



**Retrieval Practice**  
retrievalpractice.org

# HOW TO USE RETRIEVAL PRACTICE TO IMPROVE LEARNING

Pooja K. Agarwal, Ph.D.

Henry L. Roediger, III, Ph.D.

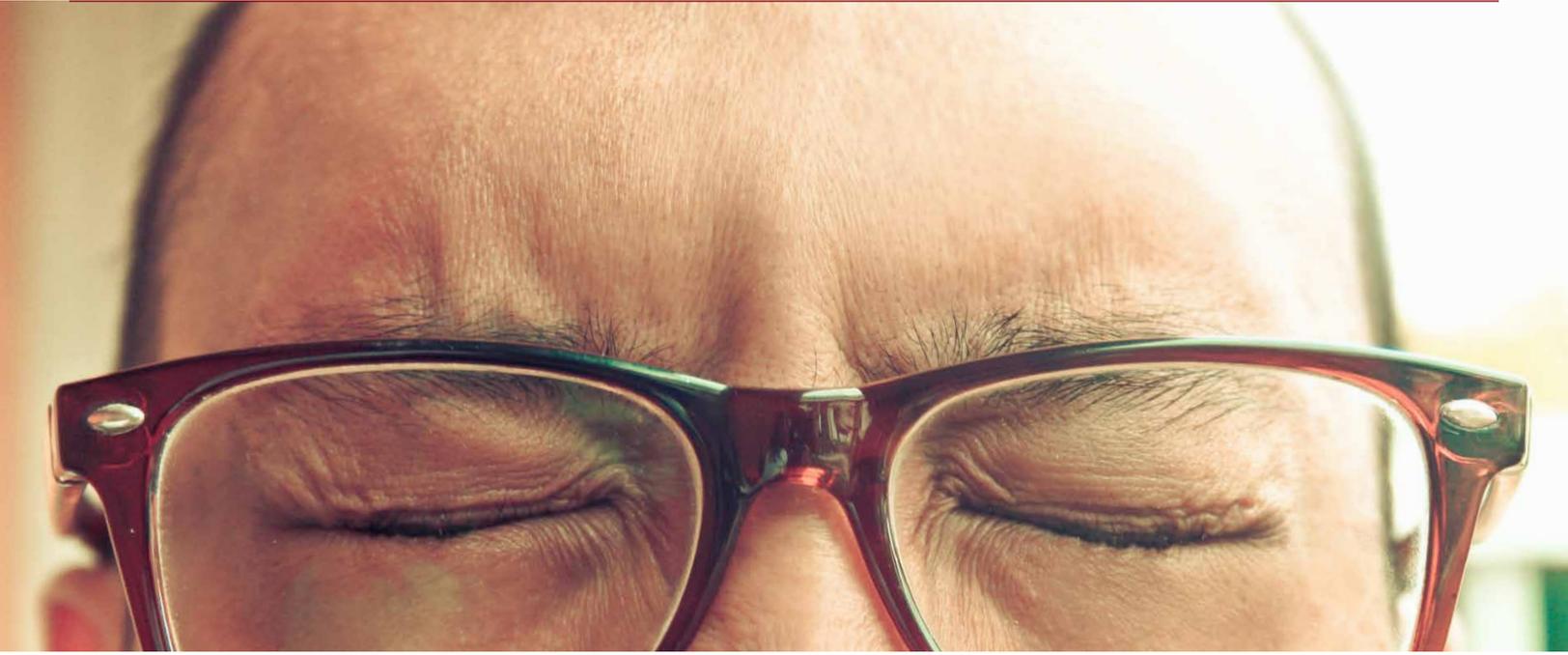
Mark A. McDaniel, Ph.D.

Kathleen B. McDermott, Ph.D.

©2018

 Washington  
University in St. Louis





**What if you could raise students' grades from a C to an A? The solution isn't technology. It's not more money. It's not more class time. Curious?**

**When we think about learning, we typically focus on getting information into students' heads. What if, instead, we focus on getting information out of students' heads?**

**"Retrieval practice"** is a learning strategy where we focus on getting information **out**. Through the act of retrieval, or calling information to mind, our memory for that information is strengthened and forgetting is less likely to occur. Retrieval practice is a powerful strategy for improving academic performance without more technology, money, or class time.

In this guide, we discuss **how to use retrieval practice to improve learning**. Established by nearly 100 years of research, retrieval practice is a simple learning technique that is easy to implement, with lasting results.

In order to improve learning, we must approach it through a new lens – let's focus not on getting information "in," but on getting information "out."

## **WHAT IS RETRIEVAL PRACTICE?**

Retrieval practice is a strategy in which calling information to mind subsequently enhances and boosts learning. Deliberately recalling information forces us to pull our knowledge "out" and examine what we know. For instance, I might have thought that I knew who the fourth U.S. President was, but I can't be sure unless I try to come up with the answer myself (it was James Madison). Often, we think we've learned some piece of information, but we come to realize we struggle when we try to recall the answer. It's precisely this "struggle" or challenge that improves our memory and learning – by trying to recall information, we exercise or strengthen our memory, and we can also identify gaps in our learning.

## You're probably already using retrieval practice.

Sounds like a no-brainer? Probably because you're already using retrieval practice in your classroom! You might ask students questions during class, give quizzes and exams, and/or provide homework as a way to "practice" what was learned – these are all examples of what we call retrieval practice. The big difference, however, is that retrieval should be used as a **learning strategy**, not an assessment tool. In fact, research demonstrates that retrieval is a more potent learning strategy than other techniques commonly used in classrooms, such as lecturing, re-reading, or taking notes. So, instead of asking students to retrieve information only during assessments, encourage retrieval **during learning** to improve students' understanding and retention of classroom material.<sup>[1]</sup>

Think of retrieval as a  
learning strategy,  
not an assessment tool.



## WHY DOES RETRIEVAL PRACTICE IMPROVE LEARNING?

Again, when we think about learning, we typically focus on getting information into students' heads. Teachers might lecture, show videos, encourage note taking, and/or provide review sheets. Students often study by re-reading their textbooks, highlighting information, and/or reviewing their notes. In both of these situations, the focus is on getting information "in," with the hope that it sticks. We've all had the experience of feeling like these methods work – if I cram, and re-read, and study my notes, I feel fairly confident that I know the information. And indeed, cramming pays off – we tend to do well on a test. So what's the problem?



Just like exercise, learning  
works the same way:  
"no pain, no gain."

The problem is that these methods only lead to **short-term learning**. Have you ever asked students about material you covered earlier in the semester, only to find that they've forgotten most everything? This common situation arises because of an assumption we make about memory: when information comes to mind easily and feels "fluent," we've learned successfully. Much to our surprise, however, memory researchers have demonstrated that the **opposite is true**: when information comes to mind easily and feels fluent, it's easy to forget. In other words, just because we learn something quickly and easily does not guarantee we'll remember it.

### Challenging learning leads to long-term learning

Retrieval practice makes learning effortful and challenging. Because retrieving information requires mental effort, we often think we are doing poorly if we can't remember something. We may feel like progress is slow, but that's when our best learning takes place. **The more difficult the retrieval practice, the better it is for long-term learning.** For instance, recalling an answer to a science question improves learning to a greater extent than looking up the answer in a textbook. And having to actually recall and write down an answer to a flashcard improves learning more than thinking that you know the answer and flipping the card over prematurely. Struggling to learn – through the act of "practicing" what you know and recalling information – is much more effective than re-reading, taking notes, or listening to lectures. Slower, effortful retrieval leads to long-term learning. In contrast, fast, easy strategies only lead to short-term learning.

## DOES RETRIEVAL IMPROVE MORE THAN JUST MEMORIZATION?

By using retrieval practice as a learning strategy (not an assessment tool!), we exercise and strengthen our memory. Research demonstrates that this improvement in memory and long-term learning is **flexible**, which:

- Improves students' complex thinking and application skills
- Improves students' organization of knowledge
- Improves students' transfer of knowledge to new concepts

In other words, retrieval practice doesn't just lead to memorization – it increases **understanding**. Because students have a better understanding of classroom material by having practiced using this information, students can adapt their knowledge to new situations, novel questions, and related contexts. You can use a variety of question types (fact-based, conceptual, complex or higher order, etc.) to ensure that students are not memorizing, but using information flexibly.<sup>[2]</sup>

As an additional benefit, retrieval practice helps us to identify gaps in learning. In other words, not only does retrieval improve learning and help us figure out what we do know – more importantly, it helps us figure out what we don't know. This crucial benefit of retrieval practice is called **metacognition**, or awareness of what students know and don't know. For instance, some students study hard for tests and don't do well, usually because they studied what they already knew – they didn't study what they didn't know. By engaging in retrieval practice, students are able to evaluate what they know and what they don't know, and then make better study decisions. Improved metacognition also benefits teachers: by seeing what students know and don't know, teachers can adjust lesson plans to ensure that all students are on the same page (similar to formative assessment). An important component of metacognition is **feedback**, or providing students information about whether they got something correct or incorrect. Without feedback, students won't know how they performed. Thus, feedback should **always** be provided to students after retrieval practice.



Retrieval practice encourages  
flexible understanding,  
improving higher order  
thinking skills and transfer  
of knowledge.

## FOR WHICH GRADE LEVELS, SUBJECT AREAS, AND STUDENTS IS RETRIEVAL PRACTICE APPROPRIATE?

### All grade levels!

Whether you use retrieval practice with 3rd graders or college students, a great deal of research has shown that retrieval practice is beneficial for all ages (even older adults). It is a straightforward technique that can be applied in a variety of ways, for a variety of ages.

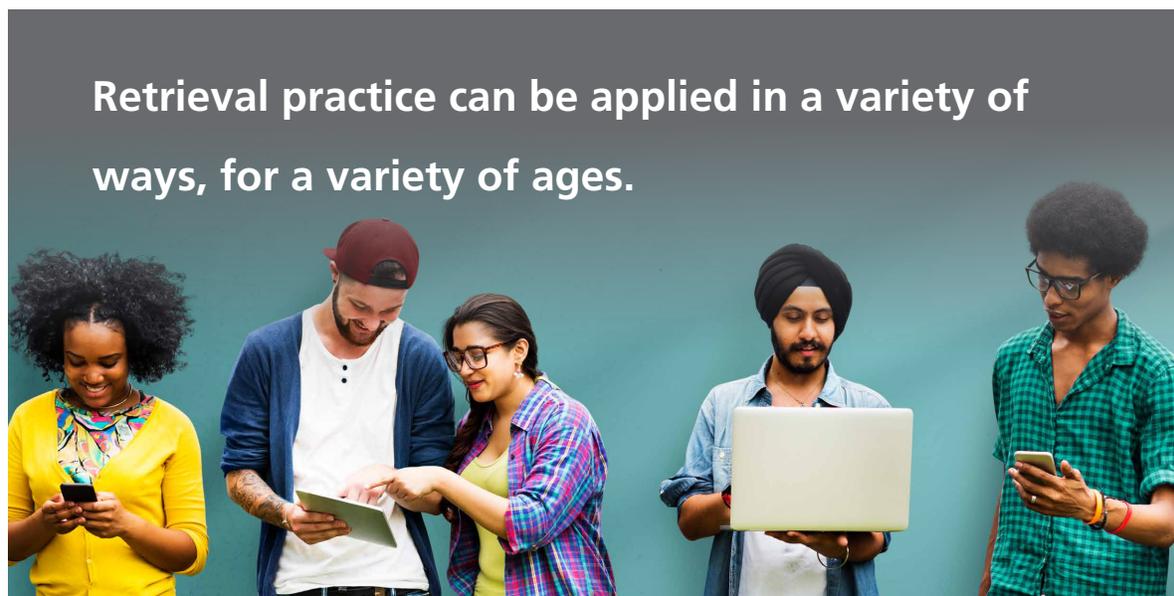
### All subject areas!

Research has shown that retrieval practice improves learning of:

- Science
- Mathematics
- Social studies/history
- Vocabulary learning
- Foreign language vocabulary

### All students!

Our research demonstrates that retrieval practice benefits both low and high ability students. Because retrieval practice is a simple, flexible learning strategy, it can be adapted to a wide variety of situations, including special education and gifted classrooms. Further, students can practice retrieval at home (e.g., answering practice questions, using flashcards) or in the classroom (e.g., with low-stakes quizzing). In other words, retrieval practice isn't just a teaching strategy; it's a powerful study strategy, too.<sup>[3]</sup>



## HOW DO I IMPLEMENT RETRIEVAL PRACTICE?

First, use retrieval practice to engage **all students**, not just one student being called on. Second, keep in mind that retrieval practice should be used as a **learning strategy**, not an assessment opportunity. Third, always provide **feedback**.

### Clickers or Colored Index Cards

Clickers, or “remotes” for personal responding, are an engaging way to implement retrieval practice, helping students recall information from mind. Do you have to use clickers? No! Clickers may be easiest for gaining instant feedback for both the student and the teacher, but the key to retrieval practice is to engage students in recalling information from memory. Paper-and-pencil and computer or web-based quizzes can be used to accomplish the same retrieval practice goals as clickers. Note that clickers/online quizzes may require you to write retrieval questions in advance.

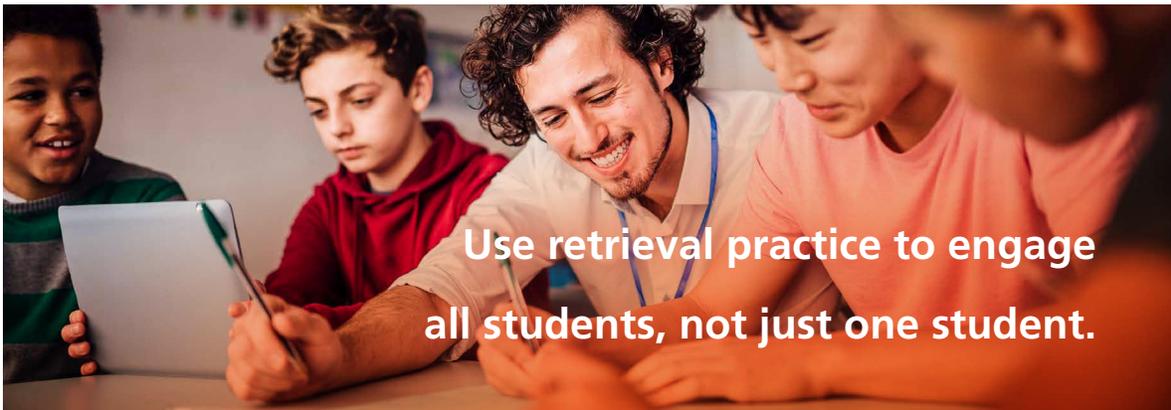
Alternatively, each student could have their own set of colored index cards, with the letters A, B, C, and D on them (or true/false, or 1, 2, 3, etc.). This way, you can ask a question (on the fly) and students can close their eyes while raising the appropriate index card to identify their response. It’s an easy, cheap alternative to using clickers, and you can provide immediate feedback after students respond.

### Bell Work or Exit Tickets

Give small slips of paper at the very beginning of class as students are entering the classroom (“bell work”) or before students leave the classroom (“exit tickets”) that include questions about content learned in class. It could even be a simple writing prompt (e.g., “Write down everything you remember from the previous class”). This engages students in retrieval practice, while conserving classroom time so you can focus on teaching – but don’t forget to give feedback!

### Page Protectors with Dry Erase Markers

Insert a piece of paper or cardboard into a page protector. This becomes a cheap, do-it-yourself “dry erase board” for each student. You can call out a question and students can write down an answer – even a short answer response – and hold up their dry erase board. Again, you can quickly scan the room and provide appropriate feedback.



## WHAT ARE POTENTIAL CHALLENGES IF I IMPLEMENT RETRIEVAL PRACTICE?

### Do I need to change my textbook?

No! Retrieval practice works with any textbook materials, especially those that come with practice questions. In our research, we used the classroom teacher's textbook materials and we consistently found that retrieval practice was better for learning than re-reading or re-studying textbook material without retrieval practice. Retrieval practice is a very flexible learning tool that you can use with any materials; you don't have to change your curriculum. Simply adapt your classroom materials to serve as practice retrieval questions.

### Do I need to change my style of teaching?

No! You can keep your style of teaching exactly the same. We simply suggest that you insert retrieval practice activities after your lessons to improve students' learning and metacognition. Retrieval practice activities can be completely separate from your teaching and lectures, meaning that retrieval practice can be a stand-alone activity. You can teach and use your typical activities in exactly the same way as you have been doing.

### If I spend time using retrieval practice, I can't cover as much material.

Retrieval practice doesn't take more classroom time – it involves using classroom time **more effectively**. Think about the activities you currently use in class – in other words, are students using their “time on task” effectively? How can you be sure that students are learning when you present material (especially if students are re-reading or taking notes)? Research demonstrates that students learn during retrieval practice. So, swap less effective activities with retrieval practice strategies. You'll spend the same amount of time teaching, but you'll be more effective.<sup>[4]</sup>



## FREQUENTLY ASKED QUESTIONS

### How is retrieval practice different from “cold calling?”

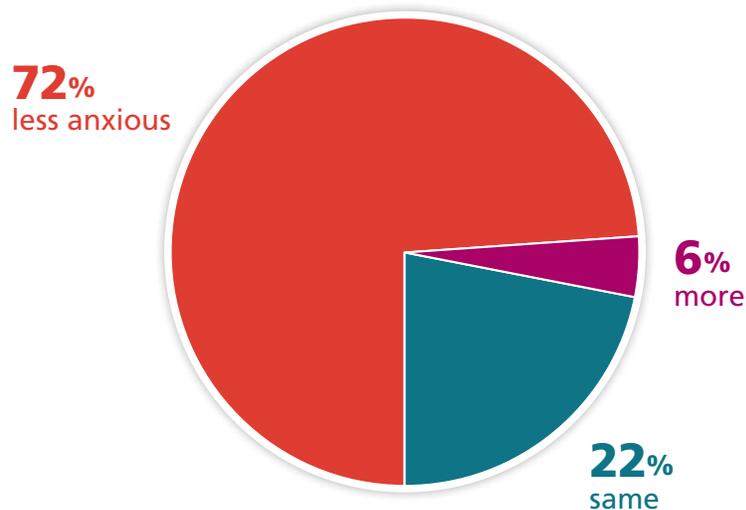
Teachers often use retrieval practice in their classrooms by simply asking questions throughout their lessons and calling on students to provide a response (also known as “cold calling”). Teachers in our focus groups said that they preferred retrieval practice strategies because they engage the **entire** class. The standard cold calling procedure, on the other hand, allows students who were not called on to be “off the hook.” By engaging every student in retrieval practice, every student reaps its benefits for long-term learning.

### How much retrieval practice do I have to give?

The more the better, and space it out. Practice makes perfect, and the more the retrieval practice, the harder it is to forget information. In addition, spacing it out makes retrieval more challenging, and remember that the more challenging the retrieval practice, the better. So, you could give a quick quiz immediately after a lesson, a week after a lesson, and a month after a lesson. These “relearning” sessions are important to refresh our knowledge. Students might forget in between relearning sessions – that’s normal. But, students will also “relearn” information more quickly and effectively each time they engage in retrieval practice.<sup>[5]</sup>

### Does retrieval practice increase test anxiety?

No, in fact it **decreases** test anxiety! Students not only become used to the process of retrieval, but because learning increases, they become more comfortable with course content and less anxious about upcoming exams. Our surveys of nearly 1,500 middle school and high school students confirm that 72% report a **decrease** in test anxiety by the end of the school year.<sup>[6]</sup>



## Should I provide feedback after retrieval practice?

Yes. Feedback helps improve students' **metacognition**. Without feedback, students don't know what they got correct and what they got incorrect during retrieval practice. Providing feedback is a key to powerful retrieval practice. Feedback **does not** mean more work for you, grading more quizzes and assignments. Simply discuss or display the answers and have students self-grade their own retrieval practice. Also, the more elaborate the feedback (e.g., with explanations), the more powerful. Learning and metacognition increase when students receive explanations about why they were correct or incorrect.<sup>[7]</sup>

## What types of questions should I include in retrieval practice?

A variety! Research demonstrates that different questions improve learning in different ways. If you want students to learn facts, concepts, and higher order or complex topics, implement retrieval practice using fact-based, concept-based, and complex questions. Don't just stick to one type or another.<sup>[8]</sup>

## Multiple-choice or short answer?

All of the above! Our research demonstrates that both short answer and multiple-choice retrieval practice enhance learning. In real classrooms, the retrieval benefit from short answer vs. multiple-choice quizzes appears to be similar. So, use what's easiest for you! Clicker software is typically used for multiple-choice questions. If you give students bell work or exit tickets, a short answer response might be more practical.<sup>[9]</sup>

## Should I provide retrieval practice before, during, or after a lesson?

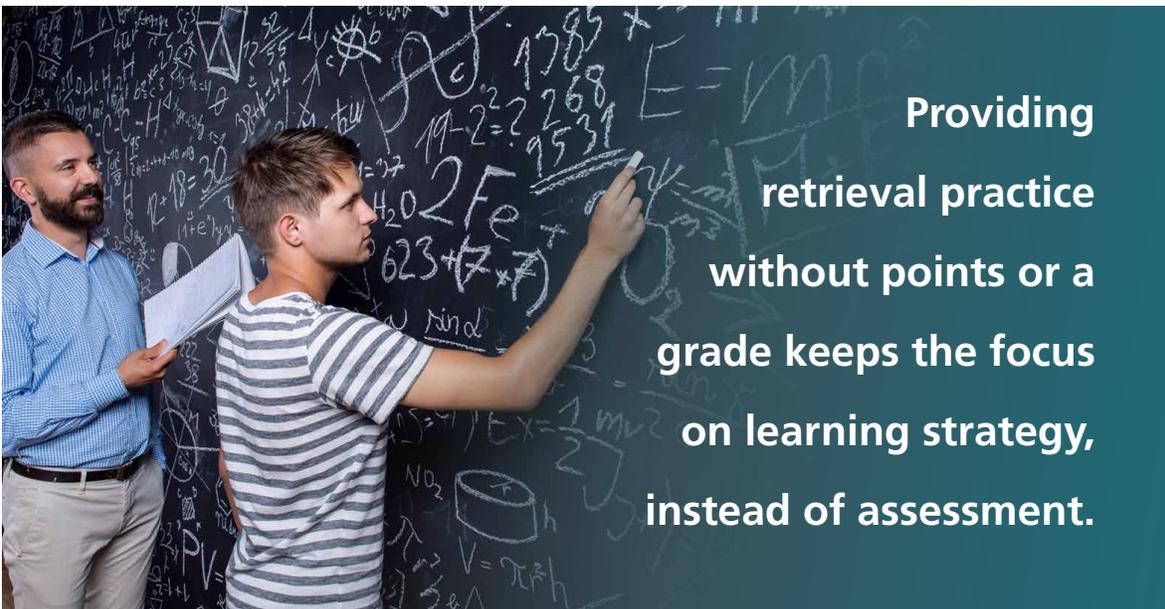
Retrieval practice is more robust if it takes place **after** a lesson. Again, the more challenging the retrieval, the better. Yet any schedule of retrieval practice enhances learning. Students, teachers, and parents should be encouraged to know that the precise schedule of retrieval practice can be flexible. Students can also practice answering questions for homework and spacing is important. Don't give students homework on what they learned in class earlier that day – challenge them by providing homework on content learned last week.<sup>[10]</sup>

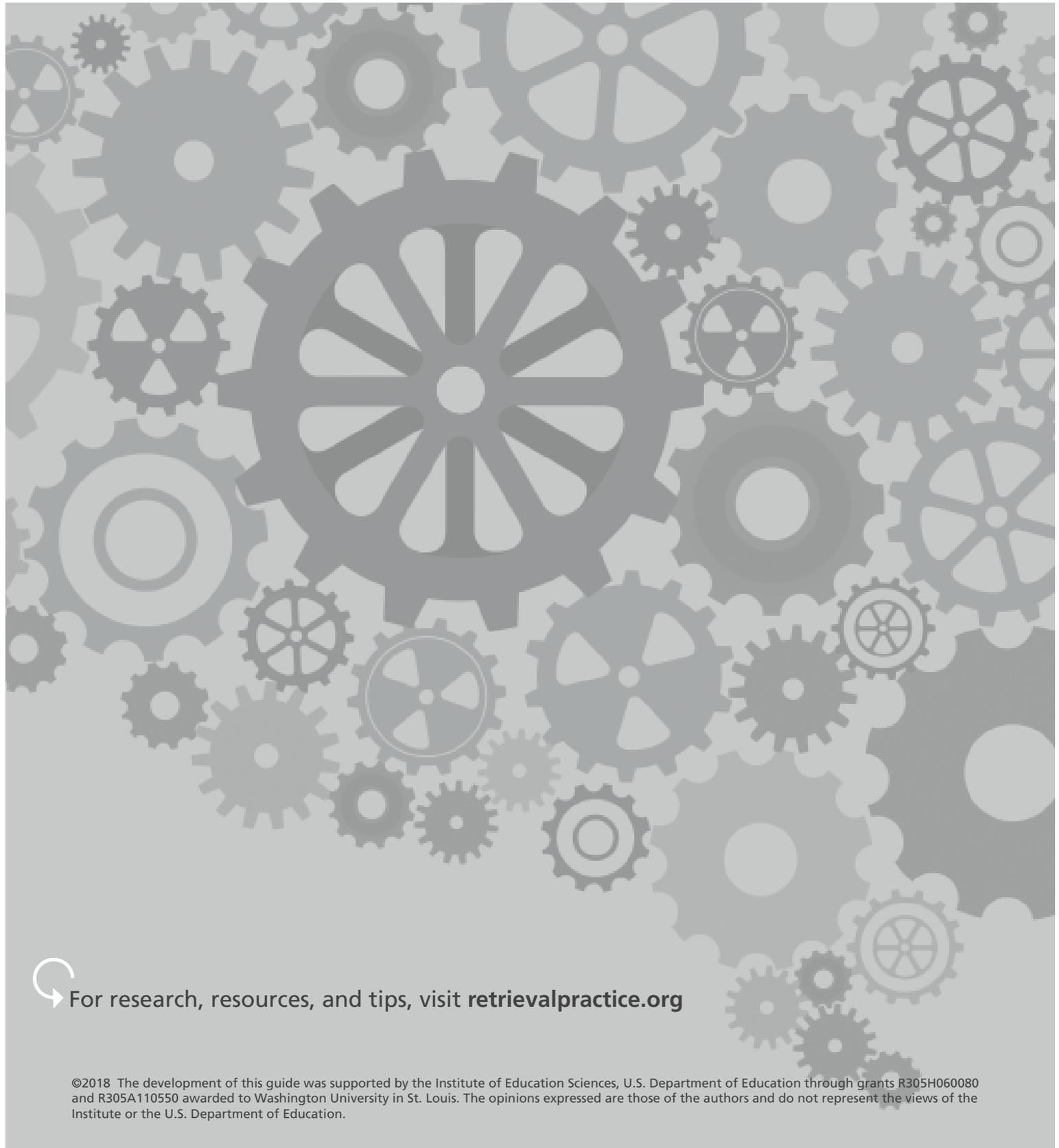
## Should I give retrieval practice for a grade?

No! In fact, providing retrieval practice **without points or a grade** will maintain focus on retrieval practice as a learning strategy, not an assessment tool. Students will feel less pressured and more comfortable when making mistakes (which is good for learning!), you can implement challenging retrieval practice without worrying about negative consequences to grades (and you'll likely see grades increase!), and parents won't worry that retrieval practice is standardized testing in disguise (it's not!). Instead, retrieval practice is a tool to **help students**, not punish them. It improves learning, it improves metacognition, and it decreases test anxiety. Provide feedback, not grades or points.<sup>[11]</sup>

## RETRIEVAL PRACTICE IMPLEMENTATION CHECKLIST

- Use retrieval practice as a learning strategy, not an assessment tool.
- Make retrieval practice low-stakes or no-stakes (i.e., not for a grade), to reduce anxiety and encourage trial-and-error.
- Provide retrieval practice frequently, as often as possible. Practice makes perfect!
- Provide retrieval practice after a lesson is complete, perhaps even a few days or weeks later. Space it out.
- Use a variety of strategies to implement frequent retrieval practice: clickers, index cards, bell work, quick writing prompts, etc.
- Use retrieval practice with a variety of students, subject areas (science, history, etc.), and grade levels.
- Encourage metacognition by giving students feedback.
- Reassure students that challenging learning (via retrieval practice) is a good thing!
- Examine your existing teaching strategies – do they focus on getting information “in” or “out” of students’ minds? Are students being challenged, or is learning easy and “fluent?”
- Use a variety of question types: fact-based, conceptual, and higher order/transfer.





 For research, resources, and tips, visit [retrievalpractice.org](https://retrievalpractice.org)

©2018 The development of this guide was supported by the Institute of Education Sciences, U.S. Department of Education through grants R305H060080 and R305A110550 awarded to Washington University in St. Louis. The opinions expressed are those of the authors and do not represent the views of the Institute or the U.S. Department of Education.



**Retrieval Practice**

[retrievalpractice.org](https://retrievalpractice.org)  
[ask@retrievalpractice.org](mailto:ask@retrievalpractice.org)



@RetrieveLearn



/RetrievalPractice