

How to Study: A Brief Guide

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If you are reading a printed version of this, you might be interested in the Web version, at

<http://www.cse.buffalo.edu/~rapaport/howtostudy.html>

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1. Introduction

It has been claimed that everyone has a different "[learning style](#)".

- If you believe in the existence and validity of learning styles, then you might find some of the following references of interest:
 - [Claxton & Murrell 1987](#),
 - ["Learning Styles" \(Wikipedia\)](#),
 - [Keirsey Temperament and Character Web Site](#),
 - [William Perry's Scheme of Intellectual and Ethical Development](#),
 - [Holland 1966](#),
 - [Kolb 1984](#),
 - [Sternberg 1999](#).
 - For some online tools targeted at different learning styles, see "[100 Helpful Web Tools for Every Kind of Learner](#)".

- **However, there is no evidence that supports their use!** The major study is [Pashler et al. 2009](#); see also [Glenn 2009/2010](#).

But everyone surely has a different "studying style".

More importantly, the way that you are studying right now might not be the best for you: How would you know? Easy: If your grades aren't what you'd like them to be, then you probably need to change how you study!

One important clarification before we begin:

"Studying" is not the same thing as "doing homework"!

Studying may *include* doing homework, but it is also a lot more, as you will see. (So, if you say that you have no homework and that therefore you can't, or you don't have to, study, you're mistaken!)

I am going to give you some suggestions on how to study efficiently. They worked for me when I was in high school, college, and graduate school.

Not only that, but they worked equally well for me in humanities courses (like philosophy and literature) and in science courses (like math and computer science).

But, to the extent that everyone's learning style may be different, some of my suggestions may not work for you, at least not without some individual modifications.

Nevertheless, I urge you to *try* them. Most successful students use them (or some slight variation of them).

2. Manage Your Time

School is a full-time job. And managing your time is important.

- If you have a "real" job after school that you do just for fun (or for some extra spending money), or if you participate in extra-curricular activities (whether school-related or not), keep your priorities in mind:

Your education should come first!

- If you must work (in order to make ends meet), you should realize the limitations that this imposes on your study time.

How much time should you devote to studying? A recent [survey in the *Chronicle of Higher Education*](#) suggested that students are not studying enough. So, how much is enough? If you assume that your education is a full-time job, then you should spend about 40 hours/week on it. Figure that 1 academic credit equals about 1 hour. So, if you're taking 15 credits, then you're

spending about 15 hours in class. Subtracting that from 40 gives you 25 hours that you should be spending studying at home (or in the library).

You should spread that out over the week. Suppose you decide to study Sunday through Thursday evenings, taking Fridays and Saturdays off (from studying, that is). Dividing that 25 hours by those 5 days gives you 5 hours of studying per night. If you think that's too much, then plan on studying in the afternoons, too, or some of Saturday.

The above are just rules of thumb. If you're taking a 3-credit independent-study course, but you meet with your instructor only 1 hour/week, then you should add the extra 2 hours to your at-home study time. If you're working to earn some money, you should subtract your work hours from your *free time*, not from your study time! (If you don't want to do that, then you should consider quitting your job or reducing your course load.)

So, for instance, if you are a part-time student taking (say) 3 courses worth a total of 9 credits and working (say) 20 hours per week, then you have 20 hours per week for your coursework (40 hours in a typical work-week minus 20 hours at your job). The 9 credits amount to approximately 9 hours in class. So, $20 - 9 = 11$ hours to spend at home studying. That works out to about 2.2 hours (2 hours and 12 minutes, to be overly precise) per day (in a 5-day week, using the assumption about no studying on Fridays or Saturdays), or about 0.7 hours (42 minutes) per course for 3 courses.

If that still seems like a lot, consider the difference between high-school courses and college courses. The typical high-school course meets every day, for about 5 hours/week. But the typical college course meets only about 3 hours/week, yet is supposed to be more intensive than its high-school counterpart. That's because in college you're expected to put more of your own time into studying.

[Set yourself a grade goal. If you don't meet it, cut down on non-school activities. \(If you can't, because you're working for a living, then consider dropping down to part-time schooling.\)](#)

For some tips on managing your time during exams, [see below](#).

[For some tips on managing your time when doing projects, see below.](#)

For some websites on time management, take a look at:

- [UB Student Affairs webpage on "Time Management"](#)
 - ["How to Be Punctual"](#)
 - ... or do a Google search on ["time management"](#) for more ideas.
 - Nice sets of printable online calendars, schedules, etc., can be found at [ePrintableCalendars.com](#) and [timeanddate.com](#)
 - Marie, Niclas (2014), ["Tips for Making & Following a Study Schedule"](#)
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3. Take Notes in Class & Rewrite Them at Home

Outline and Index:

1. [Take Notes](#)
 2. [Take Complete Notes](#)
 3. [Use Abbreviations](#)
 4. [Neatness Doesn't Count](#)
 5. [Ask Questions & Make Comments](#)
 6. [Copy Your Notes at Home](#)
 7. [Don't Take Notes on a Computer](#)
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3.1. Take Notes

Good studying at home begins with good notes taken in class. Just as everyone has a different learning style, different teachers have different teaching styles (and often these clash with the students' learning styles!): Some teachers lecture, some lead discussions, some "facilitate" individual work (as in a lab), etc. Consequently, different classroom settings will require different note-taking techniques. But the suggestions here are general enough to work in most situations.

3.2. Take Complete Notes

The key idea of taking good notes in class is to *write down as much as possible*. There are several reasons to take notes that are as complete as possible:

1. It will force you to pay attention to what's going on in class.
2. It will keep you awake (!)
3. There will be less that you'll have to remember.

Should you concentrate on *taking notes* or should you concentrate on *understanding* what you are learning? Paradoxically, I'd err on the side of taking notes, not understanding! Understanding can come later, when you [review your notes](#). But if you have incomplete notes, it will be hard for you to learn what you didn't take notes on.

3.3. Use Abbreviations

Taking complete notes will require you to write fairly quickly and, as a consequence, to *use abbreviations*. Here are some that I use (many of which I borrowed from other students and teachers), to give you an idea of how you can abbreviate. If you send text messages on your cell phone, then you know the sort of abbreviations I'm talking about. Use them when you take notes in class!

ABBREVIATION MEANING

betw	between
ccpt	concept
cd	could
compn	computation
compnl	computational
comp	complete
dn	description
fn	function
h.	human
...g	...ing
(e.g., contg)	(continuing)
...l	...al
(e.g., compnl)	(computational)
lg	language
mn	mean
mng	meaning
...n	...tion
(e.g., abbrvn)	(abbreviation)
NB:	note/note well/ <i>nota bene</i>
pn	proposition
prop	property
re	about (from Latin)
reln	relation
qn	question
...r	...er
(e.g., compr)	(computer)
shd	should
s.t.	something/sometimes (context should make it clear which you mean)
stmt	statement
thot	thought
w/	with
w/o	without
wd	would
wh	which
&	and
∨	or (this is a symbol from logic)
¬	not/negation sign

\diamond	(this is a symbol from logic) possible/possibly (this is a symbol from logic)
\square	must/necessary/necessarily (this is a symbol from logic)
\forall	all/for all/every (this is a symbol from logic)
\exists	some/there is/there are/there exists (this is a symbol from logic)

A related idea is based on a system of shorthand called [Speedwriting](#): There used to be ads in the New York City subway system that read something like this:

if u cn rd ths, u cn lrn spdwrtrg

The key idea in abbreviating is to use abbreviations that will make sense to *you*. You can put an abbreviation key in the margin of your notebook for any abbreviations that you make up on the spot.

3.4. Neatness Doesn't Count.

Yet another key idea of note-taking is that you don't have to be *neat*; you only have to be *legible enough* to be able to read your notes a few hours (or, at most, a few days) later. The reason for this will become clear [later](#).

3.5. Ask Questions & Make Comments

If you have a question or something comes to mind as you're taking notes, you have two choices: You can contribute to the class discussion by asking your question or making your comment. Or you can jot your question or comment down in your notes. I suggest always doing the latter, but also doing the former as often as possible. One reason that you should always put your question or comment in your notes is so that you won't forget it; you can then always bring it up later, either in class or one-on-one with the teacher or a fellow student. Another reason, of course, is that if you *do* bring it up in class, it should thereby become part of the day's class notes! One technique that I use to be able to distinguish my own questions or comments from the rest of the notes is to put them in the margin and/or to surround them with big, bold square brackets [like this.]

By the way, if you have a question, especially if you need clarification of something that the teacher said or wrote (possibly because it was inaudible or illegible), *ask it!* Do *not* be embarrassed about asking it! I can guarantee you that there will be at least one other student in the class (and often many more) who will be extremely grateful to you for having asked the very same question that they were too embarrassed to ask, and they will come to view you as wise and brave for having asked it. (So will the teacher!)

3.6. Copy Your Notes at Home

Notice that this section is titled "Take Notes in Class & *Rewrite* Them at Home"; the title was *not* "Take Notes in Class & *Study* Them at Home". Of course you should study your class notes at home; but just (re-)reading them is too passive. One of the themes of this guide is that studying must be *active*. It is all too easy when *just* reading passively to have your mind wander or even to fall asleep.

Moreover, notes are often incomplete or sketchy; just reading such notes won't help. And a few days or months after you take them, they may very well be illegible or incomprehensible. Finally, if you don't do something active with your notes, you run the risks of having unorganized notes or of misplacing them.

What I suggest is that you *study your notes by re-writing them*. For each class, buy a separate notebook from the one you take your notes in. I recommend a "composition" or spiral notebook, not a looseleaf notebook, for your "permanent" (i.e., re-written) notes. Then, as soon as possible after class (preferably that evening or the next), copy your notes into your permanent notebook.

The main idea behind re-writing your "raw" class notes (besides making them more legible and organized) is that the very act of copying them is one of the best ways of studying them! Further study of your class notes can then be done from these "cooked" ones that are neater, more legible, more organized, and more complete. I will suggest ways to do this [later](#).

Use this opportunity to fill in gaps from your memory while they are still fresh in mind. You may find that you have questions, perhaps something you missed or don't understand, or even a "substantive" question. If so, good! Make a note of your question and ask it in class next time!

Use this opportunity to (re-)organize your notes in a more logical or coherent fashion. You could write your permanent notes in an outline form if that seems suitable: You don't have to follow any "official" or formal outlining style (e.g., using the I.A.1.(a)(i) format or the (sometimes silly) rule that there must always be at least two subsections, never just one)—after all, these are *your* notes. Personally, I like to number main ideas (and separate them with a line), using an "indented bullet" style for details:

1. Main idea 1 - detail 1 - detail 2 - further detail 2.1 - detail 3 - further detail 3.1
- further detail 3.2

2. Main idea 2

3. Main idea 3

etc.

3.7. Don't Take Notes on a Computer

By the way, I do *not* recommend taking notes on a laptop computer *during class*. Certainly you should not do this unless you are a *very* good typist and have "compiled" your word-processing or text-editing program into your fingertips. (In any case, typing can be very noisy and disturbing to your fellow students!)

Also, typing class notes into a computer file can be inconsistent with my recommendation to [re-write your class notes](#). Rewriting on a computer might have some advantages in terms of keeping track of your notes or, especially, searching them. And, of course, you can *edit* your computer file later, but editing is not the same as *copying*, and I am recommending copying as a means to studying (for one thing, it forces you to (re-)read all your notes). Of course, you *can* copy your raw notes into a neater computer file; this may be a matter of taste, but I find that I have a firmer grasp of what I write if I handwrite it than if I type it. (As Usama Fayyad has said: computers are "great at bookkeeping but not yet great at recording impromptu ideas, thoughts, feelings. For that, paper is still far superior. You can hold it, fold it, put it in your pocket, look at it again later when it's convenient" (as quoted in [Swerdlow 1999](#): 130).) Moreover, the main use of your notes should be for summarizing them to make [a study guide for exams](#). In that case, handwritten notes would serve as well as online ones, especially if you're tempted to create the summary merely by cutting and pasting your computer file rather than by rewriting.

Worse, you may be tempted to use the computer that you're ostensibly taking notes on to surf the Internet, look at email, or chat with friends. Don't! (For an interesting debate on this topic, see [Adams 2006](#).)

For that matter, turn off your computer in class. And your iPod. And your cell phone. And your pager. And anything else that might distract you. For reasons why, see:

- Bugeja, Michael J. (2007), "[Distractions in the Wireless Classroom](#)", *Chronicle of Higher Education* (26 January): C1,C4.
- Zhu, Erping; Kaplan, Matthew; Dershimer, R. Charles; & Bergom, Inger (2011), "[Use of Laptops in the Classroom: Research and Best Practices](#)", *CRLT Occasional Papers* No. 30 (University of Michigan Center for Research on Learning and Teaching).

3.8. Don't Rely on the Instructor's Lecture Notes

Some instructors provide their own set of lecture notes, often on the Web or in PowerPoint (or some other format). These can be useful, **but you should not rely on them**. If all you do with them is print them out, maybe read them once, and save them, they are useless, because you are using them *passively*. You need to treat them just as you would with your own lecture notes: Rewrite them! Better yet: Use them to fill in gaps in your own re-written lecture notes, and to check whether you had any mistakes in your own notes. (You may find new material in the instructor's notes that was *not* discussed in class, or you may find material in your own notes that *was* discussed in class but did not find their way into the prepared notes.)

3.9. Further Reading

- Pappano, Laura (2008), "[Strategy: Notetaking—To Survive the Lecture Course, Take Heed if the Professor Waves His Arms](#)", *New York Times Education Life* (6 January): 6.
 - Hoffmann, Roald; & McGuire, Sandra Y. (2010), "[Learning and Teaching Strategies](#)", *American Scientist* 98(5) (September-October): 378–382.
 - The first of their "Six Learning Strategies" ([pp. 378–379](#)) "is to take notes by hand" and "rewrite your notes, by hand".
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4. Study Hard Subjects First & Study in a Quiet Place

Study hard subjects first. Each night (or day) when studying or doing your homework, do those subjects first for which you need to be alert and energetic. Leave the easier, or more fun, subjects to later.

Study in a quiet place, with as few distractions as possible. Do *not* listen to music or TV: It is virtually impossible to do two things at once if one of them is studying. (For the evidence on why it is difficult—if not impossible—to do two things at once (called "multitasking"), see:

[Willingham, Daniel T.](#) (2010), "Have Technology and Multitasking Rewired How Students Learn?", *Ask the Cognitive Scientist*, [American Educator](#) (Summer): 23–28, 42. [[PDF](#)]

When should you study or do your homework? It's tempting to put off your homework to the last minute. There are at least two good reasons to do your homework as soon as possible and not put it off till the evening, when it's not daylight (although you should certainly take a break between the end of the school day and before starting your homework):

1. It's better to get it done and over with, and to leave yourself enough time to do it all. If you put it off, you may find that you have an assignment or two that are going to take you a lot longer than you thought they would. If you start early and get your work done before you relax, you'll have enough time for even those hard assignments (even if it means not having enough time to Facebook or play videogames or read for fun). The general principle is: Don't eat your dessert first!
 2. You're more awake during the daytime or after relaxing for, say, an hour or so after classes end, than you will be at the end of the day just before going to sleep.
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5. Read Texts Actively & Slowly, before & after Class

Outline & Index:

1. [Read actively, not passively](#)
2. [Read slowly](#)
3. [Highlight the text in the margin](#)

4. [Make notes in the margin](#)
 5. [Keep a notebook](#)
 6. [Read literature quickly and passively the first time](#)
 7. [Read before and after class](#)
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5.1. Read Actively, Not Passively

By 'text', I mean whatever you have to read: It might be a text book, a work of fiction, a poem, an essay, an article from a journal or magazine, or even a class handout. With [one major exception](#), you should not read passively. That is, don't just read the text straight through without thinking about what you're reading.

If you read without thinking, I guarantee that your mind will eventually wander off, your eyes will eventually glaze over, and you will fall asleep—it's a form of self-hypnosis. So you must read actively. To use computer jargon, you must turn the inert medium of text on paper to an *interactive* medium, in which you have a "conversation" with the text, as you might if you could be talking to the author.

5.2. Read Slowly.

"...an undeniable truth: that in the pursuit of knowledge, slower can be better."

—Gleick, James (2011), *The Information* (New York: Pantheon): 404.

The first step in reading actively is to read *s-l-o-w-l-y*. Here is an algorithm (i.e., a procedure) for how to read any text, in any subject, slowly and actively:

```
WHILE there is a next sentence to read, DO: BEGIN { while }   Read it, SLOWLY;
IF you do not understand it, THEN BEGIN { if }       re-read the previous material,
SLOWLY;      re-read the incomprehensible sentence, SLOWLY;   IF you still don't
understand it, THEN      ask a fellow student to explain it;   IF you still don't
understand it, THEN      ask your Teaching Assistant (TA) to explain it;   IF you
still don't understand it, THEN      ask me;   IF you are in an upper-level course &
you still don't understand it, THEN      write a paper about it (!)   END { if } END;
{ while }
```

Since there is no next sentence (because the Boolean test in the WHILE is false), you've understood the text!

For those of you who may not be familiar with how to read structured computer programs such as this one, here's how it goes: In a "while" statement, if the initial test is false, then the rest of the statement is not executed. So, if you are at the beginning or the middle of reading a text, there *will* be a "next" sentence, so you *do* execute the rest of the statement, which says to read that next sentence slowly, etc. However, if you have finished reading the entire text (and, hopefully, have now understood it), then there is *no* next sentence, so you are finished! (The

words in braces, like "{ while }", are just computer-programming notation for a comment that is intended for human readers of a computer program but that is ignored by the computer.)

This algorithm has three major advantages:

1. It forces you to actively think about each sentence you read before you go on to read the next one.
2. It slows you down, so that you don't read past the point at which you don't understand. This is especially important in mathematical and scientific subjects.
3. It can help you get help from your teacher, because you can show your teacher exactly where you got lost. It is always much better to show your teacher exactly what it is that you don't understand than it is to just say that you don't understand the material.
4. Note that it also provides you an opportunity to interact with your instructors and fellow students!

How do you know whether you understand what you've read? Easy: After each sentence, ask yourself "Why?" (Pressley & El-Dinary 1992).

For more information on slow reading, see:

1. Pressley, Michael, & El-Dinary, Pamela Beard (1992), "Memory Strategy Instruction that promotes Good Information Processing", in Douglas J. Herrmann, Herbert Weingartner, Alan Searleman, & Cathy McEvoy (eds.), *Memory Improvement: Implications for Memory Theory* (New York: Springer-Verlag): 79-100.
2. [Fletcher, Lancelot R.](#) (1994), "[Slow Reading Lists \(and the Meaning of Slow Reading\)](#)"
 - o Note: If you scroll down about halfway on the above link, you'll reach the section called "What Do I Mean by "Slow Reading"?".
3. Hartman, Geoffrey H. (1996), "The Fate of Reading Once More", *PMLA (Proceedings of the Modern Language Association)* 111(3) (May): 383-389; see especially p. 386.
4. [Daly, Robert](#) (2003), "Slow Reading: Why it Matters, How to Do It, How to Teach It"
5. Waters, Lindsay (2007), "[Time for Reading](#)", *Chronicle of Higher Education* 53(23) (9 February): B6-B8.
6. Bauerlein, Mark (2008), "[Online Literacy Is a Lesser Kind: Slow Reading Counterbalances Web Skimming](#)", *Chronicle of Higher Education* 54(31) (19 September): B10-B11.
7. Blessing, Kimberly A. (2013), "[I Re-Read, therefore I Understand](#)", *Philosophy Now* No. 94 (January/February): 17.
 - o "René Descartes' advice on reading philosophy"
 1. "Read through the entire work quickly, as you would a novel...."
 2. "Read through a second time, paying greater attention..."
 3. "Read through a third time, keeping the questions and problems noted in Step 2 in mind...."
 4. "If some difficulties still remain, re-read those parts a fourth time...."
8. And for information on why *speed* reading *doesn't* work, see:

Adams, Cecil (1992), "[Does Speed Reading Training Actually Work?](#)", *The Straight Dope* (14 February).

5.3. Highlight the Text in the Margin

There are some other tricks for active reading. One, of course, is to highlight important or interesting passages. There are several ways to do this. The *worst* is to use a yellow highlighting marker (or hot pink, or whatever color you like). The main problem with this is that you will tend to find almost every sentence to be important or interesting. As a consequence, every page will become yellow (or hot pink, or whatever). Not only does this defeat the purpose of highlighting—because if *everything* has been highlighted, then really *nothing* has been!—but the pages of your text will become damp, curl up, and be generally messy.

This technique can have other problems, too.

A slightly less messy, but equally useless, technique is to use a pen or pencil to underline important or interesting passages. I guarantee that you will wind up underlining every sentence on every page, and you will have gained nothing.

The technique that I suggest is also susceptible to this problem, but has a built-in way to overcome it, so that you can re-read the text, highlighting different passages each time. The trick is to highlight a passage by drawing a *vertical line* in the margin. I like to use the right margin and to make my line a right square bracket:]. If you want to make it clear [exactly where the highlighted passage begins or ends,] you can use small square brackets in the text, as I did in this sentence, along with the vertical line in the margin. This way, even if you've slipped into the error of highlighting (i.e., vertical-lining) every sentence on every page, at least you haven't ruined the page. Moreover, when you re-read the text (note that I said 'when', not 'if' :-), you can then use a different highlighting technique (e.g., underlining) to highlight more important passages. Sometimes, I use double brackets in the margin for this second round of highlighting:]] and underlining for a third round. (If you must, you could use yellow highlighter for a fourth round.)

5.4. Make Notes in the Margin

You should also make notes in the margin of the text (*if* there's room, and *if* the text belongs to you). I like to put cross-references in the margin; e.g., if a passage on p. 20 reminds me in some way of a passage on p. 10, I'll write "see p. 10" in the margin on p. 20, and "see p. 20" in the margin on p. 10. Or I'll put some keyword in the margin if a passage reminds me of some major idea.

But now suppose that a few months (or a few years) later, you want to find that interesting passage that related to, say, consciousness; how will you find it? You could, of course, page through the book till you find it, but what I like to do is to make an index of my marginal comments; you can add entries (e.g., Consciousness: 10, 20) to the book's index if it already has one, or use a blank page at the end of the book if it doesn't have an index.

5.5. Keep a Notebook

Highlighting has the disadvantage that it can lead you to highlight everything, and margins have the disadvantage that they are often too small for making comments. The best technique for active reading is to keep a notebook. In addition to (or instead of) highlighting a passage, copy it—*verbatim*—into your notebook. Be sure to begin your notebook with a full [citation](#) to the text for use in a bibliography, and be sure to write down the page numbers of each passage that you copy. Then, write down—at length and in detail—your comments on the passage. (I sometimes like to use a pen for the text and a pencil for my commentary.)

These notes can then be used later if you write a term paper or research paper that discusses the material in the text. For that purpose, it will be useful to number your notes. I find the following scheme useful: Number each notebook page with a [Roman numeral](#) (I, II, etc.), number each quoted passage (or stand-alone comment) with an Arabic numeral (1, 2, etc.), and letter (a, b, etc.) each comment associated with a quoted passage (or stand-alone comment). Then you can refer to each passage with an identifier (like XIV-7-b, i.e., comment b about quotation 7, which comment is located on notebook page XIV) that will enable you to find it later. [See below.](#))

5.6. Read Literature Quickly and Passively the First Time.

[Earlier](#), I said that there was an exception to this method of slow and active reading. If the text is a work of literature (a story, novel, play, poem, etc.), it is often best to read it once all the way through without stopping, just as you would read something for fun, so that you get to know what it's about and can appreciate it as a work of literature. (If there's a recording of it, you might find it helpful to listen to the recording *while reading the text*; I have found this especially useful for Shakespeare.) Then you can use the slow and active reading techniques for a second (or third, or fourth, or ...) reading when you are studying the text.

Actually, even for non-fiction, it can be useful to read the text through once, quickly, to get an overview, perhaps making notes if something strikes you, and then doing the slow and active reading techniques when you are studying the text.

What about film or video versions? They can be helpful but, in general, of course are no substitute for reading. The exception here is for plays, which are intended to be seen, not (just) read. If you do decide to watch in addition to read, which should you do first? I prefer watching first, reading afterwards. I have almost always been disappointed by film adaptations of favorite texts (because they don't match the mental images that I construct when I read), but I have almost never been disappointed by a text after watching a film adaptation. Besides, if you watch first and read later, the adaptation can help you visualize what you're reading.

5.7. Read Before and After Class

Ideally, you should read a text at least twice. Read it (perhaps quickly) *before* the class in which it will be discussed, so that you are familiar with its contents. Then (re-)read it *after* class using the [slow and active method](#). If time permits, you can cut corners by only reading it—slowly and actively!—*after* class.

6. Do Your Homework

It should go without saying that you should do your homework and do it on time.

Science and math courses (and some others, such as foreign-language courses) often require you to do homework exercises or problem sets. I strongly recommend that you do *not* simply do the problems and hand them in. Rather, do them on scrap paper, check them over, and then *copy them neatly*. Turn in the neat copy (and, of course, be sure that your name is on it!). You may even want to duplicate your work in case the teacher loses it (unlikely) or doesn't give it back in time to use it for studying for an exam (this should only happen in rare circumstances, usually just before an exam (when the teacher has a lot of things to do), but it is not unheard of).

And don't just write down *answers*. Write down the problem *and* the complete solution showing *how* you arrived at your answer.

7. Study for Exams

Outline:

1. [Don't study for exams!](#)
 2. [Manage your time](#)
 3. [How *not* to study](#)
 4. [Make a study outline](#)
 5. [Write sample essays & do sample problems](#)
 6. [Make "flash cards"](#)
 7. [Stop studying when you feel confident](#)
-

7.1. Don't Study for Exams!

What?

That's right: You shouldn't study *only* for exams. And you shouldn't study *for the sake of* exams.

You should "study for learning and understanding":

- David Jaffee, ["Stop Telling Students to Study for Exams"](#), *Chronicle of Higher Education* (27 April 2012): A35.
- Henry L. Roediger III, ["How Tests Make Us Smarter"](#), *New York Times* (20 July 2014): SR12.

But in case you do want to study for that exam, here are some suggestions:

7.2. Manage Your Time

The first rule is: **Don't cram!**

[Earlier](#), I discussed managing your time. When you have exams, time management becomes even more crucial.

Begin studying about 1 week before the exam. Spend at least an hour each night (or day) studying for the exam in the manner described below. Try to spend the entire night (and/or day) before the exam studying for it. Of course, if you have two exams on the same day, you'll have to split the time in half.

For final exams, try to spend as much time as possible studying. Do not be tempted, by any free time that you have during exam week, to do anything other than studying. (If you must take some time to relax, do it *after* you've done all your studying for the day.) If you have E exams and D days to study for them, spend roughly D/E days studying for each exam. (E.g., if you have 4 exams and 5 days to study for them, spend a little more than 1 day (1.25 days to be exact) studying for each exam.)

If you have some free days, then some exams, then some more free days, then some more exams, etc., plan your studying so that you'll spend approximately the same amount of time studying for each exam, making sure that the night (or day) just before an exam is spent studying for it. E.g., suppose you have 2 free days to study before exam #1, then one more free day before exams #2 and #3. Think of each day as having 3 parts: morning, afternoon, and evening. Let's assume that each exam is in only one of these parts (i.e., it's not so long that it extends through 2 of them). Then you might divide your studying time as shown in the [chart](#). Note that you should *not* delay studying for exam #3 until after exam #2; start studying for all exams right away.

DAY	PART OF DAY	WHAT TO DO
Day 1	morning	study for exam #1
	afternoon	study for exam #2
	evening	study for exam #3
Day 2	morning	study for exam #1
	afternoon	study for exam #2 or #3 (or both)
	evening	study for exam #1
Day 3	morning	study for exam #1
	afternoon	take exam #1
	evening	study for exam #2
Day 4	morning	study for exam #3
	afternoon	study for exam #2
	evening	study for exam #3

Day 5 morning	study for exam #2
afternoon	take exam #2
evening	study for exam #3
Day 6	take exam #3

Moreover, you should *distribute* your studying, not "mass" it all together: "set aside blocks of time throughout each week to study the content for each class"; "massed practice leads to quick learning and quick forgetting, whereas interleaved practice slows learning but leads to much greater retention" (Dunlosky, John (2013), "[Strengthening the Student Toolbox: Study Strategies to Boost Learning](#)", *American Educator* 37(3) (Fall): 12–21).

7.3. How *Not* to Study

Believe it or not, **re-reading your textbook has "little or no benefit" when you are studying for a test.** (Callender & McDaniel 2009; see also John Dunlosky, "[Strengthening the Student Toolbox: Study Strategies to Boost Learning](#)", *American Educator* 37(3) (Fall 2013): 12–21.)

Most students don't realize this, because they have an "illusion of competence" (that is, you think you know the material better than you really do) when they re-read notes and textbooks (Karpicke et al. 2009; Belluck 2011), especially when re-reading *passively* instead of *actively*.

One method of studying that is better than passive re-reading is the "**read-recite-review**" ("3R") method: "Read the text, set the text aside and recite out loud all that [you can] remember, and then read the text a second time" (McDaniel et al. 2009).

More importantly, **you learn better and remember more from repeated testing** (from both in-class quizzes and from self-testing at home) than from repeated reading (Karpicke et al. 2009). (So when your instructor gives you lots of quizzes or tells you to memorize basic facts, don't complain! That's the best way to learn and to remember what you learn.)

The next few sections give you some suggestions on how to do this.

7.4. Make a Study Outline

Use your recopied class notes, together with your highlighted text and notebook, to make an outline of the material. Try to put as much as possible onto the front sides of only 1 or 2 sheets of paper (like those plasticized crib sheets that are often sold in college bookstores). Then do all your studying from these. (You could even combine this outline with "[flash cards](#)".)

7.5. Write Sample Essays & Do Sample Problems

For subjects in which you will be expected to write essays, either "psych out" the teacher and make up some plausible essay questions, or get copies of old exams that have real essay questions on them. *Then write sample essays.* Although the essay questions that you find or make up may not be the actual ones on your exam, you will probably find that much of what you wrote

in your sample essays by way of preparation for the exam can be recycled for the actual exam. You will then be in the advantageous position during the exam of not having to *create* an essay answer from scratch but being able to merely *recall* the main ideas from a sample that you have already written as part of your studying.

For subjects in which you will have to solve problems or write proofs, solve lots of sample problems from your text or from other texts ([Schaum's Outline Series \(McGraw-Hill\)](#) books are usually quite good in this regard). How will you know if your answers are correct? The best way is to form a study group of 2 or more fellow students: Solve the same problems and compare answers. If your answers agree, they're probably correct; if not, go to your Teaching Assistant (TA) or teacher. As with [slow reading](#), it's always better when asking for help from a teacher to have a specific problem or question to ask.

7.6. Make "Flash Cards"

For any subject, you can make a set of "flash cards". But I suggest using regular 8 1/2" x 11" paper, not index cards. Divide each page in half, vertically. On the left, write a "question" that requires an "answer", e.g., the name of a theorem, a term to be defined, the statement of a theorem, etc. On the right, write the answer, e.g., the statement of the theorem named on the left, the definition of the term on the left, the proof of the theorem stated on the left, etc. (This could even be your [study outline](#).)

Then *memorize* the questions and answers—but do *not* simply recite them by heart. Instead, *write down* the answers: Cover the right-hand side (the answers) with a blank sheet of paper, and *write down* the answers. When you finish a page, check your work and repeat *writing* the answers to the questions you missed until you get them all correct.

Recent psychological evidence suggests that people learn better by making mistakes than by getting everything correct. So don't worry about getting some answers wrong! (See Roediger III, Henry L.; & Finn, Bridgid (2010), "[The Pluses of Getting It Wrong](#)", *Scientific American Mind* 21(1) (March/April): 39–41.)

Why write, and not merely recite? Because you will have to *write* the answers on the actual test; get used to writing them now. (Of course, if it's going to be an oral exam, reciting may be better than writing. Still, one tends to skip details when reciting, especially if you recite silently to yourself, but if you *write* the answers and have a good memory, then, during an oral exam, you can "read" the answers with your mind's eye.)

Moreover, there is evidence that the kind of "self-testing" that you can do with this technique is one of the best ways to study: "taking practice tests (versus merely rereading the material to be learned) can substantially boost student learning", according to John Dunlosky, "[Strengthening the Student Toolbox: Study Strategies to Boost Learning](#)", *American Educator* 37(3) (Fall 2013): 12–21.

7.7. Stop Studying When You Feel Confident

How do you know when you've studied enough? It's *not* when you're tired of studying! And it's *not* when you've gone through the material one time! You should stop only when you get to the point that you feel confident and ready for whatever will be on the exam—when you're actually eager to see the exam to find out if you guessed its contents correctly.

8. Take Exams

First, read the entire exam all the way through.

For an essay question, do a "mind dump": Write down, on scrap paper, brief reminders (keywords) of everything that you remember about the topic of the question. Then [develop an outline](#) of your answer. Then write the essay. (With luck, much of the essay can be "copied from memory" from the sample essays you wrote when studying.)

For an exam with problems to solve or proofs to write, do the easy ones first.

When you are all done, review your answers carefully.

And, when all of your exams are over, take heed...:-)

9. Do Research & Write Essays.

Outline:

1. [Choose topic carefully](#)
 2. [Do research](#)
 3. [Make an outline](#)
 4. [Write, using your outline](#)
 5. [Edit](#)
 6. [Manage your time](#)
 7. [Some Interesting Online Articles on Writing](#)
-

9.1. Choose Topic Carefully

Choose your topic wisely. Avoid the two extremes of a topic that is so broad or well-known that there are too many sources of information and a topic that is so narrow or little-known that there is a paucity of information. If you are having trouble choosing a topic, talk to your teacher.

9.2. Do Research

Once you have a topic and have found appropriate resource materials, [read them slowly and actively](#), and be sure to [keep a notebook](#). I won't repeat the details of those suggestions here, with

one exception: Be sure to carefully record your sources and the page numbers of any quotations, so that you can include them in your final report.

9.3. Make an Outline

This stage may require several iterations. You should make an outline and sort your notes into categories that correspond to the main sections of your outline. But which of these should you do first? It doesn't matter. You may have a clear outline in mind, in which case, sorting your notes will be relatively straightforward (though you may find that some notes don't quite fit or that some suggest a section that you hadn't initially thought of). Or you may need to sort your notes first, to see which ones go together, and *then* create an outline based on the categories you discover during the sorting process.

How do you make an outline? The suggestions that follow work for almost anything you have to write. First, write down a handful of main themes that you want to discuss (these will be the categories that you sorted your notes into); describe each using only a few keywords. Decide in what order you want to write about them, and then—on a blank piece of paper—put each at the head of a column, something like this:

intro topic1 topic2 topic3 conclusion

These will be the main sections of your paper. In addition, you should always have an introductory section and a conclusion or summary section.

Next, in each column, write down the main ideas that you want to include, again ordering them and using just a few keywords. These will be your subsections. Under each of these, put the [identifying numbers](#) of the items in your notes that you want to include in each subsection. (You may find that you will need to repeat this process recursively for subsections, etc. If so, do this when you're ready to write that subsection, not at the beginning. This kind of process is called "top-down design and stepwise refinement".)

9.4. Write, Using Your Outline

["How can I tell what I think until I see what I say?"](#)

Once you've got your outline, start writing, using your outline and notes as a guide. Don't spend too much time editing what you write at this stage. Just write. (I should note that some people prefer "[free writing](#)", in which you *don't* spend any time preparing an outline before you write. If that works for you, go for it.)

By the way, it's always helpful for keeping track of where you are in your outline, both to you as writer and to your reader, to give each section and subsection a name, as I have done in this document.

9.5. Edit

After you've written your first draft, re-read what you wrote, using the [method of slow and active reading](#), and revise (or "edit") what you wrote. Then ask a friend to read it and give you feedback. Then revise again, and [prepare the final version](#).

9.6. Manage Your Time

And don't procrastinate!

For some tips on how to procrastinate about procrastinating, see:

Slatalla, Michelle (2007), ["The Big Dilly-Dally"](#), *New York Times Education Life* (7 January): 14-15.

On the other hand, for an argument *in favor* of procrastinating, see:

- Pannapacker, W.A. (2009), ["How to Procrastinate Like Leonardo da Vinci"](#), *Chronicle of Higher Education: The Chronicle Review* 55(24) (February 20): B4-B5.

9.7. Some Interesting Online Articles on Writing:

1. Vonnegut, Kurt (1982), ["How to Write with Style"](#)

Abstract:

- Find a subject you care about.
 - Do not ramble.
 - Keep it simple.
 - Have the guts to cut.
 - Sound like yourself.
 - Say what you mean to say.
 - Pity the readers.
2. Gray, Tara (2005), ["Publish and Flourish: Become a Prolific Scholar"](#), *Tomorrow's Professor Mailing List* #661
 3. Andrews, Mark, ["Some Elements of an Essay"](#)

10. Do I Really Have to Do All This?

Right about now, you're probably asking yourself whether you really have to do *all* of this. It seems like an awful lot of work.

Well, of course, you don't have to do all of it at once. Try various of these suggestions to see what works for you. Try some variations that may better fit your learning style or personal

circumstances. But, in the long run, there's no quick and easy road to studying. It *is* hard work and *should* take a lot of time.

So, *do* you really have to do all of this? Yes (or things very much like them)—*if* you want to really learn the material (and get good grades).

Finally, for what it's worth, here are some comments from students and others who have tried some of these methods:

- "... this is the way you taught me to study years ago and it finally paid off last year!" (a college sophomore who went from high-school grades in the 70s to a 3.00 average in college)
- "Thank you for the guide. It has some great tips! I'm surprised that I use some of the techniques myself. (E.g., I abbrev. and condense my notes.) I have one suggestion, though: when reviewing for a test/exam, only study what you aren't familiar with. It reduces studying time and is helpful if you're a last minute person like me. :) Well, that may not work for you, but who knows?"
- "... encourage some study groups! Not 5 in a group, 'cause that will be a crowd, but study environment is as important as studying itself; change of environments is sometimes good to make you study better. Thank you for your helpful hints, and it does help me to notice some of my weaknesses in studying."
- "I'd like to pass along a bit of technique that worked well for me in just about all my courses. Thinking about the subject matter—often catalyzed by discussion with others—before delving into it was my key to success. After giving it some thought, I wrote out a series of logical, fundamental questions which I sought to answer that would clarify the subject matter. You know, make it perspicuous. I read/listened/watched with those questions in mind, noting as well other points an author/instructor was attempting to make. If my questions (which were fundamental to a clear understanding) went unanswered, I would seek the answers through other written, visual, or aural materials. Visiting an instructor during office hours or asking the question in class was often most helpful. Once I had the basics well in mind, building on them was easy and fun. Studying and learning in this way also helped me to prepare for exams. Clearly, if I could think of a question, there was a good chance one writing an exam might think of it too. The technique is not a panacea for all study-related problems; however, it does set forth a system to build upon in an individualized way. I also suggest a visit to the children's section of the library when revisiting or attempting to master the basics of certain things. Books written at that level, though often oversimplified, present ideas and concepts in a clear and easily understandable form usually lacking in primers written for adults. There's no substitute for laying a good foundation on which to build additional knowledge." — [Marc L. Ames](#)
- "I would like to thank you for the effort made doing this guide.... But there is one thing I would like to suggest for ... future "upgrades" of this text: I think you have to mention that it is important to be in good physical condition as well, I mean: sleep 8 hours a day, eat well, What I would like to point is that, in my opinion, it would be good to tell students that they have to be in their best condition to study/take an exam/work." —

[Diego Fernández Fernández](#), E.U.I.T.I.O student (Computer Engineering), Oviedo (SPAIN).

- "I would like to thank you very much for the "How to Study" document I discovered on the net. It is very informative, and it will help me with my day to day activities. I only wish I had it while I was in high school!" —[Joseph Di Lillo](#), Team Lead—SAP Service Desk.
- "Thanks so much for the great study guide. I am a high school counselor, and we have been teaching a freshmen study skills class for two years.... Your ideas have really inspired me, and there are many of the same theories that we have been presenting, but in a *new* way! Thanks for the great tips!" —[Trinity Walsh](#), Guidance Counselor, Elder High School, Cincinnati, OH.

11. Are There Other Websites that Give Study Hints?

Yes; here are some that looked good to me; many of them have further links for you to follow:

- [The Harvard Guide to Happiness](#) (reprinted from *The New York Times* (18 April 2001).
- [Study Guides and Strategies](#)
- Blue, Ronald C., "[How to Study](#)"
- [How to Study with howtostudy.com](#)
- [Keys to College Success](#)
- [Graduate Study in the Computer and Mathematical Sciences: A Survival Manual \(by Dianne Prost O'Leary\)](#)
- [The PQRS Method of Studying](#)
- [UB Composition Resources for Students](#)
- [The Study Skills Help Page: Strategies for Success](#)
- [Hayes-Bohanan, James \(2002\), "The Not-the-13th-Grade Page: A FREE Online Guide to College Success"](#)
- [Masino, Dennis; & Giuliano, Jackie \(2014\), "How to Study and Learn Effectively—Techniques & Methods"](#)

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- Also see:
["An Assortment of Learning Styles"](#), *Chronicle of Higher Education* (8 January 2010): A8; published online 15 December 2009.

Holland, John L. (1966), *The Psychology of Vocational Choice* (Waltham, MA: Ginn & Co.)

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Pashler, Harold; McDaniel, Mark; Rohrer, Doug; & Bjork, Robert (2009), "[Learning Styles: Concepts and Evidence](#)", *Psychological Science in the Public Interest* 9(3): 105–119.

- Also see:
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