and confident when you actually come to the exam. Making yourself adhere to a timed session during your study can only help. It puts a sense of urgency on you, and it will help you to find out what types of problems you need to practice more than ones that perhaps you're more comfortable solving.

Leveraging Study Habits for Test Prep

In your mind, you probably know what you need to do to be prepared for tests. Occasionally, something may surprise you—emphasis on a concept you considered unimportant or a different presentation of a familiar problem. But those should be exceptions. You can take all your well-honed study habits to get ready for exams. Here's a checklist for study and test success for your consideration:



Figure 4.3.9

Read this list with each separate class in mind, and check off the items you already do. Give yourself one point for every item you checked. If you always take the success steps—congratulations! They are not a guarantee, but doing the steps mindfully will give you a nice head start. If you do fewer than five of the steps—you have some work to do. But recognition is a good place to start, and you can incorporate these steps starting now.

As strange as this may sound, you can find some interesting research articles online about using the taste or smell of peppermint to increase memory, recall, and focus. Read more at: <http://naturalsociety.com/mint-scent...gnition-memory>. While sucking on a peppermint disk won't replace studying, why not experiment with this relatively easy idea that seems to be gaining some scientific traction?

Whole Person Approach to Testing

Just because you are facing a major exam in your engineering class (or math or science or English class) doesn't mean everything else in your life comes to a stop. Perhaps that's somewhat annoying, but that's reality. Allergies still flare up, children still need to eat, and you still need to sleep. You must see your academic life as one segment of who you are—it's an important segment, but just one aspect of who you are as a whole person. Neela tries to turn off everything else when she has exams coming up in her nursing program, which is pretty often. She ignores her health, puts off her family, tries to reschedule competing work tasks, and focuses all her energy on the pending exam. On the surface, that sounds like a reasonable approach, but if she becomes really sick by ignoring a minor head cold, or if she misses an important school deadline for one of her children, Neela risks making matters worse by attempting to compartmentalize so strictly. Taking care of her own health by eating and sleeping properly; asking for help

in other aspects of her busy life, such as attending to the needs of her children; and seeing the big picture of how it all fits together would be a better approach. Pretending otherwise may work sporadically, but it is not sustainable for the long run.

A whole person approach to testing takes a lot of organization, scheduling, and attention to detail, but the life-long benefits make the effort worthwhile.

Establishing Realistic Expectations for Test Situations

Would you expect to make a perfect pastry if you've never learned how to bake? Or paint a masterpiece if you've never tried to work with paints and brushes? Probably not. But often we expect ourselves to perform at much higher levels of achievement than that for which we've actually prepared. If you become very upset and stressed if you make any score lower than the highest, you probably need to reevaluate your own expectations for test situations. Striving to always do your best is an admirable goal. Realistically knowing that your current *best* may not achieve the highest academic ratings can help you plot your progress.

Realistic continuous improvement is a better plan, because people who repeatedly attempt challenges for which they have not adequately prepared and understandably fail (or at least do not achieve the desired highest ranking) often start moving toward the goal in frustration. They simply quit. This doesn't mean you settle for mediocre grades or refrain from your challenges. It means you become increasingly aware of yourself and your current state and potential future. Know yourself, know your strengths and weaknesses, and be honest with yourself about your expectations.

Understanding Accommodations and Responsibilities

As with so many parts of life, some people take exams in stride and do just fine. Others may need more time or change of location or format to succeed in test-taking situations. With adequate notice, most faculty will provide students with reasonable accommodations to assist students in succeeding in test situations. If you feel that you would benefit from receiving these sorts of accommodations, first speak with your instructor. You may also need to talk to a student services advisor for specific requirements for accommodations at your institution.

If you need accommodations, you are responsible for understanding what your specific needs are and communicating your needs with your instructors. Before exams in class, you may be allowed to have someone else take notes for you, receive your books in audio form, engage an interpreter, or have adaptive devices in the classroom to help you participate. Testing accommodations may allow for additional time on the test, the use of a scribe to record exam answers, the use of a computer instead of handwriting answers, as well as other means to make the test situation successful. Talk to your instructors if you have questions about testing accommodations.

Prioritizing Time Surrounding Test Situations

Keep in mind that you don't have any more or less time than anyone else, so you can't *make time* for an activity. You can only use the time everyone gets wisely and realistically. Exams in college classes are important, but they are not the only significant events you have in your classes. In fact, everything leading up to the exam, the exam itself, and the post-exam activities are all one large continuum. Think of the exam as an event with multiple phases, more like a long-distance run instead of a 50-yard dash. Step back and look at the big picture of this timeline. Draw it out on paper. What needs to happen between now and the exam so you feel comfortable, confident, and ready?

If your instructor conducts some sort of pre-exam summary or prep session, make sure to attend. These can be invaluable. If this instructor does not provide that sort of formal exam prep, create your own with a group of classmates or on your own. Consider everything you know about the exam, from written instructions to notes you took in class, including any experiential notes you may have from previous exams, such as the possibility of bonus points for answering an extra question that requires some time management on your part. You can read more about time management in Chapter 3.

Get Connected

Which apps can help you study for a test, increase your memory, and even help you overcome test anxiety?

[Personal](#) Zen is a free online gaming app clinically proven to reduce stress and anxiety. The games retrain your brain to think more positively, reducing stress to help you focus on the experiences around you.

Games like solitaire, hangman, and Simon Says all build on your memory, keeping it sharp and active. There are loads of fun, free online memory games you can use to make time wasting a little less wasteful. For more than 250 options, visit the [Memory Improvement Tips](#) website.

[iTunes University](#) might be able to help you dig into a research topic or find additional content to help you if you're struggling with a course. Their library of free lectures and content comes from some of the most highly respected universities around the world.

[Chegg Prep](#) is a flashcard-based self-quizzing resource. It provides millions of pre-made flashcards and decks organized by course and topic, which you can search, sort, bookmark, and use in a variety of ways. The service is free and does not require a login unless you'd like to save or create your own cards.

Test Day

Once you get to the exam session, try your best to focus on nothing but the exam. This can be very difficult with all the distractions in our lives. But if you have done all the groundwork to attend the classes, completed the assignments, and scheduled your exam prep time, you are ready to focus intently for the comparatively short time most exams last.

Arriving to class:

Don't let yourself be sidetracked right at the end. Beyond the preparation we've discussed, give yourself some more advantages on the actual test day:

- Get to the testing location a few minutes early so you can settle into your place and take a few relaxing breaths.
- Don't let other classmates interrupt your calmness at this point.
- Just get to your designated place, take out whatever supplies and materials you are allowed to have, and calm your mind.

Taking the test:

Once the instructor begins the test:

- Listen carefully for any last-minute oral directions that may have changed some detail on the exam, such as the timing or the content of the questions.
- As soon as you receive the exam sheet or packet, make a quick scan over the entire test.
- Don't spend a lot of time on this initial glance, but make sure you are familiar with the layout and what you need to do.
- Using this first review, decide how you will allocate your available time for each section.
- You can even jot down how many minutes you can allow for the different sections or questions.

Then for each section, if the exam is divided this way, be sure you **read the section directions** very carefully so you don't miss an important detail. For example, instructors often offer options—so you may have four short-answer questions from which to choose, but you only need to answer two of them. If you had not read the directions for that section, you may have thought you needed to provide answers to all four prompts. Working on extra questions for which you likely will receive no credit would be a waste of your limited exam time. The extra time you spend at the beginning is like an investment in your overall results.

Answer every required question on the exam. Even if you don't complete each one, you may receive some credit for partial answers. Whether or not you can receive partial credit would be an excellent question to ask before the exam during the preparation time. If you are taking an exam that contains multiple-choice questions, go through and answer the questions about which you are the most confident first.

Read the entire question carefully even if you think you know what the stem (the introduction of the choices) says, and read all the choices. Skip really difficult questions or ones where your brain goes blank. Then you can go back and concentrate on those skipped ones later after you have answered the majority of the questions confidently. Sometimes a later question will trigger an idea in your mind that will help you answer the skipped questions.

And, in a similar fashion to spending a few minutes right at the beginning of the test time to read the directions carefully and identify the test elements, **allow yourself a few minutes at the end of the exam session to review your answers.** Depending on what sort of exam it is, you can use this time to check your math computations, review an essay for grammatical and content errors, or answer the difficult multiple-choice questions you skipped earlier. Finally, **make sure you have completed the entire test:** check the backs of pages, and verify that you have a corresponding answer section for every question section on the exam. It can be easy to skip a section with the idea you will come back to it but then forget to return there, which can have a significant impact on your test results.

After the Test

As you leave the exam room, the last thing you may want to think about is that particular test. You probably have numerous other assignments, projects, and life obligations to attend to, especially if you pushed some of those off to study for this completed exam. Give yourself some space from this exam, but only for the duration of the time when your instructor is grading your exam. Once you have your results, study them—whether you did really well (Go, you!) or not as well as you had hoped (Keep your spirits up!). Both scenarios hold valuable information if you will use it.

Thandie had a habit of going all-out for exams before she took them, and she did pretty well usually, but once the instructor passed back the graded tests, she would look at the letter grade, glance half-heartedly at the instructor's comments, and toss the exam away, ready to move on to the next chapter, section, or concept. A better plan would be to learn from her exam results and analyze both what she did well and where she struggled. After a particularly unimpressive exam outing in her statistics class, Thandie took her crumpled-up exam to the campus tutoring center, where the tutor reviewed the test with her section by section. Together they discovered that Thandie did particularly well on the computational sections, which she admitted were her favorites, and not well at all on the short-answer essay questions that she did not expect to find in a stats class, which in her experience had been more geared toward the mathematical side of solving statistical problems.

Going forward in this class, Thandie should practice writing out her explanations of how to compute the problems and talk to her instructor about ways to hone this skill. This tutoring session also proved to Thandie the benefit of holding on to important class papers—either electronically or in hard copy, depending on the class setup—for future reference. For some classes, you probably don't need to keep every scrap of paper (or file) associated with your notes, exams, assignments, and projects, but for others, especially for those in your major, those early class materials may come in very handy in your more difficult later undergraduate courses or even in grad school when you need a quick refresher on the basic concepts.

Test Anxiety



Figure 4.3.10 Text anxiety can be a common occurrence, but you can

use strategies to manage it.

Test anxiety is very real. You may know this firsthand. Almost everyone gets a little nervous before a major exam, in the same way most people get slightly anxious meeting a new potential date or undertaking an unfamiliar activity. We second-guess whether we're ready for this leap, if we prepared adequately, or if we should postpone this potentially awkward situation. And in most situations, testing included, that reasonable level of nervous anticipation can be a good thing—enhancing your focus and providing you with a bit of bravado to get you through a difficult time.

Test anxiety, however, can cause us to doubt ourselves so severely that we underperform or overcompensate to the point that we do not do well on the exam. Don't despair; you can still succeed if you suffer from test anxiety. The first step is to understand what it is and what it is not, and then to practice some simple strategies to cope with your anxious feelings relative to test taking. Whatever you do, don't use the label *test anxiety* to keep you from your dreams of completing your education and pursuing whatever career you have your eyes on. You are bigger than any anxiety.

Understanding Test Anxiety

If someone tries to tell you that test anxiety is *all in your head*, they're sort of right. Our thinking is a key element of anxiety of any sort. On the other hand, test anxiety can manifest itself in other parts of our bodies as well. You may feel queasy or light-headed if you are experiencing test anxiety. Your palms may sweat, or you may become suddenly very hot or very cold for no apparent

reason. At its worst, test anxiety can cause its sufferers to experience several unpleasant conditions including nausea, diarrhea, and shortness of breath. Some people may feel as though they may throw up, faint, or have a heart attack, none of which would make going into a testing situation a pleasant idea. You can learn more about symptoms of test anxiety from the Anxiety and Depression Association of America that conducts research on this topic.¹²

Back to our minds for a minute. We think constantly, and if we have important events coming up, such as exams, but other significant events as well, we tend to think about them seemingly all the time. Almost as if we have a movie reel looping in our heads, we can anticipate everything that may happen during these events—both sensational results and catastrophic endings. What if you oversleep on the test day? What if you're hit by a bus on the way to campus? What if you get stung by a mysterious insect and have to save the world on the very day of your exam?

How about the other way? You win the lottery! Your screenplay is accepted by a major publisher! You get a multimillion-dollar record deal! It could happen. Typically, though, life falls somewhere in between those two extremes, unless you live in an action movie. Our minds, however, (perhaps influenced by some of those action movies or spy novels we've seen and read) often gravitate to those black-and-white, all-or-nothing results. Hence, we can become very nervous when we think about taking an exam because if we do really poorly, we think, we may have to face consequences as dire as dropping out of school or never graduating. Usually, this isn't going to happen, but we can literally make ourselves sick with anxiety if we dwell on those slight possibilities. You actually may encounter a few tests in your academic careers that are so important that you have to alter your other life plans temporarily, but truly, this is the exception, not the rule. Don't let the most extreme and severe result take over your thoughts. Prepare well and do your best, see where you land, and then go from there.

Using Strategies to Manage Test Anxiety

You have to work hard to control test anxiety so it does not take an unhealthy hold on you every time you face a test situation, which for many of you will last well into your careers. One of the best ways to control test anxiety is to be prepared for the exam. You can control that part. You can also learn effective relaxation techniques including controlled breathing, visualization, and meditation. Some of these practices work well even in the moment: at your test site, take a deep breath, close your eyes, and smile—just bringing positive thoughts into your mind can help you meet the challenges of taking an exam without anxiety taking over.

The tests in the corporate world or in other career fields may not look exactly like the ones you encounter in college, but professionals of all sorts take tests routinely. Again, being prepared helps reduce or eliminate this anxiety in all these situations. Think of a presentation or an explanation you have provided well numerous times—you likely are not going to feel anxious about this same presentation if asked to provide it again. That's because you are prepared and know what to expect. Try to replicate this feeling of preparation and confidence in your test-taking situations.

Many professions require participants to take frequent licensing exams to prove they are staying current in their rapidly changing work environments, including nursing, engineering, education, and architecture, as well as many other occupations. You have tools to take control of your thinking about tests. Better to face it head-on and let test anxiety know who's in charge!

Footnotes

- Reteguiz, Jo-Ann. "Relationship between anxiety and standardized patient test performance in the medicine clerkship." Journal of general internal medicine vol. 21,5 (2006): 415-8. doi:10.1111/j.1525-1497.2006.00419.

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4.4: Pre- Mid- and Post-Test-Taking Strategies

Phyllis Nissila

Pre-Test Strategies



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Q: When should you start preparing for the first test? Circle...

1. The night before.
2. The week prior.
3. The first day of classes.

If you answered “3. The first day of classes,” you are correct. If you circled all three, you are also correct. Preparing to pass tests is something that begins when learning begins and continues all the way through to the final exam.

Many students, however, don’t start thinking about test taking, whether weekly exams, mid-terms, or finals, until the day before when they engage in an all-nighter, or cramming. From the previous unit on memory, you might recall that the brain can only process an average of 5-7 new pieces of information at a time. Additionally, unless memory devices are used to aid memory and to cement information into long term memory (or at least until the test is over tomorrow!) chances are slim that students who cram will effectively learn and remember the information.

Additionally, a lot of students are unaware of the many strategies available to help with the test-taking experience before, during, and after. For starters, take a look at what has helped you so far.

EXERCISE 30-1

Pre-Test Taking Strategies

PART A:

Put a check mark next to the pre-test strategies you already employ.

- ☐ Organize your notebook and other class materials the first week of classes.
- ☐ Maintain your organized materials throughout the term.
- ☐ Take notes on key points from lectures and other materials.
- ☐ Make sure you understand the information as you go along.
- ☐ Access your instructor’s help and the help of a study group, as needed.
- ☐ Organize a study group, if desired.
- ☐ Create study tools such as flashcards, graphic organizers, etc. as study aids.
- ☐ Complete all homework assignments on time.
- ☐ Review likely test items several times beforehand.
- ☐ Ask your instructor what items are likely to be covered on the test.
- ☐ Ask your instructor if she or he can provide a study guide or practice test.
- ☐ Ask your instructor if he/she gives partial credit for test items such as essays.
- ☐ Maintain an active learner attitude.
- ☐ Schedule extra study time in the days just prior to the test.

- ____ Gather all notes, handouts, and other materials needed before studying.
- ____ Review all notes, handouts, and other materials.
- ____ Organize your study area for maximum concentration and efficiency.
- ____ Create and use mnemonic devices to aid memory.
- ____ Put key terms, formulas, etc., on a single study sheet that can be quickly reviewed.
- ____ Schedule study times short enough (1-2 hours) so you do not get burned out.
- ____ Get plenty of sleep the night before.
- ____ Set a back-up alarm in case the first alarm doesn't sound or you sleep through it.
- ____ Have a good breakfast with complex carbs and protein to see you through.
- ____ Show up 5-10 minutes early to get completely settled before the test begins.
- ____ Use the restroom beforehand to minimize distractions.

PART B

By reviewing the pre-test strategies, above, you have likely discovered new ideas to add to what you already use. Make a list of them.

Mid-Test Strategies

Here is a list of the most common—and useful—strategies to survive this ubiquitous college experience.

- Scan the test, first, to get the big picture of how many test items there are, what types there are (multiple choice, matching, essay, etc.), and the point values of each item or group of items.
- Determine which way you want to approach the test: Some students start with the easy questions first, that is, the ones they immediately know the answers to, saving the difficult ones for later, knowing they can spend the remaining time on them. Some students begin with the biggest-point items first, to make sure they get the most points.
- Determine a schedule that takes into consideration how long you have to test, and the types of questions on the test. Essay questions, for example, will require more time than multiple choice, or matching questions.
- Keep your eye on the clock.
- If you can mark on the test, put a check mark next to items you are not sure of just yet. It is easy to go back and find them to answer later on. You might just find help in other test questions covering similar information.
- Sit where you are most comfortable. That said, sitting near the front has a couple of advantages: You may be less distracted by other students. If a classmate comes up with a question for the instructor and there is an important clarification given, you will be better able to hear it and apply it, if needed.
- Wear ear plugs, if noise distracts you.
- You do NOT have to start with #1! If you are unsure of it, mark it to come back to later on.
- Bring water...this helps calm the nerves, for one, and water is also needed for optimum brain function.
- If permitted, get up and stretch (or stretch in your chair) from time to time to relieve tension and assist the blood to the brain!
- Remember to employ strategies to reduce test-taking anxiety (covered in the next lesson)
- If despite all of your best efforts to prepare for a test you just cannot remember the answer to a given item for multiple choice, matching, and/or true/false questions, employ one or more of the following educated guessing (also known as “educated selection”) techniques. By using these techniques, you have a *better* chance of selecting the correct answer. It is usually best to avoid selecting an extreme or all-inclusive answer (also known as 100% modifiers) such as “always,” and “never”. Choose, instead, words such as “usually,” “sometimes,” etc. (also known as in-between modifiers). If the answers are numbers, choose one of the middle numbers. If you have options such as “all of the above,” or “both A and B,” make sure each item is true before selecting those options. Choose the longest, or most inclusive, answer. Make sure to match the grammar of question and answer. For example, if the question indicates a plural answer, look for the plural answer. Regarding matching tests: count both sides to be matched. If there are more questions than answers, ask if you can use an answer more than once. Pay close attention to items that ask you to choose the “best” answer. This means one answer is better or more inclusive than a similar answer. Read all of the response options.

Post-Test Strategies

In addition to sighing that big sigh of relief, here are a few suggestions to help with future tests.

- If you don't understand why you did not get an item right, ask the instructor. This is especially useful for quizzes that contain information that may be incorporated into more inclusive exams such as mid-terms and finals.
- Analyze your results to help you in the future. For example, see if most of your incorrect answers were small things such as failing to include the last step in a math item, or neglecting to double-check for simple errors in a short-answer or essay item. See where in the test you made the most errors: beginning, middle, or end. Also analyze which type of questions, true/false, multiple choice, essay, etc. And which topics were missed. This will help you pay closer attention to those sections in the future.

EXERCISE 30-2

Write a letter of advice to Chen incorporating 10 test-taking tips and strategies you think will help him.

Chen believes he is good at organization, and he usually is—for about the first two weeks of classes. He then becomes overwhelmed with all of the handouts and materials and tends to start slipping in the organization department. When it comes to tests, he worries that his notes might not cover all of the right topics and that he will not be able to remember all of the key terms and points—especially for his math class. During tests, he sometimes gets stuck on an item and tends to spend too much time there. He also sometimes changes answers but finds out later that his original selection was correct. Chen is also easily distracted by other students and noises which makes it hard for him to concentrate sometimes, and, unfortunately, he does admit to occasionally “cramming” the night before.

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Adaptions: Changed formatting, removed one exercise.

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4.5: Collaborative Student Learning- The Art of Study Groups

By nature, talking over course material promotes active learning. Some students shy away from studying with other people, because often study sessions deteriorate into “gripe” sessions about the course or certain members of the group do not contribute to the understanding of information. However, these distractions can be avoided with some study group “ground rules” that develop a habit for effective group work. Students who develop strong team working relationships with other students in their classes often report more motivation toward studying, less stress related to the course with this support system, and a better understanding of the material (University of Illinois–Chicago, 2008).



There are several types of study groups. Some groups simply get together prior to exams to go over the material. While this exercise can be helpful, typically these are not the type of study groups that actually promote long-term learning and social support. The most effective types of study groups tend to meet regularly—weekly or every couple of weeks—to work on homework problems, compare lecture notes, discuss current assigned readings, and create cram cards or other study tools that will aid later group review for an exam.

Activity 5-5:

Conduct a Post-Test Analysis for one of your exams by answering and reflecting on these relevant questions. It is best if you can complete this analysis prior to receiving your grade for the exam, but if you have already received a grade try to think about how you felt about the test before getting it back.

1. What grade do you think you made on this exam? (circle one)
A B C D
2. How much time did you spend preparing for this exam?
 1. None
 2. 1/2 hour or less
 3. about an hour

4. about 2 hours
 5. between 2 – 4 hours
 6. between 4 – 6 hours
 7. more than 6 hours
3. Approximately what percentage of the assigned reading did you read?
1. Zero
 2. 100%
 3. Other (write in the approximate percentage)_____
4. What parts of the textbook did you use as you were preparing for the exam? (mark all that apply)
1. Chapter headings
 2. Exercises
 3. Key points
 4. Follow-up activities
 5. Tables/graphs/photographs
 6. Chapter questions
5. Did you use your notes for the test?
1. Yes
 2. No, I do not have any notes
 3. I have notes, but I did not review them before the test
 4. I borrowed notes from someone else and reviewed them
6. Did you review the handouts given in class before the test?
1. Yes
 2. No, I do not have any handouts
 3. I have handouts, but I did not review them before the test
 4. I borrowed the handouts from someone else and reviewed them

Before the test did you:

- Read through each portion of the test when you got it? YES NO
- Set a time budget to pace yourself? YES NO

7. The objective portion of the test was:

For the Multiple Choice:

1. easy to complete
2. too difficult
3. reasonably challenging, but I feel confident about my ability to answer the questions

For the True/False:

1. easy to complete
2. too difficult
3. reasonably challenging, but I feel confident about my ability to answer the questions

For the Matching:

1. easy to complete
2. too difficult
3. reasonably challenging, but I feel confident about my ability to answer the questions

8. The short answer portion of the test was:

1. easy to complete
2. too difficult
3. reasonably challenging, but I feel confident about my ability to answer the questions

9. The essay portion of the test was:

1. easy to complete

2. too difficult
 3. reasonably challenging, but I feel confident about my ability to answer the questions
10. Did you study with other people? (mark all that apply)
1. No
 2. Yes, one other person
 3. Yes, more than one other person at the same time
 4. Yes, I attended a Supplemental Instruction (SI) test review or a test review offered by the instructor or graduate assistant
11. If you studied with others, rate how effective the study sessions were on a scale of 1-10.
(1= not at all effective in helping me review and understand the material, to 10 = highly effective in helping me review and understand the material)
12. What study techniques did you use to study for this exam? (mark all that apply)
1. I consolidated my notes with my textbook notes
 2. I re-read the book chapters
 3. I re-read my class notes
 4. I made up questions and tried to answer them and then reviewed what I did not know
 5. I reviewed exams from an authorized test file
 6. Other explain what you did below

1. Reflection Once you have received your grade, compare that with what you initially guessed you would receive. Consider some of these questions:
1. What types of questions did you tend to miss more? What were the topics of content? Do you now understand the correct answer? Do you see any patterns in the types of mistakes that you may have made? Did you tend to second guess yourself and change a correct answer to an incorrect answer?
 2. Do you see any patterns in where the test items tended to come from? Mostly from the readings? Mostly from class notes? An even mix between the readings and notes? More from the notes, but some from the readings? From places you would not have thought of like the graphs, photographs, or tables?
 3. Was there certain content that you were not as strong in answering correctly? What do you need to do to make sure you understand this material? Do you need to talk with your professor to better understand this material?
 4. Based on the answers to some of the questions throughout this assessment, what are you going to do differently next time? Be specific.

Getting a strong start with a group of committed students at the beginning of the class is tremendously important. A group with mixed levels of academic expertise can be a very effective group as long as the members are committed to working with the group. Stronger students can benefit from teaching students who may be struggling with the material, while struggling students learn study strategies as well as the material the group is reviewing. Consider “Tips for Effective Study Groups” as you move forward with developing study groups.

Tips for Effective Study Groups

- Establish a study group with 2–4 other committed students in your class. Exchange contact information with those participants. You may begin a conversation with students who attend class regularly, take notes, sit toward the front, and appear to pay attention in class. You may ask the professor to help you identify other committed students that you can recruit.
- Set a regular time and place to meet.

- Meet in a public place like the library, empty classroom, residence hall study room, cafeteria, etc.
- At the first session, decide on the rules that your group will agree to adhere to in order to promote teamwork and accountability. For instance, some groups determine that if a member does not prepare for a session that they cannot stay to learn from the others. Some groups set a routine in which they study for 50 minutes and then spend ten minutes “blowing off steam” and problem solving (with a timekeeper keeping it limited to ten minutes).
- Set study goals for each session regarding what material you want to cover or what activities you want to perform as a group.
- Establish a “monitor” for a given session to watch the time, record notes for the group, and make sure that everyone is participating. This duty can be rotated throughout the group and may even become obsolete once a strong working team has been established.
- Make sure that everyone participates actively. Take turns presenting sections of lecture notes or readings, take turns taking a group through the solution of a problem, take turns asking each other questions and having others answer them, etc.
- Share study tools developed, summaries of topics, visual organizers, etc.
- Write down any questions that one or two group members can approach the professor or graduate assistant for help and then share with the group at the next session or via e-mail.
- At the end of the study session, establish what material you are going to focus on so that everyone in the group can prepare for the next session.

Adapted from Dembo & Seli (2008) and University of Illinois–Chicago (2008).

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CHAPTER OVERVIEW

5: Math Support

- 5.1: Converting Between Fractions, Decimals and Percents
- 5.2: Decimals- Rounding and Scientific Notation
- 5.3: Using Fractions, Decimals and Percents to Describe Charts
- 5.4: Order of Operations
- 5.5: Venn Diagrams

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5.1: Converting Between Fractions, Decimals and Percents

Learning Outcomes

1. Given a decimal, convert it to a percent
2. Given a percent, convert it to a decimal
3. Convert a fraction to a decimal and percent

In this section, we will convert from decimals to percents and back. We will also start with a fraction and convert it to a decimal and a percent. In statistics we are often given a number as a percent and have to do calculations on it. To do so, we must first convert it to a percent. Also, the computer or calculator shows numbers as decimals, but for presentations, percents are friendlier. It is also much easier to compare decimals than fractions, thus converting to a decimal is helpful.

For example, we often want to see if a probability is greater than 5%. A computer will display the probability as a decimal such as 0.04836. To make the comparison we will first change it to a percent and then compare it to 5%.

Transforming a Decimal to a Percent

We have all heard of percents before. "You only have a 20% chance of winning the game", "Just 38% of all Americans approve of Congress", and "I am 95% confident that my answer is correct" are just a few of the countless examples of percents as they come up in statistics.

Defintion: Percent

Percent means Parts Per Hundred

Thus if we are given a decimal and want to convert it to a percent, we multiply the decimal by 100. In practice, this means we move the decimal point two places to the right.

Example 5.1.1

Convert the number 0.1738 to a percent.

Solution

We move the decimal over two to the right as shown below.



We get: 17.38% for the answer.

Example 5.1.2

Convert 0.7 to a percent.

Solution

We want to move the decimal two places to the right, but there is only one digit to the right of the decimal place. The good news is that we can always add a 0 to the right of the last digit. We write:

$$0.7 = 0.70$$

Now move the decimal place two digits to the right to get 70%.

Example 5.1.3

In regression analysis, an important number that is calculated is called R-Squared. It helps us determine how helpful one variable is in predicting another variable. The computer and calculator always display it as a decimal, but it is more meaningful

as a percent. Suppose that the R-Squared value that relates the amount of studying students do to prepare for a final exam and the score on the exam is: $r^2 = 0.8971$. Convert this to a percent rounded to the nearest whole number percent.

Solution

We move the decimal 0.8971 two places to the right to get 89.71%

Now round to the nearest whole number percent. Note that the digit to the left of the whole number is $7 \geq 5$. Thus we add 1 to the whole number, 89. This gives us 90%.

Exercise

A standard goal in statistics is to come up with a range of values that a population proportion is likely to lie. This range is called a confidence interval. Suppose that we want to interpret a confidence interval for the percent of patients who experience side effects from an experimental cancer treatment. The computer calculates it as the decimal range: [0.023, 0.029]. What is the likely range for the percent of patients who experience side effects from the experimental cancer treatment?

Transforming a Percent to a Decimal

To convert a decimal to a percent, we multiply the decimal by 100 which is equivalent to moving the decimal two places to the right. Not surprisingly, to convert a percent to a decimal, we do exactly the opposite. We divide the number by 100 which is equivalent to moving the decimal two places to the left.

Example 5.1.4

Convert the percent 89.4% to a decimal.

Solution

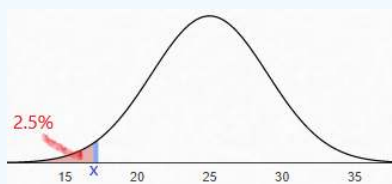
We move the decimal over two to the left as shown below.

89.4

We get: 0.894 for the answer.

Example 5.1.5

Suppose that you want to find the value of x such that 2.5% of the entire area under the Normal curve lies to the left of x . The first step will be to convert the 2.5% to a decimal. What decimal is equivalent to 2.5%?



Solution

We want to move the decimal 2.5 two places to the left, but since there is only one digit to the left of the decimal, we add a zero first: 02.5. Now move the decimal two places to the left to get 0.025.

Converting a Fraction to a Decimal and a Percent

Often in probability it is natural to represent probabilities as fractions, but it is easier to make comparisons as decimals. Thus, we need to be able to convert fractions to decimals. To do so we just divide.

Example 5.1.6

Convert the fraction $\frac{4}{7}$ to a decimal, rounding to the nearest hundredth.

Solution

We use long division:

$$\begin{array}{r} .571 \\ 7 \overline{)4.000} \\ \underline{35} \\ 50 \\ \underline{49} \\ 10 \end{array} \quad (5.1.1)$$

Next round to the nearest hundredth to get 0.57.

Although everyone's favorite thing to do is to perform long division by hand, in most statistics classes you will have a calculator or computer to use. Thus you just have to remember to perform the division with the calculator or computer and then round.

Example 5.1.7

In statistics we need to find basic probabilities and create a table for them. Suppose that you roll two six-sided dice, what percent of the time will the sum equal to a 4? Round to the nearest whole number percent.

Solution

First, notice that there are 36 total possibilities for rolling the dice, since there are 6 faces on the first die and for each value of the first die roll, there are 6 possibilities for the second die roll. Multiplying: $6 \times 6 = 36$. This will be the denominator. To find the numerator, we list all the possible outcome where the sum is 4:

(1,3), (2,2), and (3,1)

There are three possible outcomes with the sum equaling a 4. Thus:

$$P(\text{sum} = 4) = 3/36$$

Now we divide:

$$\frac{3}{36} = 0.08333...$$

Next to convert this decimal to a percent, we move the decimal two places to the right to get: 8.333...%

We are asked to round to the nearest whole number percent. The digit to the right of the whole number (8) is a 3. Since $3 < 5$, we can just erase everything to the left of the 8 and leave the 8 unchanged to get 8%. Thus there is an 8% chance of getting a sum of 4 if you roll two six sided dice.

- [Convert Percentages to Decimals](#)
- [Relating Fractions, Decimals, and Percents](#)
- [Statistics Application of Converting Decimals to Percents](#)

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5.2: Decimals- Rounding and Scientific Notation

Learning Outcomes

1. Understand what it means to have a number rounded to a certain number of decimal places.
2. Round a number to a fixed number of digits.
3. Convert from scientific notation to decimal notation and back.

In this section, we will go over how to round decimals to the nearest whole number, nearest tenth, nearest hundredth, etc. In most statistics applications that you will encounter, the numbers will not come out evenly, and you will need to round the decimal. We will also look at how to read scientific notation. A very common error that statistics students make is not noticing that the calculator is giving an answer in scientific notation.

For example, suppose that you used a calculator to find the probability that a randomly selected day in July will have a high temperature of over 90 degrees. Your calculator gives the answer: 0.4987230156. This is far too many digits for practical use, so it makes sense to round to just a few digits. By the end of this section you will be able to perform the rounding that is necessary to make unmanageable numbers manageable.

Brief Review of Decimal Language

Consider the decimal number: 62.5739. There is a defined way to refer to each of the digits.

- The digit 6 is in the "Tens Place"
- The digit 2 is in the "Ones Place"
- The digit 5 is in the "Tenths Place"
- The digit 7 is in the "Hundredths Place"
- The digit 3 is in the "Thousandths Place"
- The digit 9 is in the "Ten-thousandths Place"
- We also say that 62 is the "Whole Number" part.

62.5739

Tens
Ones
Tenths
Hundredths
Thousandths
Ten thousandths

Keeping this example in mind will help you when you are asked to round to a specific place value.

Example 5.2.1

It is reported that the mean number of classes that college students take each semester is 3.2541. Then the digit in the *hundredths place* is 5.

Rules of Rounding

Now that we have reviewed place values of numbers, we are ready to go over the process of rounding to a specified place value. When asked to round to a specified place value, the answer will erase all the digits after the specified digit. The process to deal with the other digits is best shown by examples.

Example 5.2.2: Case 1 - The Test Digit is Less Than 5

Round 3.741 to the nearest tenth.

Solution

3.741
Tenths Test Digit

Since the test digit (4) is less than 5, we just erase everything to the right of the tenths digit, 7. The answer is: 3.7.

Example 5.2.3: Case 2 - The Test Digit is 5 or Greater

Round 8.53792 to the nearest hundredth.

Solution

8.53692
Hundredths Test Digit

Since the test digit (6) is 5 or greater, we add one to the hundredths digit and erase everything to the right of the hundredths digit, 3. Thus the 3 becomes a 4. The answer is: 8.54.

Example 5.2.4: Case 3 - The Test Digit is 5 or Greater and the rounding position digit is a 9

Round 0.014952 to four decimal places.

Solution

0.014952
Rounding Position Test Digit

The test digit is 5, so we must round up. The rounding position is a 9 and adding 1 gives 10, which is not a single digit number. Instead look at the two digits to the left of the test digit: 49. If we add 1 to 49, we get 50. Thus the answer is 0.0150.

Applications

Rounding is used in most areas of statistics, since the calculator or computer will produce numerical answers with far more digits than are useful. If you are not told how many decimal places to round to, then you often want to think about the smallest number of decimals to keep so that no important information is lost. For example suppose you conducted a sample to find the proportion of college students who receive financial aid and the calculator presented 0.568429314. You could turn this into a percent at 56.8429314%. There are no applications where keeping this many decimal places is useful. If, for example, you wanted to present this finding to the student government, you might want to round to the nearest whole number. In this case the ones digit is 6 and the test digit is 8. Since $8 \geq 5$, you add 1 to the ones digit. You can tell the student government that 57% of all college students receive financial aid.

Example 5.2.5

Suppose that you found out that the probability that a randomly selected person with who has misused prescription opioids will transition to heroin is 0.04998713. Round this number to four decimal places.

Solution

The first four decimal places are 0.0499 and the test digit is 8. Since $8 \geq 5$, we would like to add 1 to the fourth digit. Since this is a 9, we go to the next digit to the left. This is also a 9, so we go to the next one which is a 4. We can think of adding 0499 +

$1 = 0500$. Thus the answer is 0.0500. Note that we keep the last two 0's after the 5 to emphasize that this is accurate to the fourth decimal place.

Rounding and Arithmetic

Many times, we have to do arithmetic on numbers with several decimal places and want the answer rounded to a smaller number of decimal places. One question you might ask is should you round before you perform the arithmetic or after. For the most accurate result, you should always round after you perform the arithmetic if possible.

When asked to do arithmetic and present your answer rounded to a fixed number of decimal places, only round after performing the arithmetic.

Example 5.2.6

Suppose you pick three cards from a 52 card deck with replacement and want to find the probability of the event, A, that none of the three cards will be a 2 through 7 of hearts. This probability is:

$$P(A) = (0.8846)^3$$

Round the answer to 2 decimal places.

Solution

Note that we have to first perform the arithmetic. With a computer or calculator we get:

$$0.8846^3 = 0.69221467973$$

Now we round to two decimal places. Notice that the hundredths digit is a 9 and the test digit is a 2. Thus the 9 remains unchanged and everything to the right of the 9 goes away. The result is

$$P(A) \approx 0.69$$

If we mistakenly rounded 0.8846 to two decimal places (0.88) and then cubed the answer we would have gotten 0.68 which is not the correct answer.

Scientific Notation

When a calculator presents a number in scientific notation, we must pay attention to what this represents. The standard way of writing a number in scientific notation is writing the number as a product of a number greater than or equal 1 but less than 10 followed by a power of 10. For example:

$$602,000,000,000,000,000,000 = 6.02 \times 10^{23}$$

The main purpose of scientific notation is to allow us to write very large numbers or numbers very close to 0 without having to use so many digits. Most calculators and computers use a different notation for scientific notation, most likely because the superscript is difficult to render on a screen. For example, with a calculator:

$$0.00000032 = 3.2E-7$$

Notice that to arrive at 3.2, the decimal needed to be moved 7 places to the right.

Example 5.2.7

A calculator displays:

$$2.0541E6$$

Write this number in decimal form.

Solution

Notice that the number following E is 6. This means move the decimal over 6 places to the right. The first 4 moves is natural, but for the last 2 moves, there are no numbers to move the decimal place past. We can always add extra zeros after the last

number to the right of the decimal place:

$$2.0541E6 = 2.054100E6$$

Now we can move the decimal place to the right 6 places to get

$$2.0541E6 = 2.054100E6 = 2,054,100$$

Example 5.2.8

If you use a calculator or computer to find the probability of flipping a coin 27 times and getting all heads, then it will display:

$$7.45E-9$$

Write this number in decimal form.

Solution

Many students will forget to look for the "E" and just write that the probability is 7.45, but probabilities can never be bigger than 1. You can not have a 745% chance of it occurring. Notice that the number following E is -9. Since the power is negative, this means move the decimal to the left, and in particular 9 places to the left. There is only one digit to the left of the decimal place, so we need to insert 8 zeros:

$$7.45E-9 = 000000007.45E-9$$

Now we can move the decimal place to the right 9 places to the left to get

$$7.45E-9 = 000000007.45E-9 = 0.00000000745$$

- [Application of Rounding Decimal Numbers](#)
- [Here is a video that explains rounding.](#)

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5.3: Using Fractions, Decimals and Percents to Describe Charts

Learning Outcomes

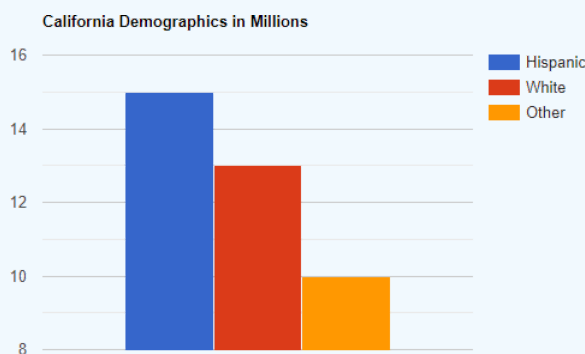
1. Interpret bar charts using fractions, decimals and percents
2. Interpret pie charts using fractions, decimals and percents

Charts, such as bar charts and pie charts are visual ways of presenting data. You can think of each slice of the pie or each bar as a part of the whole. The numerical versions of this are a list of fractions, decimals and percents. By the end of this section we will be able to look at one of these charts and produce the corresponding fractions, decimals, and percents.

Reading a Bar Chart

Bar charts occur frequently and it is definitely required to understand how to read them and interpret them in statistics. Often we want to convert the information of a bar chart to information shown numerically. We need fractions and/or percents to do this.

Example 5.3.1



The above bar chart shows the demographics of California in 2019 where the numbers represent millions of people. Here are some questions that might come up in a statistics class.

- A. What fraction of Californians was Hispanic in 2019?
- B. What proportion of all Californians was White in 2019? Write your answer as a decimal number rounded to four decimal places.
- C. What percent of Californians who were neither Hispanic nor White in 2019? Round your answer to the nearest percent.

Solution

- A. To find the fraction of California that was Hispanic in 2019, the numerator will be the total number of Hispanics and the denominator will be the total number of people in California in 2019. The height of the bar that represents Hispanics is 15. Therefore the numerator is 15. To find the total number of people in California, we add up the heights of the three bars:

$$15 + 13 + 10 = 38$$

Now we can just write down the fraction:

$$\frac{15}{38}$$

To find the proportion of Californians who were White in 2019, we start in the same way. The numerator will be the number of Whites: 13. The denominator will be the total number of Californians which we already computed as 38. Therefore the fraction of Californians who were White is:

$$\frac{13}{38}$$

To convert this to a decimal, we use a calculator to get:

$$\frac{13}{38} \approx 0.342105$$

Next round to four decimal places. Since the digit to the right of the fourth decimal place is $0 < 5$, we round down to:

$$0.3421$$

B. To find the percent of Californians who were neither Hispanic nor White in 2019, we first find the fraction who were neither. The numerator will be the number of "Other" which is: 10. The denominator will be the total which is 38. Thus the fraction is:

$$\frac{10}{38}$$

Next, use a calculator to divide these numbers to get:

$$\frac{10}{38} \approx 0.263158$$

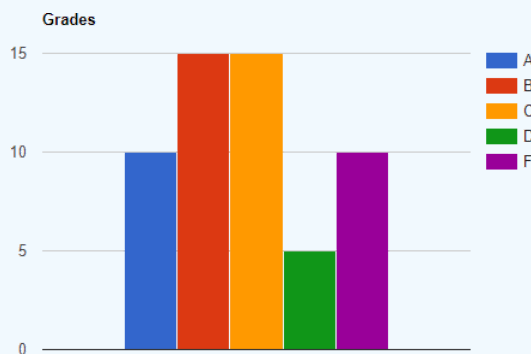
To convert this to a percent we multiply by 100% by moving the decimal two places to the right:

$$0.263158 \times 100\% = 26.3158\%$$

Finally we round to the nearest whole number. Noting that $3 < 5$, we round down to get: 26%

Exercise

The bar chart below shows the grade distribution for a math class.



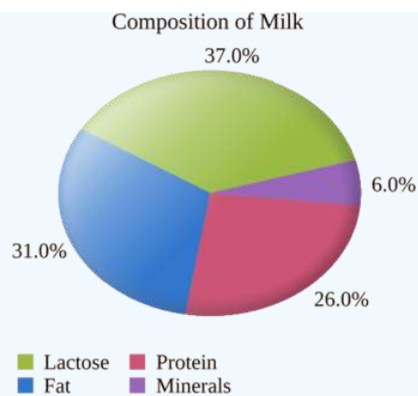
- Find the fraction of students who received a "C" grade.
- Find the proportion of grades below a "C". Write your answer as a decimal number rounded to the nearest hundredth.
- What percent of the students received an "A" grade? Round your answer to the nearest whole number percent.

Reading a Pie Chart

Another important chart that is used to display the components of a whole is a pie chart. With a pie chart, it is very easy to determine the percent of each item.

Example 5.3.2

The pie chart below shows the makeup of milk. Write the proportion of fat contained in milk as a decimal.

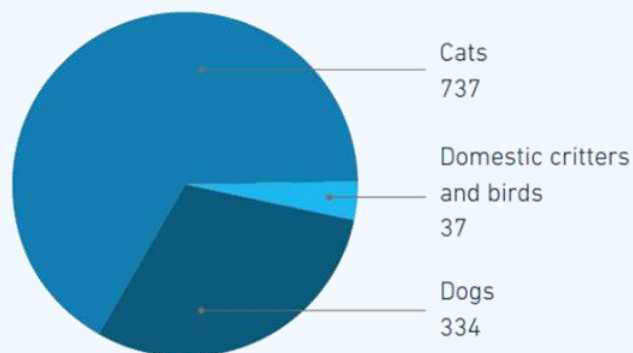


Solution

We see that 31% of milk is fat. To convert a percent to a decimal, we just move the decimal over two places to the left. Thus, 31% becomes 0.31.

Example 5.3.3

Euthanasia by species



The pie chart above shows the number of pets of each type that had to be euthanized by the humane society due to incurable illnesses.

- What fraction of the euthanized pets were dogs?
- What percent of the euthanized pets were cats? Round to the nearest whole number percent.

Solution

- We take the number of dogs over the total. There were 334 euthanized dogs. To find the total we add:

$$737 + 37 + 334 = 1108$$

Therefore, the fraction of euthanized dogs is

$$\frac{334}{1108}$$

- To find the percent of euthanized cats, we first find the fraction. There were 737 cats over a total of 1108 pets. The fraction is

$$\frac{737}{1108}$$

Next use a calculator to get the decimal number: 0.66516. Now multiply by 100% by moving the decimal place two digits to the right to get: 66.516%. Finally, we need to round to the nearest whole number percent. Since $5 \geq 5$, we round up.

Thus the percent of euthanized cats is 67%.

- [Finding Fractions, Decimals and Percents from a Bar Chart](#)
- [Ex: Find the a Percent of a Total Using an Amount in Pie Chart](#)

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5.4: Order of Operations

Learning Outcomes

1. Use the order of operations to correctly perform multi-step arithmetic
2. Apply the order of operations to statistics related complex questions.

When we are given multiple arithmetic operations within a calculation, there is a, established order that we must do them in based on how the expression is written. Understanding these rules is especially important when using a calculator, since calculators are programmed to strictly follow the order of operations. This comes up in every topic in statistics, so knowing the order of operations is an essential skill for all successful statistics students to have.

PEMDAS

The order of operations are as follows:

1. **P**arentheses
2. **E**xponents
3. **M**ultiplication and **D**ivision
4. **A**ddition and **S**ubtraction

When there is a tie, the rule is to go from left to right.

Notice that Multiplication and division are listed together as item 3. If you see multiplication and division in the same expression the rule is to go from left to right. Similarly, if you see addition and subtraction in the same expression the rule is to go from left to right. The same goes for two of the same arithmetic operators.

Example 5.4.1

Evaluate: $20 - 6 \div 3 + (2 \times 3^2)$

Solution

We start with what is inside the parentheses: $2 + 3^2$. Since exponents comes before addition, we find $3^2 = 9$ first. We now have

$$20 - 6 \div 3 + (2 \times 9)$$

We continue inside the parentheses and perform the multiplication: $2 \times 9 = 18$.

This gives

$$20 - 6 \div 3 + 18$$

Since division comes before addition and subtraction, we next calculate $6 \div 3 = 2$ to get

$$20 - 2 + 18$$

Since subtraction and addition are tied, we go from left to right. We calculate: $20 - 2 = 18$ to get

$$18 + 18 = 36$$

The key to arriving at the correct answer is to go slow and write down each step in the arithmetic.

Hidden Parentheses

You may think that since you always have a calculator or computer at hand, that you don't need to worry about order of operations. Unfortunately, the way that expressions are written is not the same as the way that they are entered into a computer or calculator. In particular, exponents need to be treated with care as do fractions bars.

Example 5.4.3

Evaluate 2.1^{6-2}

Solution

First, note that we use the symbol "^" to tell a computer or calculator to exponentiate. If you were to enter 2.1^6-2 into a computer, it would give you the answer of 83.766121 which is not correct, since the computer will first exponentiate and then subtract. Since the subtraction is within the exponent, it must be performed first. To tell a calculator or computer to perform the subtraction first, we use parentheses:

$$2.1^{(6-2)} = 19.4481$$

Example 5.4.4: z-scores

The "z-score" is defined by:

$$z = \frac{x - \mu}{\sigma}$$

Find the z-score rounded to one decimal place if:

$$x = 2.323, \mu = 1.297, \sigma = 0.241$$

Solution

Once again, if we put these numbers into the z-score formula and use a computer or calculator by entering $3.323 - 1.297 \div 0.241$ we will get -0.259 which is the wrong answer. Instead, we need to know that the fraction bar separates the numerator and the denominator, so the subtraction must be done first. We compute

$$\frac{2.323 - 1.297}{0.241} = (2.323 - 1.297) \div 0.241 = 4.25726141$$

Now round to one decimal place to get 4.3. Notice that if you rounded before you did the arithmetic, you would get exactly 5 which is very different. 4.3 is more accurate.

Exercise

Suppose the equation of the regression line for the number of pairs of socks a person owns, y , based on the number of pairs of shoes, x , the person owns is

$$\hat{y} = 6 + 2x$$

Use this regression line to predict the number of pairs of socks a person owns for a person who owns 4 pairs of shoes.

- [Order of Operations - The Basics](#)
- [Order of Operations](#)

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5.5: Venn Diagrams

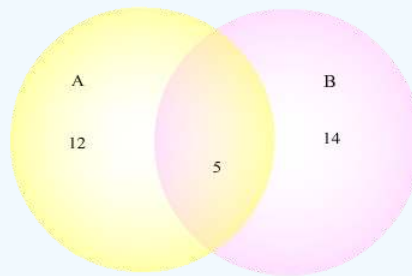
Learning Outcomes

1. Read a Venn Diagram to extract information.
2. Draw a Venn Diagram.

Venn Diagrams are a simple way of visualizing how sets interact. Many times we will see a long wordy sentence that describes a numerical situation, but it is a challenge to understand. As the saying goes, "A picture is worth a thousand words." In particular, a Venn Diagram describes how many elements are in each set displayed and how many elements are in their intersections and complements.

Example 5.5.1

Consider the Venn Diagram shown below.



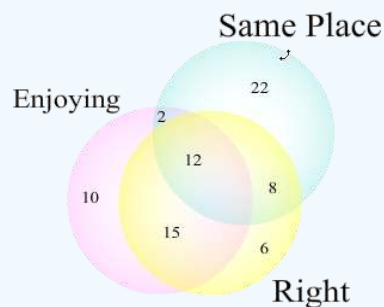
Describe how many elements are in each of the sets.

Solution

Once we understand how to read the Venn Diagram we can use it in many applications. For the Venn Diagram above, there are 12 from A that are not in B, there are 5 in both A and B, and there are 14 in B that are not in A. If we wanted to find the total in A, we would just add 12 and 5 to get 17 total in A. Similarly, there are 19 total in B.

Example 5.5.2

Consider the Venn Diagram below that shows the results of a study asking students whether their first college class was at the same place they are at now, whether they are right handed, and whether they are enjoying their experience at their college.



Determine how many students are:

1. Right handed and enjoy college.
2. At the same place but not right handed.
3. Enjoy college.

Solution

1. To be right handed and enjoy college they must be in both the Right circle and the Enjoying circle. Notice that the numbers 12 and 15 are in both these circles. Thus, there are $12 + 15 = 27$ total students who are right handed and enjoy college.

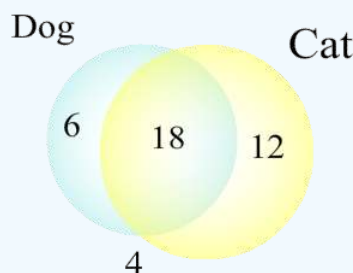
2. To be in the same place and not be right handed, the number must be in the same place circle but not in the right circle. We see that 2 and 22 are the numbers in the same place circle but not in the right circle. Adding these gives $2 + 22 = 24$ total students who are at the same place but not right handed.
3. We must count all the numbers in the Enjoying circle. These are 2, 10, 12, and 15. Adding these up gives: $2 + 10 + 12 + 15 = 39$. Thus, 39 students enjoy college.

Example 5.5.3

Suppose that a group of 40 households was looked at. 24 of them housed dogs, 30 of them housed cats, and 18 of them housed both cats and dogs. Sketch a Venn Diagram that displays this information.

Solution

To get ready to sketch the Venn Diagram, we first plan on what it will look like. There are two main groups here: houses with dogs and houses with cats. Therefore we will have two circles. The intersection will have the number 18. Since there are 24 houses with dogs and 18 also have cats, we subtract $24 - 18 = 6$ to find the houses with dogs but no cats. Similarly, we subtract $30 - 18 = 12$ houses with cats and no dogs. If we add $18 + 6 + 12 = 36$, we find the total number of houses with a dog, cat or both. Therefore there are $40 - 36 = 4$ houses without any pets. Now we are ready to put in the numbers into the Venn Diagram. It is shown below.



Exercise

Suppose that a group of 55 businesses was researched. 29 of them were open on the weekends, 25 of them paid more than minimum wage for everyone, 17 of them were both open on the weekends and paid more than minimum wage for everyone, and 4 of them were government consulting businesses. None of the government consulting businesses were open on the weekend nor did they pay more than minimum wage for everyone. Sketch a Venn Diagram that displays this information.

- [Solving Problems with Venn Diagrams](#)
- <https://youtu.be/t67RMAWGMdY>

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