White Paper

Retrieval Practice: Enhancing Application Skills

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RETRIEVAL PRACTICE:
ENHANCING APPLICATION SKILLS

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"My students report that they spend hours reading their texts and class notes, but it doesn't improve their tests grades — or their ability to apply this material in their clinical practice. How can I help them to do better?"

Most faculty have asked this question as they struggle to help students become competent practitioners. Understanding how retrieval practice can be effective in addressing this problem can be the first step in improving student outcomes.

Learning involves committing knowledge to long-term memory. This knowledge is represented within the brain as a network of associations among concepts. Developing this network involves acquiring, storing, and retaining knowledge, and then later retrieving the knowledge as memories. For example, once the knowledge is successfully encoded, it must be stored in memory for later use. However, this stored memory is usually outside of our conscious awareness, except when we actually need to use it. Through various teaching-learning activities, students can strengthen their ability to acquire knowledge and encode it for later use. However, to ensure that students are successful in clinical practice, faculty must also help students learn to retrieve these long-term memories in order to apply them in specific situations.

There are four ways that memories can be retrieved:

> **Recall:** Being able to access information without being cued.
>
> **Recognition:** Identifying information after experiencing it again.
>
> **Recollection:** Reconstructing memory using logical structures, partial memories, narratives, or clues.
>
> **Relearning:** Relearning information that has been previously learned, thereby improving the strength of memories.

Cherry (2015). https://www.verywell.com/memory-retrieval-2795007

An important role of faculty is to plan teaching-learning activities that help students make the retrieval process more effective. These teaching-learning activities can be considered to be **retrieval practice.** The most common approach to fostering retrieval practice is frequent testing. Rather than reading or re-reading material over and over again, when students are frequently tested on their knowledge, the knowledge is reinforced. Below are some of the benefits of retrieval practice.

1. **Requiring students to frequently retrieve necessary information encourages retention of knowledge.** For example, in a study cited by Roediger, Putman, and Smith (2011), students were expected to study a passage of prose and then, after a varying number of study and testing sessions, take a final examination. When the final exam was given immediately after the student had studied, as when a student "crams" for a test, the studying influenced students' relative success on the test. However, if the final testing period is not immediately after the study sessions, the more often students were tested, the better they did on the final examination. This finding has been confirmed in a number of studies, validating the effectiveness of testing on the retrieval process in end-of-course examinations (Roediger, et al., 2011).

2. **Identifying for students the gaps in their knowledge.** Students who study by re-reading materials, rather than by testing themselves in different contexts, find the material so familiar, they think that they know it. However, they may not be able to apply their knowledge in a meaningful way. Frequent testing helps students identify what they might not know and in what context, so they can allocate future study time to areas of weakness.

3. **Improving metacognitive monitoring.** Metacognitive monitoring is awareness and understanding of one's own thought processes (Kornell, 2014). As students become aware of their own strengths and weaknesses in processing information, they are better able to effectively manage their studying.

4. **Providing feedback to instructors.** Formative assessment not only helps faculty to better understand what their students know, but also serves to improve the metacognitive judgments of students' own knowledge. With appropriate feedback, students will be better able to assess the difference between their current knowledge state and their goal knowledge state, as well as understand what steps they need to take to close that gap (Kornell, 2014).

5. **Producing better organization of knowledge.** An indirect benefit of retrieval practice is that students can often more effectively organize information, because as they actively retrieve it, they are more likely to notice important details and weave them into a cohesive structure (Roediger, et al., 2011).

6. **Improving transfer of knowledge to new contexts.** Multiple studies have found that repeated testing not only increases the retention of facts and concepts, but also facilitates the application of knowledge in context when students are studying another exemplar (Roediger, et al., 2011). Furthermore, Karpicke (2012) notes that every time a person retrieves knowledges, their ability to retrieve it again in the future is improved. As a result, this retrieval practices produces meaningful, long-term learning.

Other factors that facilitate retrieval-based learning include:

1. **Practicing with real-world scenarios.** Studies related to retrieval-based learning demonstrate that context can serve as a cue for retrieval (Roediger, et al., 2011). It would follow that practicing retrieval of necessary information in a wide range of clinical situations would improve the transfer of knowledge to new contexts.

2. **Providing multiple self-checks and exercises.** Students entering nursing and allied health professions programs may be used to completing a course, receiving a grade, and believing that they no longer needed to "remember" the content. However, nursing and health professions education is built upon sequential learning, requiring students to apply concepts learned in earlier courses to experiences they will have later in the course of study. Since repeated recall has been shown to increase long-term retention, this expectation results in multiple opportunities for learners to test themselves on critical information, even when they have proven they know the material earlier in the course or curriculum (Roediger, et al., 2011).

Limitations of frequent testing as a method of retrieval practice

Despite the many ways in which frequent testing provides retrieval practice, there are a number of criticisms of this type of learning. Perhaps most importantly from the perspective of faculty, because constructing test items that stimulate application and analysis is difficult and time consuming. In addition, if questions are not well constructed, students may be rewarded for learning by rote memorization, rather than applying the content in specific contexts.

Digital Solutions

Fortunately, in today's digital world, there are products that can assist faculty in overcoming the burden of generating multiple high-level test questions. For example:

Elsevier Adaptive Quizzing (EAQ), an optimized formative assessment tool, is comprised of a bank of high-quality practice questions that allow students to advance at their own pace — based on their performance — through

multiple mastery levels for each content area in selected texts. As a result, students are able to quickly identify gaps in their knowledge. The educator dashboard, grade book, and reporting capabilities provide feedback about student performance, enabling faculty to monitor individual student activity, assess overall class performance, and identify strengths and weaknesses.

Elsevier's **Sherpath** product provides a single, mobile-optimized interface that allows students in each course to use content materials and technology to meet the course objectives in a timely manner. Content to meet the objectives is adapted to the students' needs. Interspersed throughout the delivery of the content are micro-quizzes, which allow students to test their knowledge in a particular area. If students are not clear on a concept, they can click on an "I am confused" button to receive additional information. Students can rate their level of confidence with their answers. If they answer a question incorrectly, they will be given clarifying information until they answer the question correctly. Case studies and micro-simulations are also available. At the end of each section, there is an "end-of-lesson" assessment, which students may take several times.

Sherpath expands upon the advantages of EAQ in several ways. Not only does the system provide retrieval practice through multiple testing formats, it also allows students to practice with real-world scenarios. The multitude of testing options provides students with multiple self-checks and exercises and helps students to organize materials effectively. The dashboards for both faculty and students are robust and provide a great deal of information regarding the progress of individual students and the entire class as they move through the course. This provides faculty with feedback regarding student performance that can be used to support individual students, and the entire class, during the progress of the course. It also provides information that can be used in curriculum evaluation and revision. The breadth of data in the student dashboard can also assist individual students in improving their metacognition monitoring.

Conclusion

Technology has provided faculty and students in nursing and the health professions programs with multiple strategies to help students practice the retrieval of knowledge necessary for competent practice. The more often faculty integrate these techniques into the teaching-learning activities, the more likely students are to be successful in their courses, on licensing/certification examinations, and in clinical practice.

References

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