

## Research-Based Guidelines for Using Flashcards to Improve Your Learning

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November 2019

\*Adapted from: Cerbin, W., Beckett, S. & Krause, A. (2018). *Research-based guidelines for using flashcards to improve your learning*, Unpublished working paper.

## Introduction

Flashcards are a popular study aid among college students. For example, a study with 247 undergraduates found that 67% used flashcards to study in their classes. Students also use them to prepare for graduate school entrance exams such as the GRE. In fact, flashcards are a common study aid used by medical students to prepare for medical board exams.

Even though flashcards are a popular and simple study technique, students may not benefit much if they use them inappropriately. For example, in working through a stack of cards students tend to think they *know* the answers after getting them correct a few times. Students sometimes become overconfident and stop studying before they have learned the material. Research demonstrates students may be able to answer a question accurately a few times during a study session but may not be able to answer it a few days later.

In the interest of supporting student learning, we developed guidelines for making and using flashcards. There is substantial research on how to use flashcards, and we used research findings as a basis for recommendations about the most effective ways to use flashcards to support your learning. If you have never used flashcards, these guidelines can help you start. If you already use flashcards, we offer tips to help you use them more effectively.

## How to Make High Quality Flashcards

Making your own *high quality* flashcards involves identifying key content and skills, and then writing good questions and answers related to the material. Below are guidelines for writing high quality flashcards to: 1) memorize definitions and factual information, 2) test the types of questions your instructor asks, and 3) test the level of knowledge expected in your course.

**I. Memorizing definitions and factual information.** Flashcards can be an effective way to learn definitions of concepts or remember factual information.

### **Making cards for memorizing definitions:**

1. Make a list of the most important concepts based on your text and/or other course materials.
2. Use your lecture notes, textbook, and other course materials to develop a definition of each concept.
3. The concept name goes on one side of the card, and the definition on the other.

Example of a concept definition question:

Q: What is an *attitude*?

A: An attitude is the tendency to think, feel, or act positively or negatively toward objects in our environment.

### **Making cards for memorizing factual information:**

1. Make a list of the facts you need to know.
2. Use your course material (notes, readings, class handouts) to locate the factual information you need.
3. On one side of the card write the fact (answer). On the reverse side of the card write a question that prompts you to recall the fact(s).

Example of a factual test question:

Q: Name the stages of prenatal development and indicate when they take place.

A: There are three stages of prenatal development

Zygotic	first two weeks after conception
Embryonic	Two weeks after conception to 2 months
Fetal	Starts at 2 months after conception until birth

## II. Match cards to the types of questions your instructor asks.

If your instructor provides examples of test questions or practice tests, then use these types of questions for flashcards. If your instructor does not provide examples, then ask for some. In addition, after the first exam you may be able to predict the types of questions that will be on future exams.

### Make cards based on the types of questions on exams and quizzes.

Your instructor may give practice quizzes, practice tests, or study guides that include possible test questions. Use these to make flashcards!

Of course, the practice quiz questions may not appear on the actual exam. So, the challenge is to write questions in the *same format*, but with content from the current unit of material. For example, suppose your instructor tends to include questions that ask you to compare and contrast different theories, ideas or events. It would be a good idea to write some compare and contrast flashcards. Below are some other common types of questions used on college level tests.

- Compare and contrast . . .
- Use your knowledge of the course content to *predict* the outcome of a certain experiment, situation or event.
- Explain why . . .
- Explain how . . .
- Give an example of . . .
- What are the strengths and weaknesses of . . .
- Which theory does the best job of explaining . . .
- What decision would you make in this situation? Use evidence from the course readings to support your choice.

## III. Match cards to the level of knowledge expected.

College teachers usually expect you to know more than definitions of concepts. Test questions often require you to have some depth of understanding, to be able to explain, analyze, and evaluate ideas. If the tests in your class expect you to demonstrate depth of understanding and complex thinking, then try to create flashcards that test these different levels of learning.

### Make cards that test different levels of learning.

*Select topics and content.* Decide what concepts and material are most relevant for flashcards. Select concepts from class lectures, assigned readings, and whatever your instructor highlights as important.

### *Identify the level of learning for each concept*

Before you make the cards, identify how well you need to know the concepts. For example, do you need to be able to explain, apply, analyze, evaluate, synthesize, or use the concepts to solve

problems? If so, then it is best to create flashcards that test these different levels of learning. To identify the expected level of learning in your course:

- look at the course learning outcomes in the syllabus
- look at information or study guides your instructor provides about exams
- look at any practice exam questions or previous exams from the course
- ask your instructor what kinds of questions will be on the test

*Make cards that test the expected level of learning.* For example, on an upcoming exam if you need to analyze or evaluate concepts, then simply remembering the definitions of the concepts won't help you. You need to make flashcards that help you practice *analyzing* and *evaluating*. Below are examples of flashcard questions that target different levels of learning.

**To make cards that test *explaining* concepts or information:**

1. Write a question that involves explanation on one side of the card. Here are some examples of question types.
  - Explain how
  - Explain why
  - Give an example of how
  - Give reasons why it is important
2. On the reverse side write down the key points to the answer.

**To make cards that test *analyzing* concepts or information**

Ask your instructor to clarify what it means to “analyze.” Usually, analysis involves breaking a concept up into its components parts, and determining how the parts relate to one another and to an overall structure or purpose.

On one side of the card write a question prompt that involves analyzing. On the reverse side write down the major points of your analysis.

Examples of analysis:

Q: Based on the reading about the American Civil War, which facts support and do not support the conclusion that the Civil War was caused by differences in the rural and urban composition of the North and South.

A: Your answer should outline the facts from the article on both sides of the issue. Simply list these rather than write out a long essay answer.

Q: Based on textbook chapters and class notes for a unit in statistics, create a matrix that includes the name and formula for each statistical test in the unit, and the conditions in which it is used

A: A table with three columns: 1) Test name, 2) formula, and 3) conditions of use.

**To make cards that test *evaluating* concepts or information**

Ask your instructor to clarify what it means to “evaluate.” Usually, evaluation involves using criteria and standards to judge the quality, effectiveness, or significance of something. To make a flashcard, write a question prompt that involves *evaluating* on one side. On the reverse side, list the key parts of the answer.

Examples of evaluation:

Q: List the logical flaws in a persuasive message by a political candidate. This question assumes you have access to the message, e.g., recorded advertisement, print advertisement, etc.

A: Identify specific passages in the message and describe the logical flaws they illustrate.

Q: Read a scientific article about climate change, and determine how well the evidence in the article supports the conclusions.

A: Make a list of the conclusions and for each one explain what evidence is cited in the article and whether it is sufficient to support the conclusion.

### How to Use Flashcards to Improve Your Learning

Recommendations	Comments
<b>Adding Flashcards to Your Study Routine</b>	
Use a variety of methods to study.	Flashcards can be a useful tool for learning, but they should not be your only method to learn the course material.
Study the material first and then make flashcards.	Flashcards should not be your first exposure to the course material. Study first so that you begin to develop an understanding of the material. Start using flashcards after you have read and studied the material.
Spread out studying over days and weeks.	Any type of study, including flashcards, is MUCH more effective when spread out over time. Plan ahead and schedule flashcard study sessions on specific days well before exam days. For example, if you have an exam on an upcoming Monday, schedule 3 flashcard study sessions for 40 minutes each on the preceding Tuesday, Thursday and Saturday.
<b>Use Flashcards to Self-Test</b>	
Use flashcards to self-test.	Self-testing is a very potent learning strategy. It works because whenever you try to recall information from memory, you strengthen the memory and make it more likely that you will be able to recall the material in the future.
Try to answer the question on the card <b>before</b> you look at the answer.	To learn effectively you need to test yourself—really test yourself. Don't turn over the card until you have tried hard to think of the answer. Looking at the answer before trying to answer the question is not an effective way to learn.

<b>Timing of Practice</b>	
Allow “lag time” between your flashcard study sessions.	Lag time is the period of time between study sessions. Self-testing with flashcards is most effective when using longer lag times. After studying a stack of flashcards you should wait for a day or two before practicing with them again.
Plan your study schedule to allow lag time between study sessions.	It is much more effective to study a stack of flashcards every other day than in an extended single study session. Lag time allows you to start to forget the information. After you start to forget the information is the best time to self-test with the flashcards again and strengthen your memory for the material.
Test yourself over the same cards in several different study sessions.	Again, the most effective strategy is to retest yourself several times with sufficient lag time between practice sessions, such as every 2 days.
<b>Amount of Practice to Learn the Material</b>	
Continue to test yourself over the cards even if you answer the questions correctly.	<p>Sometimes when students answer a question correctly, they think they <i>know</i> the answer and drop the card from their stack. Even if you answer the question correctly several times during a study session, that is no guarantee you will know the answer several days later. Continue testing yourself over cards even when you answer them correctly.</p> <p>In one study the researchers offer this rule of thumb – They recommend recalling flashcard items three times during initial learning, and then learning them again during three future study sessions.</p>
Study your entire stack of cards each practice session rather than dividing them up into several smaller stacks to study separately.	Suppose you have 30 flashcards to study for an exam. It is more effective to study the entire stack of 30 than to divide them into smaller stacks.
Continue to study your cards throughout the semester to prepare for a cumulative final exam.	You can prepare for cumulative final exams by practicing with your flashcards throughout the semester. Don’t wait until the end of the semester! Every 3-4 weeks return to the concepts from earlier in the semester, and use your flashcards to study.

Different Levels of Learning	
<p>Use flashcards that help you learn at the appropriate level in your course.</p>	<p>Exam questions differ with respect to the level or complexity of learning expected of students. Some questions expect only rote memorization, e.g., being able to remember a definition of a concept or a formula verbatim from lecture or the text. Other questions expect you to be able to explain a concept, give an example, analyze or evaluate an idea.</p> <p>Using flashcards only to memorize material, will <u>NOT</u> help you answer questions based on more complex or higher-level learning. You need to create cards that test higher levels of learning.</p>
<p>Create flashcards that test higher levels of learning, not just rote memorization.</p>	<p>Suppose your instructor uses test questions in which you have to explain a concept or idea and not simply remember a memorized definition. Create flashcards to test yourself on explaining key concepts. For example, on one side of the card write a question such as, "Explain concept X" or "Explain how concepts X and Y are related." Then on the reverse side write down some of the key points of an explanation. When you test yourself with the flashcard, you can write out an answer and then compare it with the notes on the card to make sure you have hit all the main points. (Refer to the section on "How to Make Flashcards" for additional information.)</p>
<p>Practice with classmates.</p>	<p>Use flashcards with one or more classmates to test one another. Or, trade flashcards with another student and see how well you can answer a new set of cards on the same material. Group study is also an opportunity to discuss and explain difficult material with other students.</p>
<p>Using flashcards to master the subject.</p>	<p>Mastering a subject is not a matter of accumulating isolated facts and definitions. Of course, when you master a subject, you do know a lot of facts and specific information about it. But mastery involves developing a body of knowledge in which you learn how facts and concepts are related to one another, use that knowledge to understand new ideas about the subject, use it to solve problems and make decisions, and more.</p>

How can flashcards help you master a subject? First, use flashcards to develop the foundational knowledge of the topic. It is important to know facts and ideas, and flashcards can help you do that! Second, use flashcards that promote higher-level learning and more complex thinking related to the topic. If you do both of these, then flashcards can support mastery of the subject.

Finally, don't rely exclusively on flashcards to study. They are only one tool and should be used in combination with other study methods.

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### Appendix: Digital Flashcard Systems

There are many online flashcards systems for college level education. Below are 11 examples. Some are free and some charge a fee. Check the system's website for current fees. The systems are listed in alphabetical order, and not ranked by features, preference or quality. We do not recommend using any specific system. However, if you do use one of these programs we strongly urge you to create your own flashcards based on the content of your courses, rather than use pre-made cards for a subject or the flashcards made by former students in the course.

System	Features
<b>Anki</b> <a href="https://apps.ankiweb.net/">https://apps.ankiweb.net/</a>	<ul style="list-style-type: none"> <li>- Cards can be available on multiple devices</li> <li>- Can use images, videos, and audio clips on flashcards</li> <li>- Download the software onto your computer or download onto mobile device</li> <li>- Free for Androids</li> </ul>
<b>Brainscape</b> <a href="https://www.brainscape.com/">https://www.brainscape.com/</a>	<ul style="list-style-type: none"> <li>- Teachers can set up flashcards, and create a competitive leaderboard that encourages students to engage, and see where they are excelling and where they need help.</li> <li>- Can find pre-made flashcards</li> <li>- Free, upgrade for \$9.99/mo. Includes adding sound/images, reverse flashcards (Q &amp; A) study unlimited.</li> </ul>
<b>ExamTime</b> <a href="https://www.gocongr.com/en-US/examtime/">https://www.gocongr.com/en-US/examtime/</a>	<ul style="list-style-type: none"> <li>- Flashcards, mindmaps, quizzes, notes, groups, flowchart and study planner</li> <li>- Create your own flashcards, pre-made flashcards, and share flashcards</li> <li>- Develop ideas, test abilities, track progress, and improves learning potential</li> <li>- Discover relevant resources from community library</li> <li>- Free</li> </ul>
<b>Flashcard Machine</b> <a href="https://www.flashcardmachine.com/">https://www.flashcardmachine.com/</a>	<ul style="list-style-type: none"> <li>- Games - quiz me, speed, pop quiz</li> <li>- Has a mobile app</li> <li>- Add images/audio</li> <li>- Study modes: Standard - review, flip and continue or 4D - learn cards over time-based cycles</li> <li>- Free</li> </ul>
<b>Memorang</b> <a href="https://www.memorangapp.com/">https://www.memorangapp.com/</a>	<ul style="list-style-type: none"> <li>- Flashcards, quizzes, games</li> <li>- Can create your own, or buy pre-made sets, eg. GRE, SAT, MCAT, EMT</li> <li>- Features include learning mode, e.g. multiple choice quizzes, flashcards, matching cards, rapid response, eliminator</li> <li>- Input images</li> <li>- Free or pay for premade sets (3 days free, \$12.00 per month or \$39.99 annually)</li> </ul>

<p><b>Quizlet</b></p> <p><a href="https://www.quizlet.com">https://www.quizlet.com</a></p>	<ul style="list-style-type: none"> <li>- Flashcards, quizzes (multiple choice, matching, fill in the blank)</li> <li>- Learn feature (eliminates terms as you master them)</li> <li>- Can add images, voice recordings</li> <li>- Make diagrams</li> <li>- Can share with others/classes</li> <li>- Quizlet Plus allows you to add voice recording and create diagrams</li> <li>- App for iPhone/Android</li> <li>- Free or Quizlet Plus is \$1.67 per month</li> </ul>
<p><b>QuizMeOnline</b></p> <p><a href="http://www.quizmeonline.net/">http://www.quizmeonline.net/</a></p>	<ul style="list-style-type: none"> <li>- Make your own or pre-made flashcards in business, math, science, history, engineering, law, psychology, social work</li> <li>- Make your own study or look at pre-made study guides</li> <li>- Make surveys</li> <li>- Educational games &amp; quizzes</li> <li>- Free</li> </ul>
<p><b>StudyBlue</b></p> <p><a href="https://www.studyblue.com/">https://www.studyblue.com/</a></p>	<ul style="list-style-type: none"> <li>- Pre-made flashcards in different subjects (e.g. science, math, psychology, biology, history)</li> <li>- Can make your own</li> <li>- Add text, images, and audio</li> <li>- Can upload your notes to study anytime, anywhere</li> <li>- Teachers can see progress goals</li> <li>- App for iPhone/Android</li> <li>- Free or get upgrade for \$7/mo</li> </ul>
<p><b>Study Stack</b></p> <p><a href="https://www.studystack.com/">https://www.studystack.com/</a></p>	<ul style="list-style-type: none"> <li>- Have pre-made flashcards in business, geography, history, languages, math, medical, science, standardized tests</li> <li>- Can make your own</li> <li>- Play games created from your flashcards</li> <li>- Apps for Android and iPhone</li> <li>- Free</li> </ul>
<p><b>Flashcard Systems for Pre-medical and Medical Fields</b></p>	
<p><b>Firecracker</b></p> <p><a href="http://www.firecracker.me/">http://www.firecracker.me/</a></p>	<ul style="list-style-type: none"> <li>- Pre-made flashcards and exams for pre-med, MD/DO</li> <li>- School use -- teachers can incorporate curriculum in flashcards and students may have access, teachers can also see patterns of effectiveness.</li> <li>- Free 7 day trial</li> <li>- Must pay (\$250 per year)</li> </ul>
<p><b>Osmosis</b></p> <p><a href="https://www.osmosis.org/">https://www.osmosis.org/</a></p>	<ul style="list-style-type: none"> <li>- Premade sets are for future physicians, including sets for Intro, Preclinical, Step 1, and Clinical</li> <li>- Personalized quizzes, mnemonics, videos, reference articles</li> <li>- Free two week trial</li> <li>- (\$14/12 mo, \$10/mo for 2 years, custom term \$9/mo)</li> </ul>