

Lippincott® Nursing Education Trends & Insights

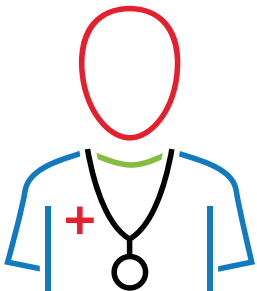
Test-enhanced learning: A new twist on testing

Purpose: To clearly demonstrate the value of test-enhanced learning (TEL) for nurse educators and students with the goals to enhance learning, retention, and information retrieval by supporting the application of knowledge in clinical nursing practice.



Standard approaches to testing and quizzing have focused on evaluation or summative assessment. However, mounting evidence redefines testing as a powerful formative teaching tool. Test-enhanced learning (TEL) leverages evidence-based, brain-based strategies — such as retrieval practice, spaced retrieval, and calibration — to proactively support student-centered, personalized learning plans and improve educational outcomes.

TEL sharpens student comprehension and application of information through four core mechanisms: practice retrieval, spaced retrieval, retention, and transfer:¹⁻⁷



1. Following initial exposure to content, students are required to **recall** information (**retrieval practice**). Testing activities require students to exert considerable effort to remember, or encounter *desirable difficulties*, creating elaborate memory traces. These rich memories are organized within complex neural networks based on the level of effort or energy devoted to learning and **retrieving** information. Interestingly, information that is considered *too easy* by learners is often not learned or retained.²



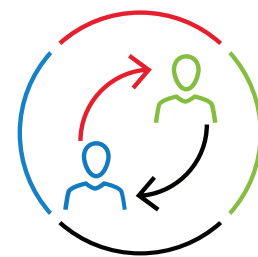
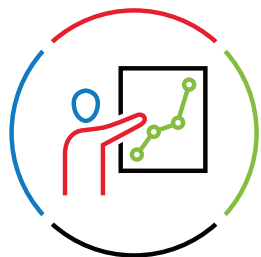
2. Information that is **repetitively retrieved** over a period of time (**spaced retrieval**) is most effectively filed for future use. **Retrieval** is strengthened when the time intervals between **retrieval** are increased, allowing for cumulative building of knowledge in the long-term memory and easing later **retrieval**.²⁻⁴



3. **Retention** is supported by frequent **retrieval**. The more information is **retrieved** and applied, the more powerful memories become, ensuring longer term **retention** and availability for future **retrieval**. This is known as the *testing effect*.²⁻⁵



4. Perhaps most importantly for nursing education, this information is then available for **transfer** to new contexts and circumstances, ensuring that learned information can be applied to future learning opportunities, patient care situations, and clinical practice.^{3,8} Research demonstrates that TEL is a sound method to enhance clinical reasoning.⁸



An additional component of brain-based learning, **Calibration**, is also at work within TEL. This is the judgment of one's perceived performance as it compares with actual performance. A self-regulated learner uses TEL to identify learning gaps, develop study plans, and to *study what they don't know*. Research demonstrates that lower performing students often overestimate their level of knowledge (*cognitive bias, fluency of knowledge*) and may significantly benefit from TEL to detect and provide evidence of knowledge gaps.⁹⁻¹⁰ In addition, TEL proved highly effective for students experiencing test anxiety by giving them greater control over their study process and helping them identify personal learning needs along with effective study, organizational, and time management strategies.¹⁰ Anxiety hampers learning, but students who engage in TEL reported decreased anxiety, and therefore increased performance.¹

Researchers suggest that production-oriented, context-rich assessments such as the clinical judgment cases and items featured on the current NCLEX® demand a higher level of cognitive effort than recall-based, context-free multiple-choice questions. This deeper engagement promotes greater knowledge retention and enhances metacognitive awareness.³⁻⁵ Cognitive effort and learning associated with TEL in formative strategies is also increased when feedback is provided to students, including correct answers, rationales, and discussion. This feedback will strengthen retrieval cues, ensure correct answer recall, and foster deep learning. It may be noted that, although this feedback is critical with formative assessments, this level of detail may not be necessary in summative testing.^{2-3,5,11} Nonetheless, formative and summative evaluations benefit from debriefing exercises to ensure accuracy of student understanding and clarification of unclear concepts or content.³⁻⁵ As with any teaching strategy, debriefing may also explore new applications of information, further strengthening memory traces and building neural networks.

Using TEL pre-engagement (before class), during engagement (in the learning session), and post-engagement (after class) allows students to view TEL activities as self-improvement strategies, rather than “busy work.” As students experience increasing levels of accomplishment and performance, there is reported increased engagement in TEL exercises.³⁻⁵ As a word of caution, researchers indicate that, as with all teaching strategies, learners' cognitive loads should be considered and faculty may best judge the number of tests, frequency of low-stakes versus no-stakes exercises, and intervals between testing activities.^{2,5} Researchers emphasize that TEL is not dependent on prior learning methods and may be initiated at any time to improve deep learning and application-focused teaching.⁶ TEL is implemented in nursing education through various methods, including frequent and adaptive quizzing,^{13,14,16} standardized testing,^{7,17} NCLEX® review,¹⁰ and integrated testing tools throughout coursework. These approaches consistently yield positive educational outcomes, reinforcing TEL's role as a powerful strategy for deep learning, retention, and clinical application.

Evidence-based benefits:

Research both within nursing education and in the educational psychology literature validates the benefits of TEL over other methods of studying such as rereading or restudying. These outcomes are sustained even when more time is spent studying, reading, or restudying than time spent testing/retrieving.⁵ In addition, testing using several questions to measure the same construct in diverse ways strengthens memories and learning.⁵ These positive impacts were shown to last for six months or more, indicating incorporation into long-term memory stores.³



Additional evidence-based benefits:



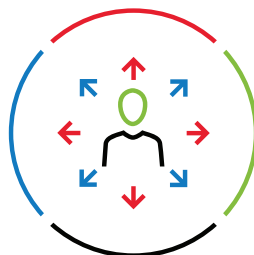
- Learning/content mastery, retention, and information transfer
- Student perceptions of learning
- Student attendance and engagement
- Exit exam, test scores, and grades
- Ability to transfer and apply knowledge to clinical situations, at the bedside and in case exercises
- Effectiveness of NCLEX® review and preparation
- Student retention and program completion
- Student confidence
- Student satisfaction with the program
- Student motivation to study and time spent efficiently studying

- Student anxiety
- Resistance to individualized/focused remediation practices
- Program attrition
- Complaints about or lack of motivation in response to student-centered instructional methods
- Faculty burden by shifting to student-centered roles and responsibilities for learning
- Bias in education and remediation strategies by increasing objectivity of student strengths and learning gaps
- Fixed-mindset behaviors while encouraging growth-mindset strategies¹⁸

Top three actions:



Teach students about retrieval learning, calibration, and neuroscience evidence to promote effective studying and test preparation.



Use diverse formative evaluations to enhance memory, retention, and learning.



Encourage quizzing to identify strengths, address knowledge gaps, and optimize study time.

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